Bommarito Consulting

PREPARED FOR THE TOWNSHIPS AND RESIDENTS OF THE ONEIDA–SABINE LAKE CORRIDOR

The Proposed ITC Oneida–Sabine Lake 345 kV Transmission Line

An Independent Route and Environmental Analysis, Route-Wide and Per-Jurisdiction

PRELIMINARY DRAFT For discussion and public comment — subject to revision.

ITC has proposed a 345 kV transmission line running roughly fifty miles from the Oneida substation in Eaton County to a new Sabine Lake substation in Livingston County, as part of MISO's Long Range Transmission Planning portfolio. For Phase 3 public comment, ITC has narrowed its candidate network to seven named route alternatives (Blue, Orange, Green, Purple, Yellow, Red, Pink). This document is a parallel, public-data-only analysis: it retrieves those seven published routes directly from ITC's ArcGIS services, scores each on the factors the Michigan Public Service Commission weighs under Act 30 — environmental impact, residential proximity, and use of existing rights-of-way — ranks them, and resolves the impact township by township, including Meridian and Williamstown. The findings are in the body; the data provenance and reproduction steps are in the appendices. It is offered as a neutral baseline that any affected party can use and against which the applicant's eventual filing can be compared.

PREPARED BY Bommarito Consulting LLC · Michael J. Bommarito II

PROJECT ITC Oneida–Sabine Lake 345 kV · MISO LRTP · pre-filing route study

JURISDICTIONS 15 townships across 3 counties (Eaton County, Ingham County, Livingston County)

DATA VINTAGE Retrieved from public sources; every layer hashed and inventoried (Appendix A)

A Reliance and Disclaimer follows on page 2. Every figure in this document is generated directly from the provenance-tracked analysis pipeline; none is hand-entered.

Reliance and Disclaimer

This document is a desk study based on publicly available data. It applies standard public-domain geospatial and route-optimization methods to public regulatory datasets (ITC's own published route layers, FEMA, USFWS/USGS, Michigan EGLE, and the U.S. Census Bureau). The application of these methods to these data is fully reproducible from the same public sources.

Nothing here constitutes engineering design, professional engineering certification, legal advice, or a stamped siting study. It is intended for public review and informational use only. Bommarito Consulting LLC prepared this report at its own expense, without commission, contract, or grant from ITC, Burns & McDonnell, the MPSC, any landowner, or any party supporting or opposing the project.

Where the public data is insufficient to complete a step, that limitation is identified explicitly rather than papered over.

The data sources are enumerated with content hashes in Appendix A, and the exact reproduction steps in Appendix B. A reader who wishes to challenge or extend the analysis can re-run it against the same public sources.

Contents

1 Qualifications and Scope

This report presents an independent, public-data analysis of the proposed ITC Oneida–Sabine Lake 345 kV transmission line in central Michigan. It is prepared by Michael J. Bommarito II of Bommarito Consulting, LLC, as a public-service baseline for the townships and residents along the corridor.

1.1 Scope and discipline

The analysis is deliberately bounded:

- It uses *only* public data sources (ITC's own published route layers, Michigan EGLE, FEMA, USFWS/USGS, the U.S. Census Bureau, and the U.S. Geological Survey).
- Every input layer is enumerated with its source URL, retrieval timestamp, SHA-256 hash, and feature count (Appendix A).
- Every reported number is reproducible end-to-end from a clean checkout (Appendix B).

It is not a critique of ITC or Burns & McDonnell. It is a parallel, transparent analysis that affected parties can use as a common baseline and against which the applicant's eventual filing can be compared.

1.2 What this analysis is not

It does not opine on electrical engineering, cost allocation, or need; those are outside its public-data scope. It addresses route geometry and the environmental and jurisdictional footprint of the candidate corridor under the criteria the Michigan Public Service Commission weighs in transmission siting (Section 3).

2 Executive Summary

The ITC Oneida–Sabine Lake project is a 345 kV transmission line running approximately 50 miles from the Oneida substation (Eaton County) to a new Sabine Lake substation (Livingston County) as part of MISO's Long Range Transmission Planning portfolio [1, 2]. For Phase 3 public comment, ITC has narrowed its candidate network to **7 named route alternatives** — Blue, Orange, Green, Purple, Yellow, Red, and Pink — published on its public dashboard. The corridor crosses 15 townships across 3 counties (Eaton County, Ingham County, Livingston County).

2.1 Approach

We retrieve ITC's 7 published Phase 3 routes directly from its ArcGIS services and score each one on a transparent, configurable composite of the factors the Michigan Public Service Commission weighs under Act 30: environmental impact (wetlands, hydric soils, floodplain, protected areas) and residential proximity as *penalties*, and co-location with existing rights-of-way (existing transmission, major highways, railroads) as a *reward* (the full factor set and weights are given in Table 3). Every input is public and provenance-tracked.

2.2 Headline result

Ranking of ITC's published alternatives

Of ITC's 7 Phase 3 routes, the **Orange Route** scores best on the composite Act 30 objective (58.0 miles, 1,364 acres of environmental impact in the 200 ft corridor), and the Blue Route scores worst. The routes differ in how much they parallel existing (voltage-weighted) rights-of-way — the recommended route does so the least — but at the current weights environmental footprint and residential proximity dominate the ranking. The full ranking is in Table 4 and Figure 13.

The objective now includes the count of residences within 500 ft — the factor the MPSC weights most heavily — using Michigan property-class parcels across all three route counties (Eaton, Ingham, and Livingston; Section 7.6). The objective weights are configurable and the factors are deliberately grouped so that correlated impacts are not double-counted (Section 7.4), so the ranking should be read as a transparent baseline, not a verdict. Across 1,000,000 weightings spanning every factor from one-eighth to eight times its Act 30 value, the Orange Route ranks first in 66% and sits in the top three 95% of the time, never last. The Purple Route is the principal alternative (29%); it overtakes Orange chiefly where existing-corridor co-location is weighted most heavily, which is the one Act 30 factor the MPSC has called important but *not* controlling (Section 3.3). The environmentally heaviest routes never win (Appendix C). Results are also reported per jurisdiction (Section 9).

3 Project Background and Regulatory Context

3.1 The project

The Oneida–Sabine Lake 345 kV line is part of the Midcontinent Independent System Operator's Long Range Transmission Planning (LRTP) Tranche 2.1 portfolio [1]. As of this writing the project is in the pre-filing route-study phase; Burns & McDonnell is conducting the siting GIS work on ITC's behalf, and the candidate alignment and study area are published through ITC's public project portal [2].

The siting process has proceeded through public open houses. An initial "Round 1" network of candidate segments was published in late 2025; ITC has since narrowed that network to **7 named route alternatives** — Blue, Orange, Green, Purple, Yellow, Red, and Pink[1] — which are the subject of the Phase 3 public-comment dashboard. This report evaluates those 7 published alternatives; it does not enumerate the superseded Round-1 network.

3.2 Regulatory framework

Transmission siting in Michigan is governed by Public Act 30 of 1995 [3], which requires a Certificate of Public Convenience and Necessity from the Michigan Public Service Commission (MPSC) for lines longer than five miles operating at 345 kV or above. The Commission weighs, among other factors, environmental impact, the use of existing rights-of-way, and the proximity of the route to residences and sensitive resources. Two adjacent 345 kV

[1] ITC's June 2026 public-comment dashboard relabels the route it had previously shown as "Brown" as "Red"; the alignment is unchanged. This report follows ITC's current label. The synthetic maximum-freeway route we construct in Section 8.5 is named "Teal" to keep it distinct from ITC's Red.

projects — Nelson Road–Oneida (Case U-21471) and Helix–Hiple (Case U-21472) — were approved in July 2025 [4].

3.3 The "feasible and reasonable" standard and existing rights-of-way

Because the weight given to existing rights-of-way is central to how a route is chosen, it is worth stating precisely what Act 30 requires. The Commission must grant a certificate only if it determines, among four criteria, that "[t]he proposed or alternative route is feasible and reasonable" (MCL 460.568(5)(b)) [3]. The test is conjunctive — a route must be both feasible *and* reasonable — and the Commission construes "reasonable," by its ordinary meaning, as "fair and proper under the circumstances": a holistic judgment, not a fixed hierarchy in which one factor automatically prevails.

The July 2025 order certifying the adjacent Oneida–Nelson Road and Helix–Hiple lines applies that standard to existing corridors [4]. The Commission held that "the use of existing utility ROWs to minimize the condemnation of private land is *an important factor* for establishing a reasonable route under Act 30," and directed applicants to "thoroughly explore" such corridors. But it treated co-location as a weighted consideration, not a controlling one. It expressly *weighed* the residential burden of the route it preferred — one whose social-evaluation score was higher "based on the number of parcels crossed and residences located within 101–500 feet" — and accepted that burden only because, on those facts, the corridor was one "that landowners are either aware of or can reasonably be expected to be aware of" and the route "performs better" overall once the impacts were counted. The order's logic runs in both directions: it rejected the applicant's own primary route as "while feasible,… not reasonable given the opportunity to use an existing ROW," confirming that reasonableness is a live constraint a route can fail — whether or not it follows an existing right-of-way — when its impacts are disproportionate.

Two points follow for this analysis. First, existing-route status *supports* a route's reasonableness but does not *compel* its selection: the Commission "need only determine that the… route selected is feasible and reasonable," not that it carries the most existing right-of-way or is superior to every alternative [5]. Second, residential and environmental impacts are inputs to the reasonableness determination throughout — the order reached its result only after netting those impacts against the corridor benefit — not a backstop relevant solely once a route is otherwise "unreasonable." This is why the present analysis scores each route on roughly two dozen engineering, environmental, and social factors — the same three categories, normalized the same way, as the weighted-overlay routing analysis the Commission relied on in the Nelson–Oneida record — and makes their relative weighting explicit and adjustable (Section 7; Appendix C): a route that ranks first only when existing-corridor co-location is weighted above all else is not, for that reason alone, the route the "feasible and reasonable" standard identifies.

3.4 Why a per-jurisdiction analysis

The corridor crosses 15 townships in 3 counties. Impacts and political accountability are local: a route that is attractive in the aggregate may concentrate its burden in one or two townships. This analysis therefore resolves every metric both route-wide and per jurisdiction.

4 Study Area and Jurisdictions

4.1 Study area

The study area is the project corridor — the union of ITC's candidate route segments and its 7 named Phase 3 routes — buffered by 2000 ft; impact is attributed to each route within a 200 ft buffer around it. All area and distance calculations are performed in the Michigan GeoRef projected coordinate system (EPSG:3078), whose units are meters, with an explicit feet-to-meters conversion. (A historical error in related work treated this meter-based CRS as foot-based; that class of bug is structurally excluded here.)

4.2 Jurisdictions on the corridor

The corridor spans the 15 townships listed in Table 1, across 3 counties (Eaton County, Ingham County, Livingston County), ordered from the Oneida terminus to the Sabine Lake terminus. The mileage column is the extent of ITC's candidate route segments within each township; the 7 named routes are alternatives within this corridor, and each route's own per-township mileage is reported in Section 9.

Table 1: Townships the corridor crosses, ordered source to sink.

#	Township	County	Candidate mi
1	Benton Township	Eaton County	9.73
2	Oneida Charter Township	Eaton County	1.42
3	Eaton Rapids Township	Eaton County	0.55
4	Windsor Charter Township	Eaton County	19.06
5	Aurelius Township	Ingham County	4.68
6	Delhi Charter Township	Ingham County	12.46
7	Alaiedon Township	Ingham County	20.19
8	Meridian Charter Township	Ingham County	4.24
9	Wheatfield Township	Ingham County	16.21
10	Williamstown Township	Ingham County	10.74
11	Leroy Township	Ingham County	17.75
12	Locke Township	Ingham County	14.85
13	Handy Township	Livingston County	6.53
14	Conway Township	Livingston County	20.98
15	Cohoctah Township	Livingston County	5.97

Meridian Charter Township and Williamstown Township — the jurisdictions whose residents have been most engaged in the corridor — both lie on the corridor and are resolved individually in the findings (Section 9). Figure 1 shows the county and township divisions the routes cross.

5 Corridor Constraints

Before scoring the routes it helps to see what the corridor actually contains. The maps in this section draw the 7 candidate routes — the recommended Orange route in bold, the others in grey — against each constraint that enters

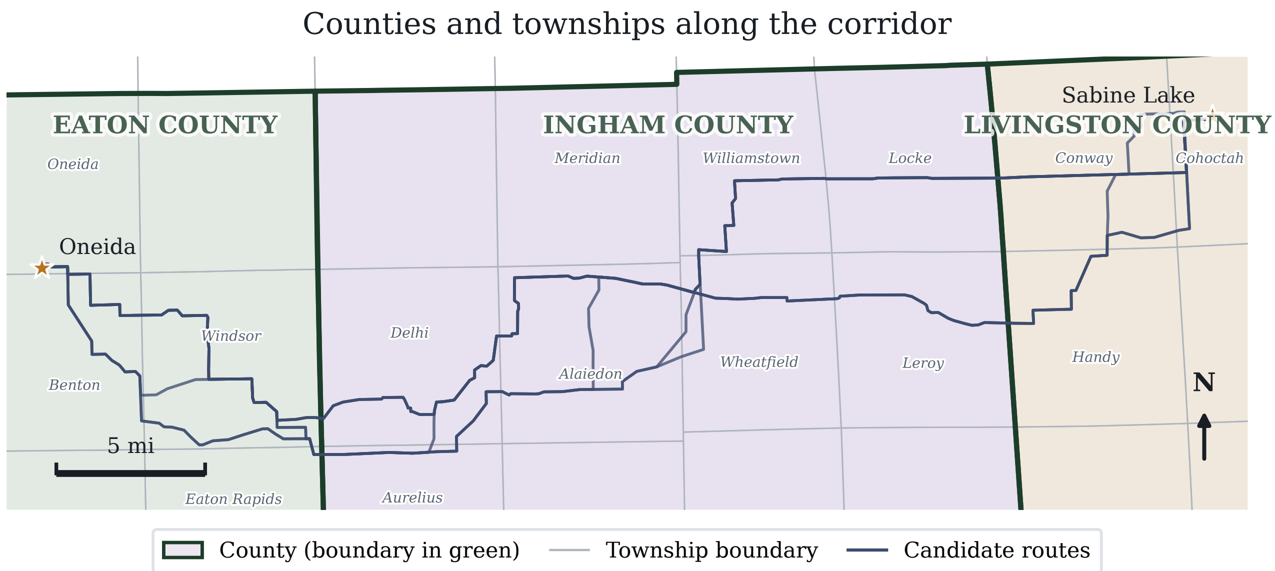

Figure 1: County (heavy green boundaries, tinted) and township divisions along the corridor, with the candidate routes. The corridor runs west to east through Eaton, Ingham, and Livingston counties.

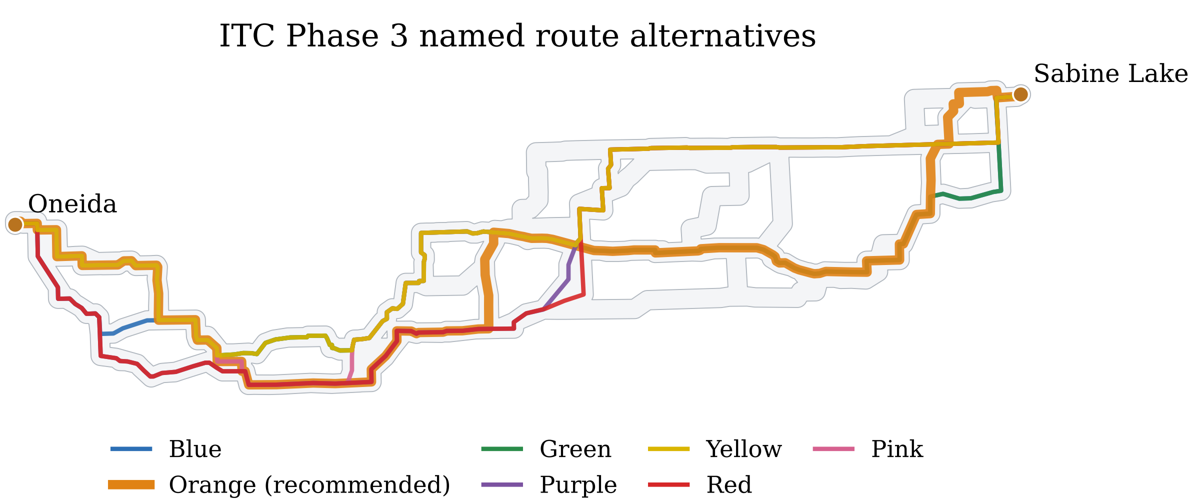

Figure 2: ITC's 7 Phase 3 named route alternatives between the Oneida and Sabine Lake substations, on the study area. The objective-preferred Orange Route is drawn heavier.

the objective, rendered from the same clipped public layers the scoring uses (Section 6). They are a visual companion to the per-route numbers in Section 8: where a route runs through shading, it accrues impact; where it follows an existing line, it earns co-location credit.

5.1 Environmental constraints together

Figure 3 overlays all four environmental penalties — wetlands, floodplain, hydric soils, and protected land. The constrained ground is not evenly spread: it concentrates in the low, wet central reach, which is where the routes diverge most and where the ranking is largely decided.

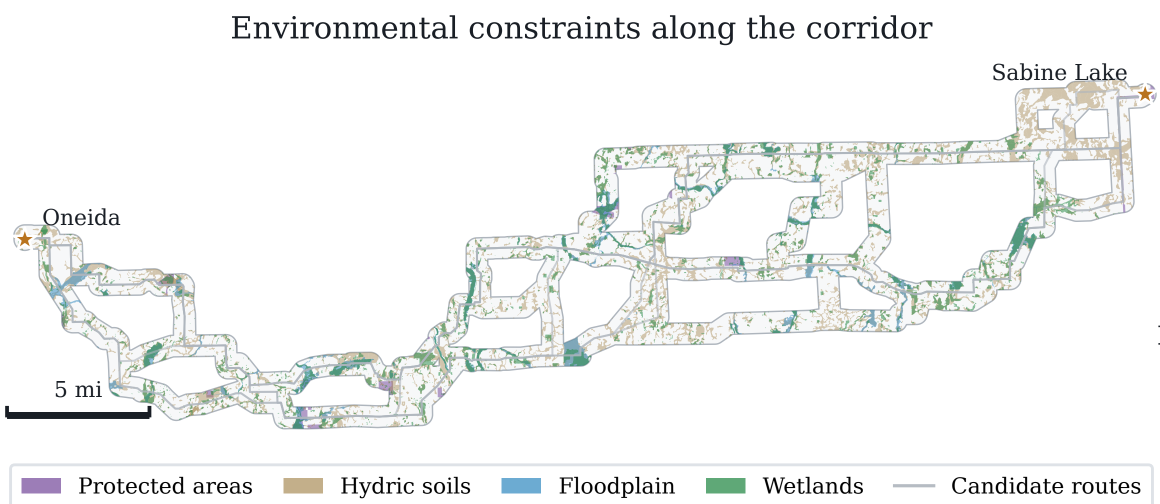

Figure 3: The four environmental constraints along the corridor, with the candidate routes overlaid (recommended route in bold).

5.2 Residential density

Figure 4 bins the occupied-dwelling parcels (classes 401 and 407) into a density grid — the social factor the MPSC weighs most heavily. The densest clusters sit in the east-central townships (Meridian and Williamstown); the recommended route stays south of the heaviest concentrations. The count covers all three counties, including the Livingston tail near the Sabine Lake terminus (Section 7.6).

5.3 Wetlands and floodplain

Wetlands (Figure 5, Michigan EGLE NWI Plus) and the FEMA regulatory floodplain (Figure 6, zones A and AE) are the corridor's two largest mapped water-resource constraints. Both follow the low ground through the central townships, where every candidate route must cross the wet reach between the drier uplands at each terminus. The routes therefore differ less in *whether* they cross these features than in *how much* of each they intersect — the per-route acreages are tabulated in Section 8.

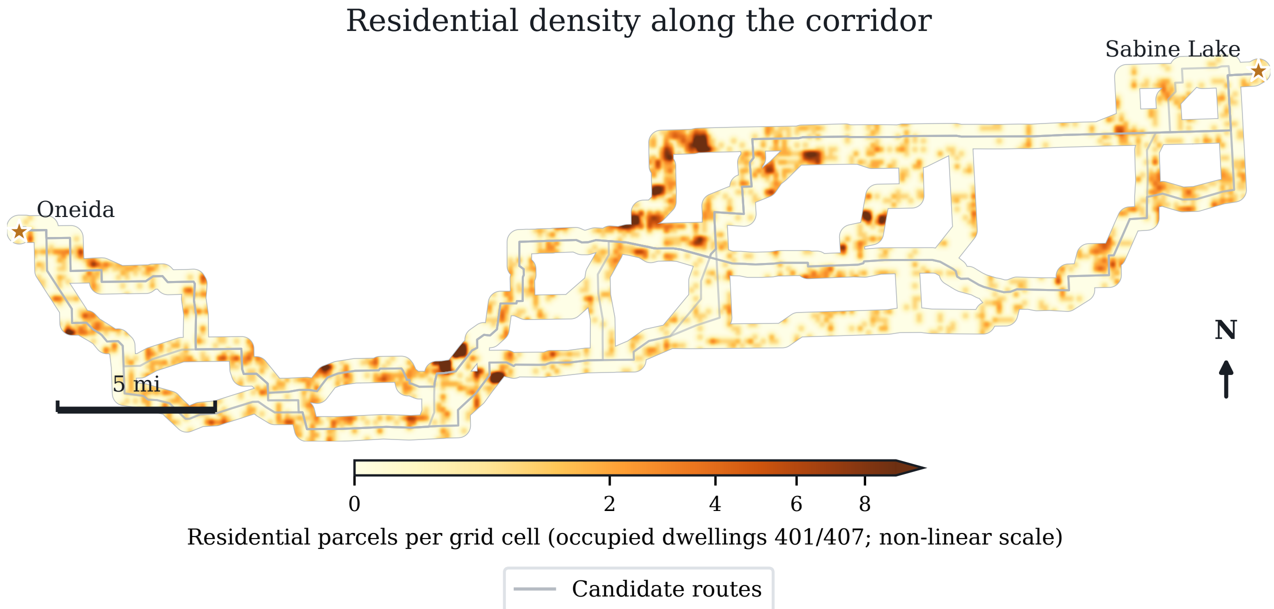

Figure 4: Residential-parcel density (occupied dwellings, classes 401 and 407) as a hex-bin heatmap; 4,729 parcels fall within the study-area corridor.

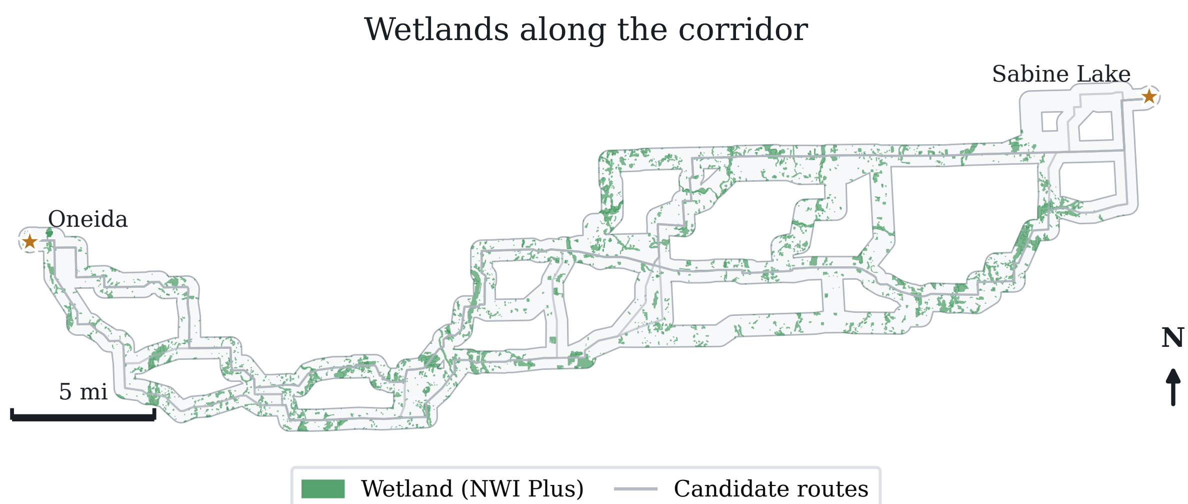

Figure 5: Wetlands (Michigan EGLE NWI Plus) along the corridor.

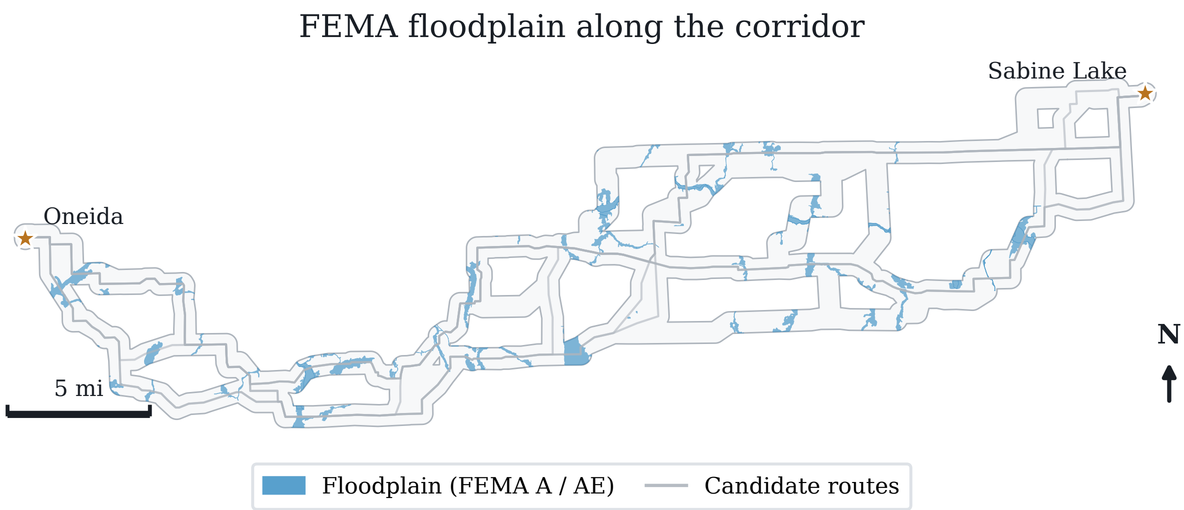

Figure 6: FEMA regulatory floodplain (zones A and AE) along the corridor.

5.4 Hydric soils and protected land

Hydric soils (Figure 7) are a broader wetness indicator than mapped wetlands — soils saturated long enough to develop anaerobic conditions — and are the single largest environmental penalty by area; they shadow the wetland and floodplain pattern but extend well beyond it. Protected land (Figure 8, USGS PAD-US) is comparatively sparse here, so it separates the routes mainly where one alignment clips a state game or recreation area that the others skirt.

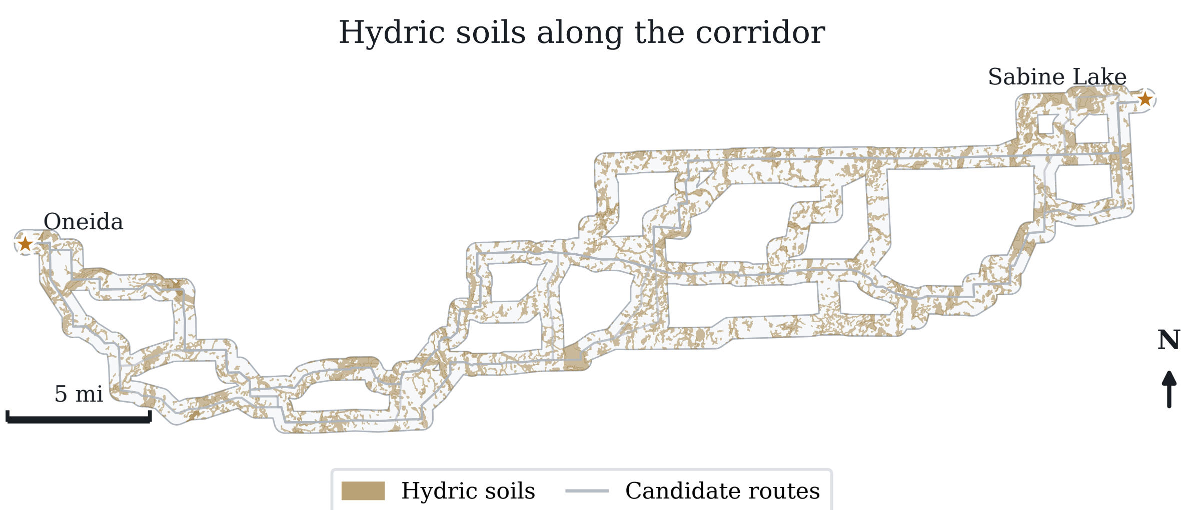

Figure 7: Hydric soils along the corridor — a wetness indicator that tracks, but is broader than, mapped wetlands.

5.5 Land cover

Beyond the discrete water-resource layers, the corridor's land cover (Figure 9, NLCD 2021) sets the agricultural and woodland impact. The corridor is predominantly cultivated cropland, broken by forest blocks and scattered wetland.

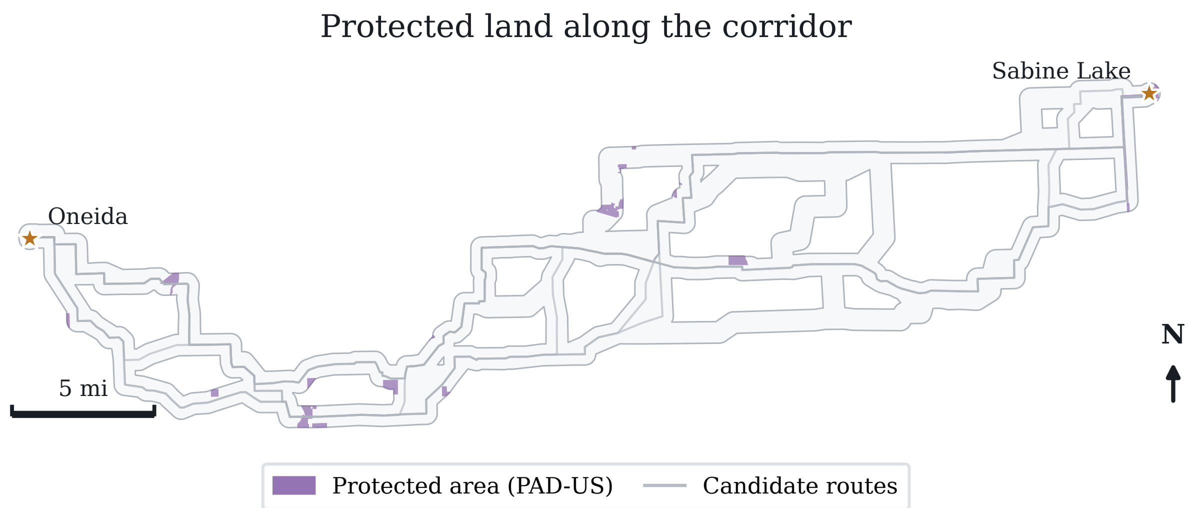

Figure 8: Protected land (USGS PAD-US) along the corridor.

Forest clearing and farmland conversion enter the objective as separate factors (`forest_acres`, `cropland_acres`, `pasture_acres`, `grassland_acres`), each measured by zonal statistics over this raster: routes that swing through the forest blocks accrue woodland-clearing impact, while the cropland-heavy alignments trade that for farmland conversion.

5.6 Wellhead protection areas

Wellhead protection areas (Figure 10) delineate the recharge zones around public-supply wells, where corridor construction and vegetation maintenance pose a drinking-water risk. Their overlap with the corridor varies widely across the routes — from roughly 110 to 330 acres — which makes `wellhead_protection_acres` one of the more discriminating environmental factors.

5.7 Sensitive receptors and cultural resources

Two social point factors round out the picture (Figure 11). *Sensitive receptors* — schools, hospitals, clinics, and places of worship — are counted within 1,000 ft of each route (`receptors_1000ft`); the three leading routes have none in that band, while each lower-ranked route passes one. *Cultural and historic resources* (historic sites and cemeteries) are drawn from OpenStreetMap, a partial public proxy — Michigan SHPO archaeological records are access-restricted — and so are carried at a token weight only, as a sensitivity check rather than a headline factor (Appendix C).

5.8 Existing transmission

Figure 12 shows the existing transmission lines coloured by voltage. Co-location credit is voltage-weighted (Section 7.5), so the 345 kV corridors — which the new line shares its voltage with — are worth more to parallel than the 138 kV lines.

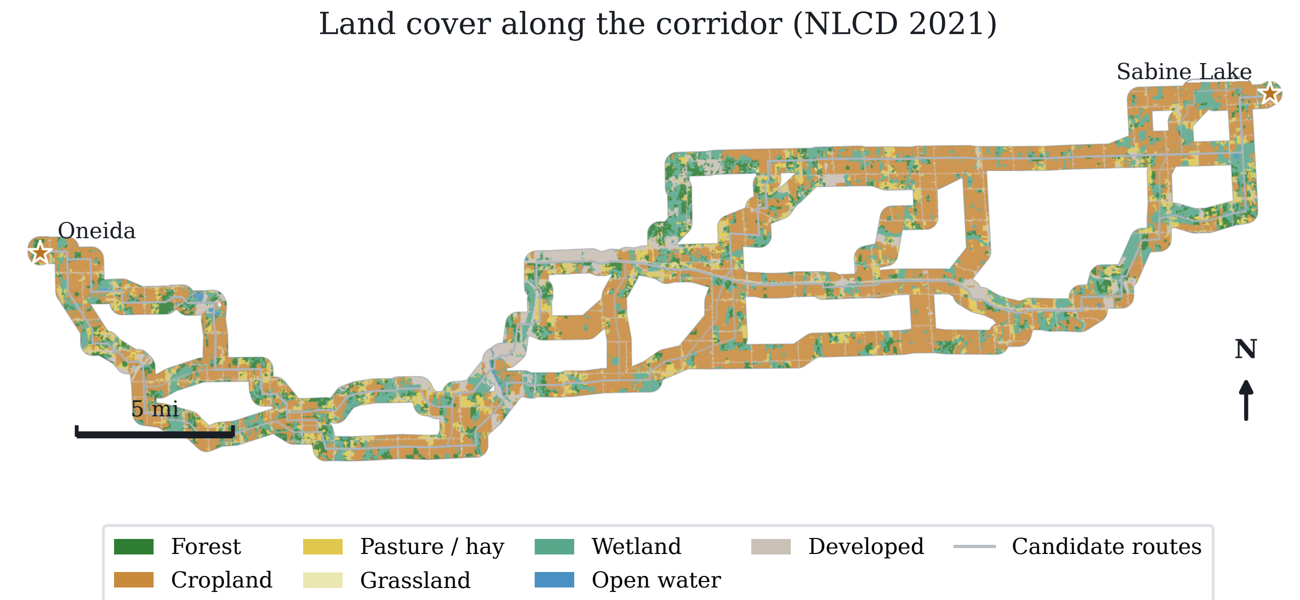

Figure 9: NLCD 2021 land cover along the corridor; forest, cropland, pasture, grassland, wetland, and open water each enter the objective as a separate factor.

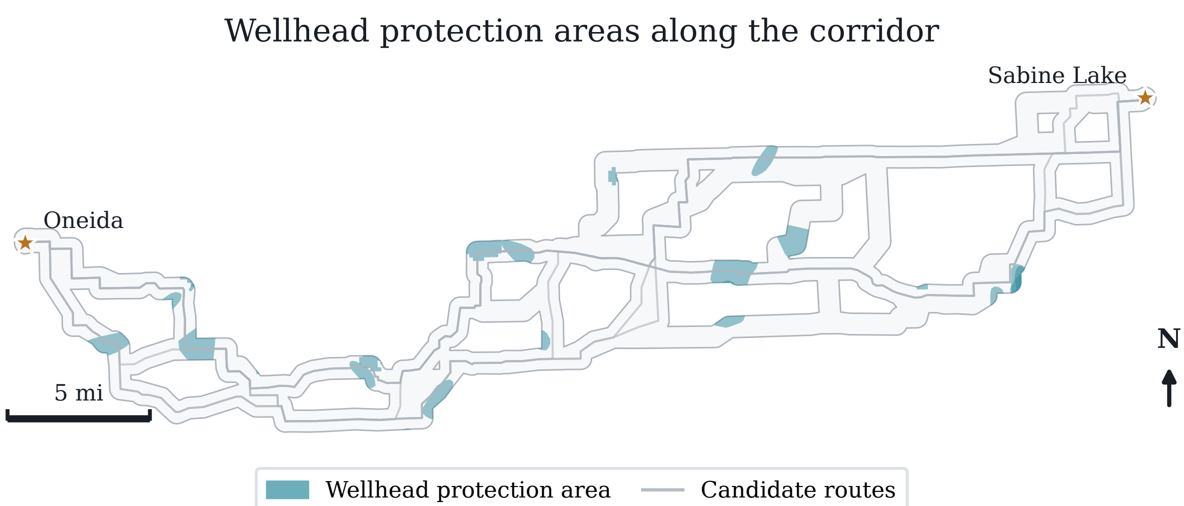

Figure 10: Wellhead protection areas (Michigan EGLE) along the corridor.

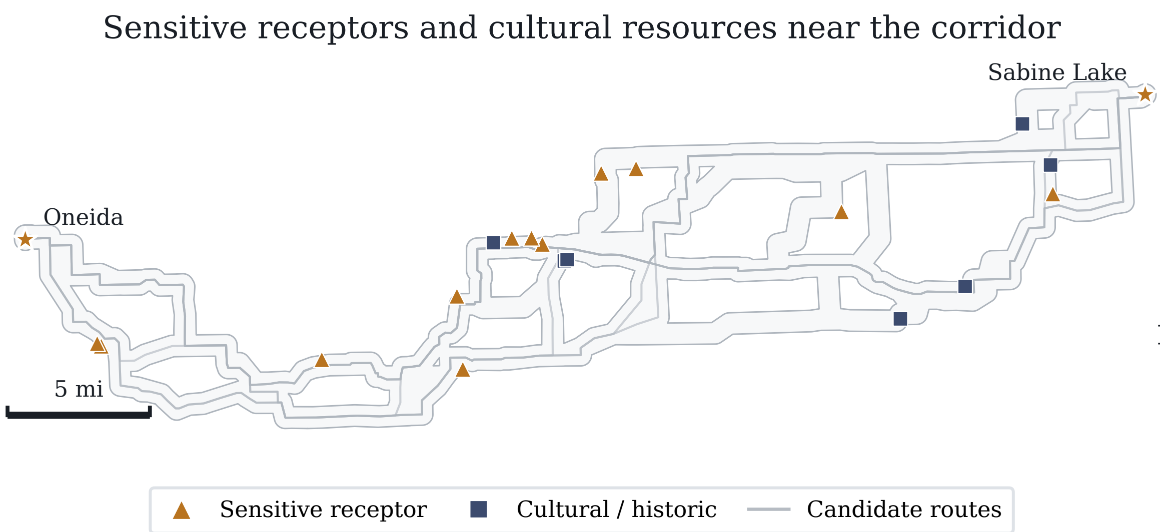

Figure 11: Sensitive receptors (OSM: schools, hospitals, clinics, places of worship) and cultural/historic resources (OSM: historic sites and cemeteries) near the corridor.

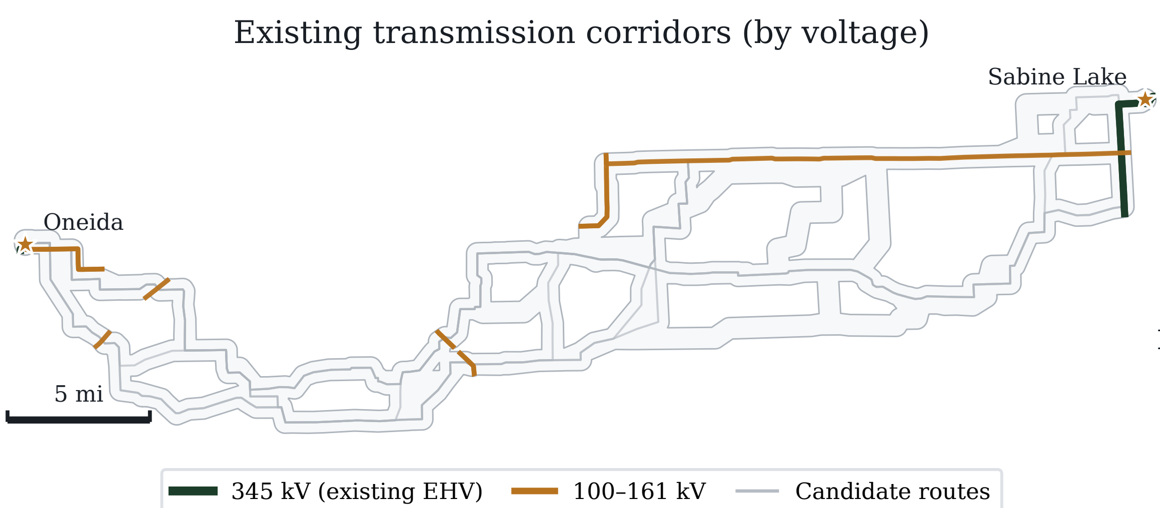

Figure 12: Existing transmission corridors by voltage (nine 138 kV, four 345 kV); the new line is 345 kV.

6 Data Sources and Provenance

6.1 Source layers

The route geometry, study area, structures, and administrative boundaries are retrieved directly from ITC's public ArcGIS FeatureServer endpoints [2]. The environmental, contamination, and infrastructure layers are retrieved from their authoritative public providers through the shared `geodata` library:

- **Flood zones** — FEMA National Flood Hazard Layer (regulatory zones A and AE; Zone X excluded).
- **Wetlands and hydric soils** — Michigan EGLE Wetlands Map Viewer (NWI Plus and hydric soils).
- **Protected areas** — USGS PAD-US [6].
- **Hydrography** — USGS National Hydrography Dataset flowlines.
- **Contamination** — Michigan EGLE RRD (Part 201 sites, USTs, brownfields).
- **Transportation** — MDOT roads and railroads.
- **Boundaries** — Michigan county and county-subdivision layers.
- **Residential parcels** — Michigan property-class parcels, per-county (Section 6.2).

6.2 Residential parcel sources

The residences-within-500 ft factor (Section 7.6) is built from Michigan real-property parcels classed as occupied dwellings (codes 401 and 407). Each county is sourced from its own assessment data, retrieved independently of ITC; Table 2 gives the source and the property-class field for each, with the number of qualifying parcels that fall within the study-area corridor.

Table 2: Residential parcel sources by county (occupied-dwelling classes 401 and 407; "in-corridor" counts parcels within the 2000 ft study area).

County	Source	Class field	Coverage	In-corridor
Eaton	County assessor (local)	`CLASSCD`	Full county	873
Ingham	County 2025 (ArcGIS)	`PROPCLASS`	Full county	3,235
Livingston	County GIS + assessor†	`property_class`	Full corridor	621

†Livingston County does not publish property class on its GIS parcel layer (Eaton and Ingham do), so its parcels are assembled from two public sources: parcel geometry from the county GIS public parcel viewer (an ArcGIS service) joined to each parcel's Michigan property class from the county assessor's records. Coverage is complete across all three route counties.

6.3 Provenance guarantee

Every retrieved and derived artifact carries a `.provenance.json` sidecar recording its source URL, UTC retrieval timestamp, SHA-256 hash, and feature count. These are aggregated into a single `data/inventory.json` manifest. The complete inventory — the attestable evidence chain underlying every number in this report — is reproduced in

7 Methodology

7.1 Routes evaluated

We retrieve ITC's 7 Phase 3 named routes directly from its public ArcGIS feature service (one polyline per route) and evaluate each as published. Geometries are stored in WGS 84 (EPSG:4326); all area and distance calculations are performed in Michigan GeoRef (EPSG:3078), whose units are meters, with an explicit feet-to-meters conversion for buffers and the square-meters-to-acres factor for areas.

7.2 Per-route metrics

Each route is buffered at 200 ft (the routing-corridor envelope) and, for each public regulatory layer clipped to the study area, we compute:

- polygon layers — overlap area in acres (flood zones, wetlands, hydric soils, protected areas);
- line layers — crossing counts (roads, railroads, streams);
- co-location — a 0–1 score per existing-ROW type (existing transmission, major highways, railroads), where 1 means the route runs on or beside that infrastructure.

Each route is also intersected with township boundaries for per-jurisdiction reporting.

7.3 Configurable objective

Routes are ranked by a single composite *impact*. Each factor draws on a per-route metric, carries a weight, and acts either as a *penalty* (minimize — e.g. wetlands, floodplain, residences within 500 ft) or as a co-location *reward* (being near existing right-of-way lowers impact). This mirrors how the MPSC and standard GIS siting practice weigh Act 30 factors: environmental and social impacts are penalized; use of existing rights-of-way is rewarded. Penalty metrics are min–max normalized across the 7 routes so factors with different units combine fairly. The factor set used here was:

Because the objective is separated from the (expensive) spatial metrics, weights can be re-tuned and the ranking re-derived without recomputing any geometry.

7.4 Weighting: category balance without double-counting

The weights are set by a stated principle, not tuned to a desired ranking. Following the MPSC's own routing analysis, factors are grouped into three categories — *environmental*, *social*, and *engineering* (including co-location). Each category is given a comparable total *budget* — environmental ≈ 3.0, social ≈ 2.4, and engineering/co-location ≈ 2.0 (Table 3, where the per-category budgets are shown at right) — with the social category highest because the Commission weighs residences most heavily. The category budget, not any single factor's weight, is the quantity that carries meaning here: within a category, a concept measured by several correlated sub-factors *splits one budget among them* rather than letting each carry full weight, so adding sub-factors to a concept never inflates that concept's

Table 3: Active objective factors, grouped by the three Act 30 categories with each category's budget shown at right (the bold total per category), so the per-concept weights can be read against the budget they share. *Preset: act30; weights grouped by category (budget at right).*

Factor	Direction	Weight / **budget**
Environmental		**3.00 (+0.50 screened)**
Wetlands	penalty	0.70
Floodplain	penalty	0.40
Hydric soils	penalty	0.15
Open water	penalty	0.10
Wellhead protection area	penalty	0.40
Protected areas	penalty	0.50
Forest / woodland clearing	penalty	0.45
Cropland	penalty	0.20
Pasture	penalty	0.05
Grassland	penalty	0.05
Contaminated (Part 201) sites†	penalty	0.10
Leaking / underground storage tanks†	penalty	0.10
Brownfields†	penalty	0.10
Dams†	penalty	0.10
Airports†	penalty	0.10
Social		**2.40**
Residences within 500 ft	penalty	1.80
Sensitive receptors (≤1000 ft)	penalty	0.50
Cultural / historic (≤1000 ft)	penalty	0.10
Engineering & co-location		**2.00**
Parallel existing transmission	reward	0.70
Parallel road / highway	reward	0.30
Parallel railroad	reward	0.20
Stream crossings	penalty	0.25
Road crossings	penalty	0.20
Railroad crossings	penalty	0.15
Heavy-angle structures	penalty	0.20

Budgets are the sum of a category's substantive weights. †Screened factors are zero across this corridor. New-ROW is computed but omitted from the default (it mirrors co-location).

influence. That is the *one concept, one budget* discipline; where several factors measure overlapping, or mutually exclusive shares of, the same underlying impact, they share a budget. Concretely:

- **Wet ground.** Wetlands, floodplain, and hydric soils are strongly correlated (hydric soils are, by definition, broader than mapped wetlands). The objective anchors on the regulatory wetland and floodplain layers and gives hydric soils only a small weight, rather than counting the same wet ground three times.
- **Land cover.** Forest, cropland, pasture, and grassland are *disjoint shares of the same corridor area*, so penalizing all four at full weight would re-score one land allocation from four sides. The objective anchors on forest (woodland clearing, the most sensitive) and carries cropland, pasture, and grassland at small weights.
- **New right-of-way.** "New ROW required" is simply the complement of co-location — the two are anti-correlated by construction — so it is *omitted*; the co-location rewards already capture corridor reuse.

This discipline matters because, with only 7 routes varying along a few underlying geographic axes, most factors are highly correlated; a weighting that ignored the overlap would silently over-weight whichever axis happened to be split across the most factors. Appendix C stress-tests the weights directly.

7.5 Co-location with existing rights-of-way

Following an existing utility or transportation corridor reduces a new line's incremental footprint. We reward it by the *share of each route that runs within 800 m (about half a mile) of an existing right-of-way*, rather than by mere nearness at a single point — a min-distance reward saturated, because every route touches the 345 kV network at the substations. For existing transmission, the reward is **voltage-weighted**: a higher-voltage line has a wider, already-cleared ROW to share, so paralleling it adds less new impact. Each stretch is credited in proportion to the existing line's voltage, scaled to the project's own 345 kV (so a 345 kV neighbour earns full credit, a 138 kV neighbour about 40%); the reference voltage is configurable. All thirteen existing transmission lines crossing the study area carry a known voltage (nine at 138 kV, four at 345 kV), so no voltage is imputed.

7.6 Residential proximity

The 500 ft residential count — the heaviest factor the MPSC weighs — uses Michigan property-class parcels, counting parcels classed as occupied dwellings (class 401 Residential-Improved and 407 Residential Condo; configurable) within 500 ft of each route. Coverage is **complete across all three route counties**: Eaton and Ingham from their county assessment parcels, and Livingston from its county GIS public parcel viewer (geometry) joined to the county assessor's property-class records (Section 6.2). This spans both the residentially dense, most-contested western stretch (Meridian, Williamstown, Alaiedon, Leroy) and the eastern Livingston tail near the Sabine Lake terminus.

Coverage is complete across all three counties

An earlier version of this analysis lacked Livingston County's parcels and treated each route's eastern tail as uncounted. Those parcels have since been retrieved, and filling the gap did not change the result: every route gained a comparable number of residences (50–90), the recommended route still has the fewest within 500 ft, and the order is unchanged. The residence counts are therefore full counts, not a lower bound.

8 Evaluation of ITC's Published Alternatives

8.1 The seven Phase 3 routes

ITC's Phase 3 dashboard presents 7 named route alternatives. They share a common spine through much of the corridor and diverge in several decision areas (Figure 2). Their lengths range from roughly 54 to 58 miles. We score each on the configurable Act 30 objective (Section 7).

8.2 Ranking

Table 4 ranks the 7 routes by composite objective (lower is better); Figure 13 shows the same ranking. The routes do differ in how much they follow existing rights-of-way — and co-location is voltage-weighted, so paralleling an existing 345 kV corridor counts more than a 138 kV line (Section 7.5) — but at the current weights environmental footprint and residential proximity dominate, which Figure 14 decomposes factor by factor.

Table 4: ITC's Phase 3 routes ranked on the composite Act 30 objective.

Rank	Route	Length (mi)	Env. (ac)	Residences*	Objective
1	**Orange**	58.0	1,364	235	3.870
2	Purple	53.7	1,329	280	4.082
3	Red	54.3	1,356	279	4.098
4	Pink	56.4	1,316	287	4.797
5	Yellow	54.9	1,419	318	5.149
6	Green	56.2	1,620	310	5.416
7	Blue	55.7	1,589	329	5.591

*Residential parcels (class 401/407) within 500 ft; Eaton and Ingham complete, Livingston parcels not public, so counts are a lower bound.

8.3 What drives each route's score

Because the objective is an additive composite, each route's score decomposes exactly into the contribution of every factor. Figure 14 shows that decomposition: environmental and residential penalties push the score up (bars to the right of zero), co-location credits pull it down (bars to the left), and the marker is the net. This makes the trade-offs legible — one can see *why* a route ranks where it does, and which single factor would flip it — rather than collapsing everything into one opaque number.

8.4 Recommended alternative

On the composite Act 30 objective the **Orange Route** ranks first (58.0 miles, 1,364 acres of environmental impact in the 200 ft corridor), with the Purple and Red routes close behind and a clear gap to the rest. The recommendation is robust to how the factors are weighted — Orange leads across the great majority of weightings tested, yielding only to Purple where existing-corridor co-location is weighted most heavily (Appendix C). This ordering should still be read as "which of ITC's routes best fits the Act 30 factors as weighted here," not as a single inarguable answer

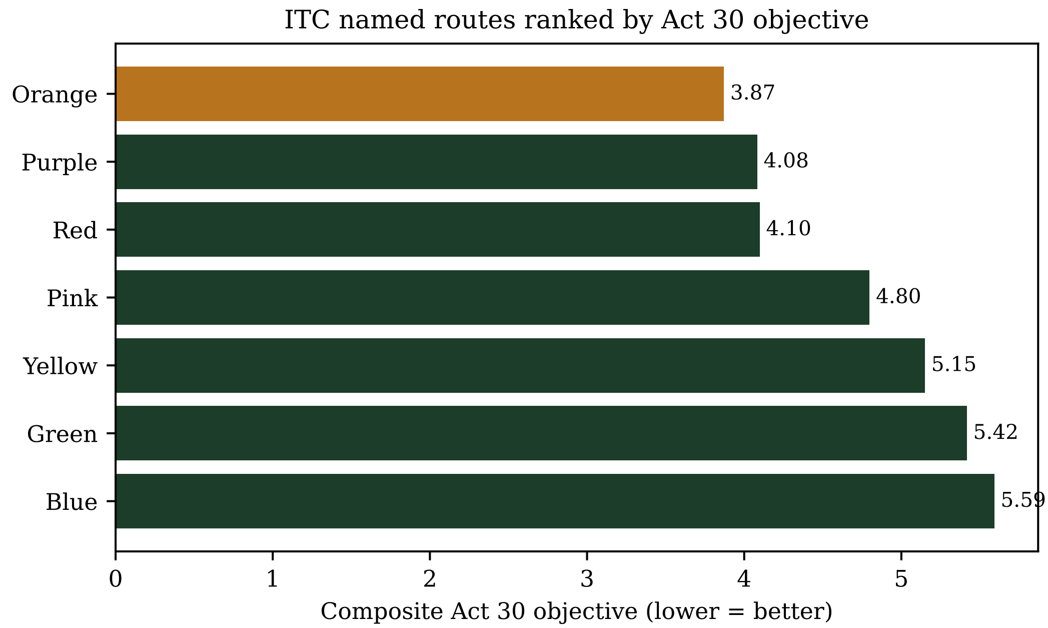

Figure 13: ITC's named routes ranked by the composite Act 30 objective (lower = better); the recommended route is highlighted.

— the weights are configurable and deliberately avoid double-counting (Section 7.4). (The residential count now covers all three counties, including each route's Livingston tail; Section 7.6.) The per-jurisdiction breakdown of the recommended route is in Section 9.

8.5 A synthetic test: the maximum-freeway "Teal" route

A natural objection is that ITC's seven routes might miss the obvious option — a route that simply follows the freeway as far as possible. We tested it directly. Two of the published routes, Orange and Yellow, run together along I-96 and then split: Orange swings south on a long loop while Yellow grazes I-96 to the west (Figure 16). Because the two are coincident where they rejoin, their *existing* segments can be recombined into a route that maximises freeway co-location — Yellow's I-96-grazing western half spliced to Orange's I-96-hugging eastern half. We call this synthetic alignment the **Teal route** (to avoid confusion with ITC's published Red route). It is our construct, not an ITC alternative; it is a constructed stress test.

The Teal route does maximise freeway co-location: 13.5 miles on I-96, more than any published route (Orange, the next-most, manages 12.0), and at 56.4 miles it is shorter than Orange. Yet it is *not* the lowest-impact route (Table 5).

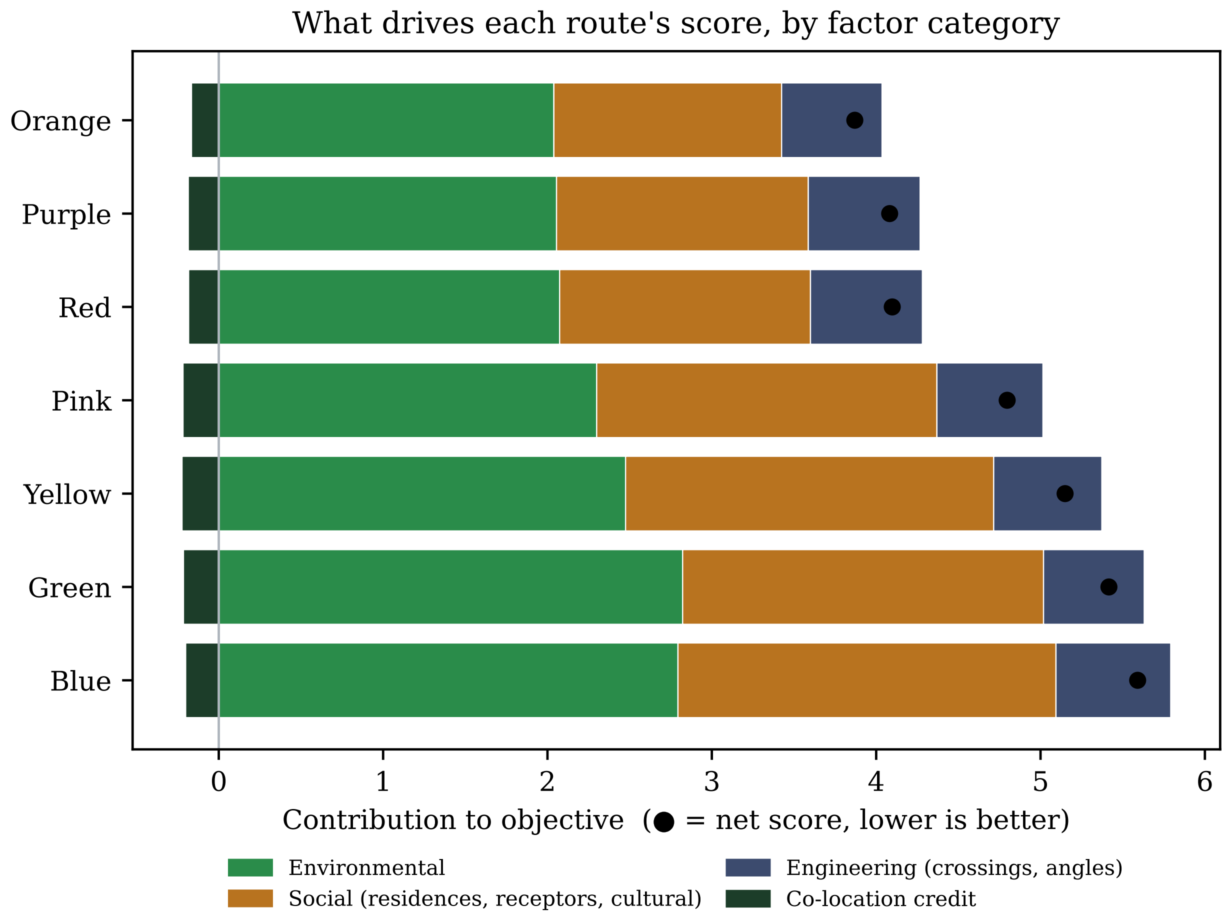

Figure 14: Per-route decomposition of the composite objective. Penalties (environmental, residential, stream crossings) stack to the right of zero; co-location credits (existing transmission, highway, rail) stack to the left; the black marker is the net score (lower is better). Factor weights are configurable (Section 7); the values shown use the active configuration.

Table 5: The synthetic Teal route against the two routes it is spliced from.

Route	Length (mi)	On I-96 (mi)	Wetland (ac)	Floodplain (ac)	Residences ≤500 ft	Objective
Orange	58.0	12.0	306	156	235	3.870
Yellow	54.9	5.2	317	182	318	5.149
Teal	56.4	13.5	354	214	284	5.018

Maximising freeway co-location does not minimise impact here

Near Lansing, I-96 runs through river floodplain and developed, residential land, so hugging it more *adds* impact. Relative to Orange, the Teal route picks up 48 acres of wetland, 57 acres of floodplain, and 49 more residences within 500 ft, and it scores 5.018 against Orange's 3.870. Ranked against ITC's seven, it lands fifth (Figure 15). Orange's southern loop, in other words, is deliberate avoidance, not a careless detour: it routes around the wet, developed land beside the western half of I-96 and rejoins the freeway only for its drier eastern half. The Teal route undoes that trade — which is why a route like it was not, and should not have been, put forward.

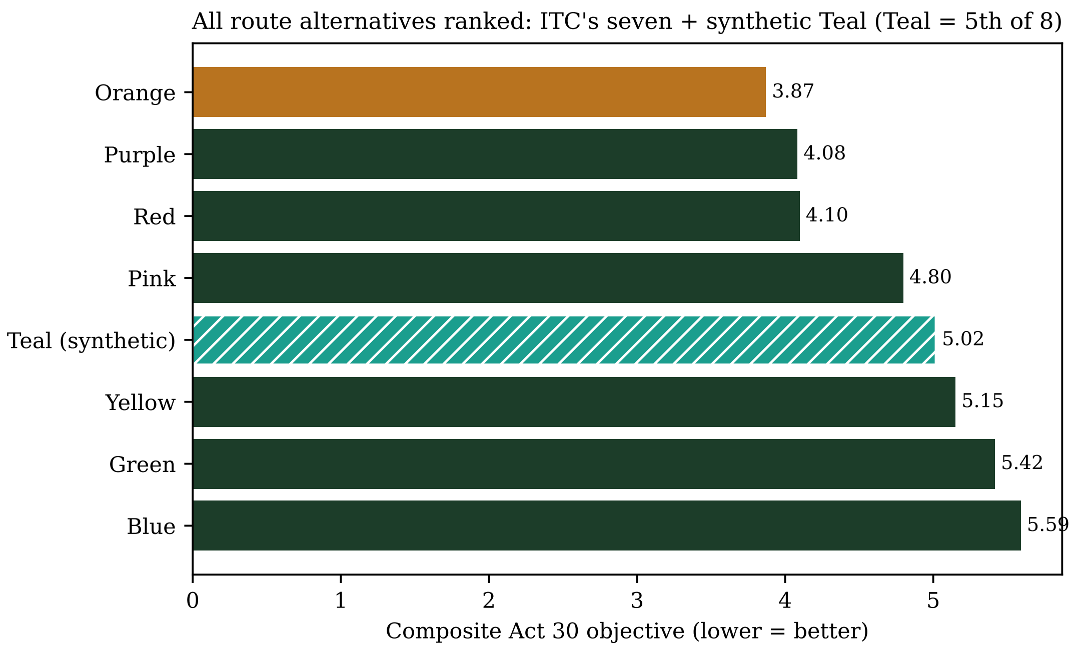

Figure 15: ITC's seven published routes and the synthetic Teal route ranked together on the composite objective (lower is better). Teal (hatched) places fifth — ahead of Yellow, Green, and Blue, behind Orange, Purple, Red, and Pink — so even the maximum-freeway route does not beat the leaders.

9 Findings and Recommendations

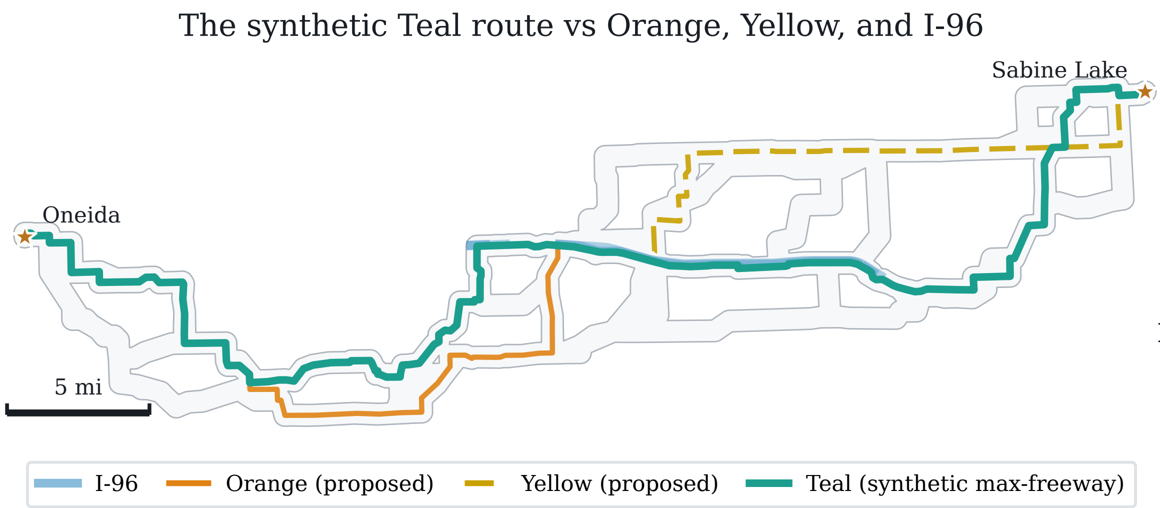

Figure 16: The synthetic Teal route (teal) — Yellow's western half joined to Orange's eastern half — maximises I-96 co-location but runs wetter and nearer more homes than Orange.

9.1 Findings

Finding 1

Of ITC's 7 published Phase 3 alternatives, the Orange Route is the best fit for the Act 30 factors as weighted here (58.0 miles, 1,364 acres of environmental impact in the 200 ft corridor), and the Blue Route is the worst (Table 4). Co-location with existing rights-of-way is voltage-weighted and varies across the routes — the recommended route in fact parallels existing transmission the *least* — so at the current weights the ranking is governed by environmental footprint and residential proximity, not corridor reuse.

Finding 2

The objective includes the count of residences within 500 ft — the heaviest factor the MPSC applies — from Michigan property-class parcels covering all three route counties, including Livingston, whose parcels were assembled from the county GIS viewer and assessor records (Section 7.6). Adding this factor changed the ordering, confirming it is decision-relevant; completing the Livingston coverage did *not* change it — every route gained a comparable number of residences and the recommended route still has the fewest. The top three alternatives remain relatively close, but once the objective is weighted without double-counting the recommended route leads them robustly, yielding only to the Purple route where existing-corridor co-location is weighted most heavily (Appendix C); the ranking is still best read as a transparent, reproducible baseline rather than a verdict.

9.2 Per-jurisdiction view

Because impacts and accountability are local, Table 6 resolves the recommended Orange Route by township, so Meridian, Williamstown, and the other crossed jurisdictions can see how much of the route falls within their boundaries.

Table 6: Recommended (Orange) route: miles within each township.

Township	Route miles
Windsor Charter Township	9.89
Alaiedon Township	9.84
Conway Township	6.37
Leroy Township	6.24
Handy Township	5.38
Wheatfield Township	5.33
Aurelius Township	4.77
Benton Township	3.91
Delhi Charter Township	2.66
Cohoctah Township	1.73
Oneida Charter Township	1.28
Eaton Rapids Township	0.55

9.3 Recommendations

Recommendation 1

Treat this ranking as a transparent, reproducible baseline for comparing ITC's 7 published alternatives on the Act 30 factors — not as a substitute for the Commission's weighing. Where ITC's preferred route is not the objective-preferred one, the difference in environmental, residential, and co-location terms should be made explicit on the record.

Recommendation 2

Add the residential-parcel count within 500 ft (the MPSC "social-evaluation" bucket) before relying on the ordering of the top alternatives, and re-derive the ranking under alternative weightings to test how robust each route's standing is. Both are supported by the configurable objective without recomputing the spatial metrics.

A Data Inventory and Provenance

Every dataset used in this analysis is listed in Table 7 with its feature count, geometry type, and the first ten hexadecimal digits of its SHA-256 content hash. The full hashes, source URLs, and UTC retrieval timestamps are recorded in the machine-readable `data/inventory.json` manifest and in the per-file `.provenance.json` sidecars that accompany every layer. Re-running the retrieval pipeline reproduces these artifacts; a hash mismatch indicates the upstream source has changed.

Table 7: Retrieved and derived data inventory (SHA-256 truncated).

Dataset	Features	Geometry	SHA-256
boundaries.michigan.counties	83	MultiPolygon,Polyg	e83409f88d
boundaries.michigan.county_subdivisions	1580	MultiPolygon,Polyg	d2205745fd
contamination.michigan.brownfields	37	Point	4c509cffda
contamination.michigan.part201	458	MultiPoint	192cc95087
contamination.michigan.usts	939	Point	6cfe8d4ab3
environment.michigan.hydric_soils	4754	MultiPolygon,Polyg	9d4180dc73
environment.michigan.nwi_plus	8618	MultiPolygon,Polyg	c3db03626e
environment.us.fema_flood_zones	797	Polygon	e86a43e5cc
environment.us.nhd_flowlines	713	LineString	fa78667977
environment.us.padus	230	MultiPolygon,Polyg	89a1bb7a47
infrastructure.michigan.airports	487	Point	78fecf3afa
infrastructure.michigan.dams	14	Point	a67ccb40f3
infrastructure.michigan.railroads	650	LineString	7e09e7b554
infrastructure.michigan.roads	32000	LineString	ca155b1368
infrastructure.michigan.wellhead_protection	77	MultiPolygon,Polyg	f7c0426ab8
infrastructure.us.transmission_lines	33	LineString	aa11fa5951
project.itc.county_boundary	6	Polygon	a2871734dc
project.itc.current_alignment	62	LineString,MultiLi	31a907c992
project.itc.eng_point_features	2	Point	091efb6526
project.itc.incorporated_area	29	MultiPolygon,Polyg	fd13bdbabf
project.itc.phase3_routes	7	LineString	1d71123137
project.itc.routing_buffer	1	Polygon	53b8188d49
project.itc.structures_marked	4116	Point	b10efcbe17
project.itc.survey_study_area	1	Polygon	5b83ebadf6
project.itc.township_boundary	103	MultiPolygon,Polyg	b995d2bd81

B Reproducibility

This report is reproducible end-to-end from a clean checkout of the `oneida-sabine-analysis` repository. The analysis library depends on the shared `geodata` module and is managed with `uv`.

B.1 Pipeline

1. `uv sync` — install dependencies (including the local `geodata` module).
2. `uv run oneida-sabine retrieve --all` — download every source layer (ITC project layers + geodata environmental, contamination, transportation, and boundary layers), writing a provenance sidecar per file and aggregating `data/inventory.json`.
3. `uv run oneida-sabine buffers` — build the 2000 ft study-area and 200 ft corridor buffers.
4. `uv run oneida-sabine clip` — clip metric layers to the study area.
5. `uv run oneida-sabine segments` — compute per-segment, per-township intersection metrics.
6. `uv run oneida-sabine named-routes` — retrieve ITC's 7 Phase 3 named routes, score each on the configurable objective, rank them, and write the per-jurisdiction summary.
7. `make` in `report/` — regenerate the LaTeX tables, macros, and figures from the derived artifacts and build this document.

B.2 Coordinate reference systems

Geometries are stored in WGS 84 (EPSG:4326). All area and distance calculations are performed in Michigan GeoRef (EPSG:3078), whose units are meters; acreage uses the square-meters-to-acres factor and buffer distances use an explicit feet-to-meters conversion.

B.3 Attestation

Every number in this report is generated by `oneida_sabine.reporting.generate` directly from the provenance-tracked JSON artifacts of the pipeline. No figure is hand-entered. The data inventory (Appendix A) records the SHA-256 of every input, so the evidentiary chain from source to finding is verifiable.

C Sensitivity to the Objective Weights

The ranking depends on roughly two dozen factor weights spanning the engineering, environmental, and social categories, and reasonable people will weight the Act 30 factors differently. The default weights are set by a stated principle — category balance with no double-counting (Section 7.4). To test how much the exact numbers matter, we drew 1,000,000 weightings and re-ranked all 7 routes under every one. We use two draws. The *Act 30-centred* draw varies each default weight independently from one-eighth to eight times its value (log-uniform), preserving the category structure; this is the principled robustness test. The *uniform* draw instead gives every factor an independent random weight, which deliberately *ignores* that structure and so re-introduces the very double-counting the default removes. Scoring a weighting is a single matrix product over the fixed route metrics, so each sweep is evaluated exactly. The raw draws are retained under `data/derived/sweep/`; reproduce with `oneida-sabine sweep`.

C.1 The recommendation, and its principal rival

The recommendation is robust; one route is the live alternative

Across 1,000,000 Act 30-centred weightings, the **Orange Route** ranks first in 66% of them, sits in the top three 95% of the time, and is never last. The **Purple Route** is the one live alternative (29%): it overtakes Orange chiefly where existing-corridor co-location is weighted most heavily. Under the structure-free *uniform* draw — which re-introduces the double-counting the default removes — Purple leads (89% to 8%); that measures how much the redundant factors favour Purple, not a neutral robustness test. Only four of the seven routes ever rank first (Orange, Purple, Red, and Pink); Green and Blue never win and finish last 14% and 84% of the time.

Figure 17 shows the full picture: each route's distribution of finishing ranks under the Act 30-centred draw. The field separates into stable tiers — Orange first, Purple a close and persistent second, a next pair (Red and Pink) that occasionally reach the top, and a settled bottom (Green and Blue, never in contention). Blue finishes last in 84% of weightings; neither it nor Green ever reaches the top three in more than a rounding error.

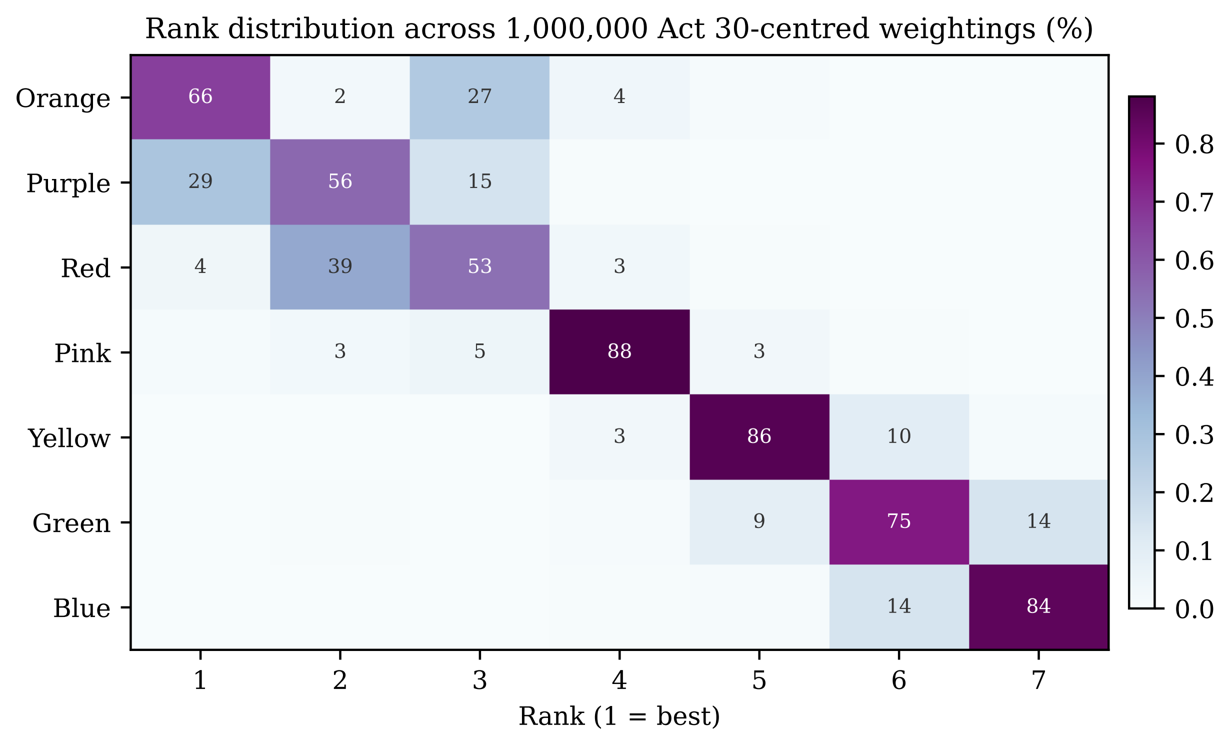

Figure 17: Distribution of each route's finishing rank across 1,000,000 Act 30-centred weightings (row % sums to 100). Routes are ordered by mean rank. The near-diagonal banding shows the order is structurally stable, not an artifact of one particular weighting.

C.2 What it would take to change the answer

Figure 18 sweeps each factor's weight one at a time, holding the others at their default. The great majority of the factors never change the winner at all, even pushed to eight times their weight (the figure shows only the few that can); and every flip hands first place to Purple — once, to Red — not to an environmentally heavier route. No single factor, swung anywhere in that range, lifts Green or Blue near the top. Whether Orange or Purple comes out ahead turns on how heavily existing-ROW co-location is weighted against residential and environmental impact — precisely the holistic judgment Act 30 commits to the Commission, in which co-location is "an important factor" but not controlling (Section 3.3).

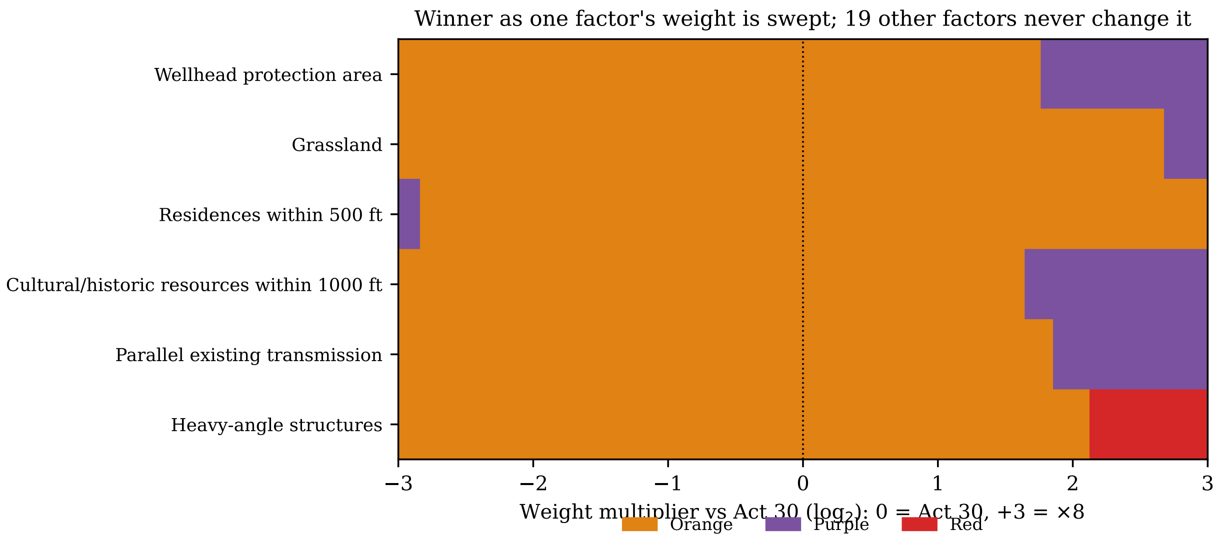

Figure 18: Winner as each factor's weight is swept from one-eighth to eight times its default (others held at default); the dotted line marks the default. Only a handful of factors can change the winner, and every flip is to Purple (once to Red); the recommended route holds across the rest.

The practical reading: Orange is the recommended route on the default weighting and across the great majority of perturbations of it; Purple is the serious alternative, and a decision-maker who weights corridor reuse most heavily could defensibly prefer it. The *bottom* of the field is not in question — the environmentally heavier routes rank low under every reasonable weighting.

A note on the cultural layer: the objective carries the count of cultural and historic resources within 1,000 ft (historic sites and cemeteries from OpenStreetMap) at only a token weight, because it is a partial, SHPO-restricted public proxy. The recommended route is the only one with such a resource in that band, so it is mildly penalized by this factor; even so, at its token weight the leader does not change, and it would take weighting cultural resources several times higher — beyond what such partial data warrants — to bring Purple level.

This conclusion rests on the complete residential data: the earlier gap in Livingston County (the recommended route's longest tail) has since been filled, and doing so left the ranking unchanged (Section 7.6).

Sources

[1] Midcontinent Independent System Operator. *Long Range Transmission Planning (LRTP) Tranche 2.1 Portfolio*. https://www.misoenergy.org/planning/long-range-transmission-planning/. 2024.

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[4] Michigan Public Service Commission. *Order Granting Certificates of Public Convenience and Necessity, Case Nos. U-21471 and U-21472 (Order O-013347)*. Issued July 10, 2025; retrieved via OpenMPSC (openmpsc.com). 2025. URL: https://mi-psc.my.site.com/sfc/servlet.shepherd/version/download/068cs00000ynBT4AAM.

[5] Michigan Court of Appeals. *In re Application of Michigan Electric Transmission Co., 309 Mich App 1 (2014), aff'd 500 Mich 988 (2017)*. 2014.

[6] U.S. Geological Survey. *Protected Areas Database of the United States (PAD-US)*. https://www.usgs.gov/programs/gap-analysis-project/science/pad-us-data-overview. 2024.