Document 1: Design Options and Assessment of Road Realignment

Alternative Cross section Analysis

The 11 cross-sections produced, analyzed, and evaluated are as follows and are shown in the following figures:

Options 1-8 and Option 11 use a 26-metre right-of-way (ROW). Options 9 and 10 use a 27-metre and 34-metre ROW and a rural or partial rural cross-section. Most cross-section options feature a 9-metre roadway. The cross-section alternatives offer varying options in terms of roadway median, tree boulevard and snow storage configuration, and active transportation mode delineation, with some options having multi-use pathways (MUP) rather than delineation.

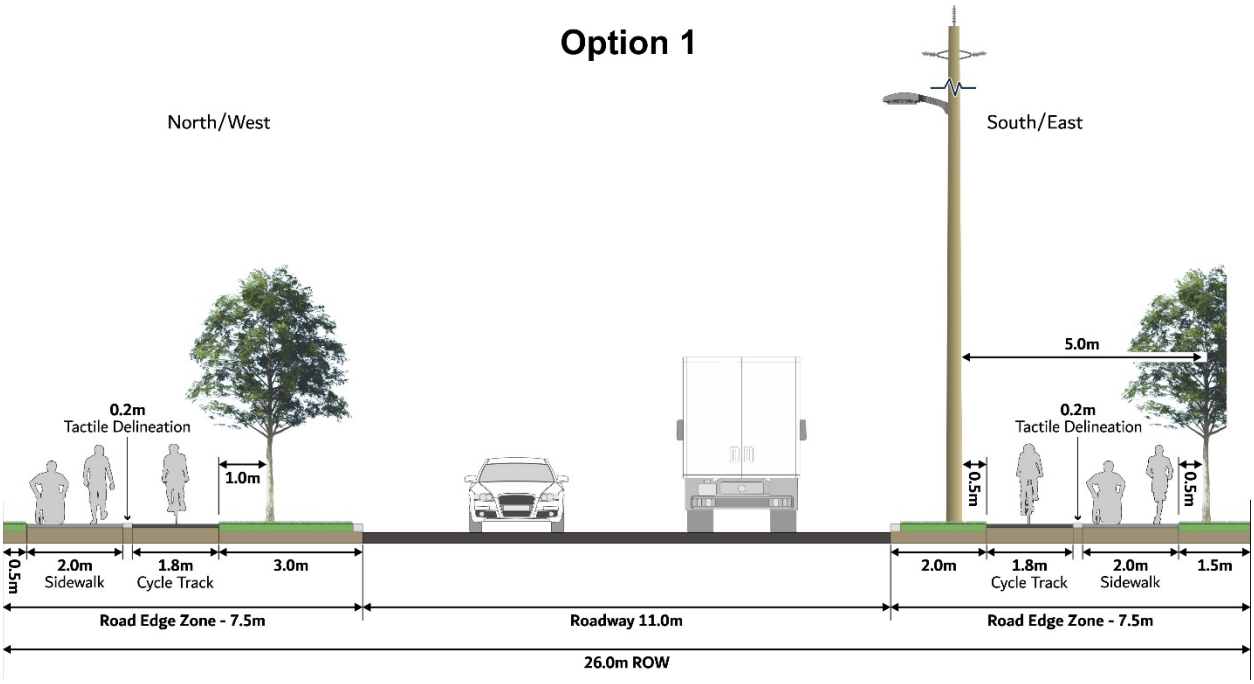

Figure 1: Option 1

Option 1 above features an 11-metre roadway and tactile delineation of active transportation modes

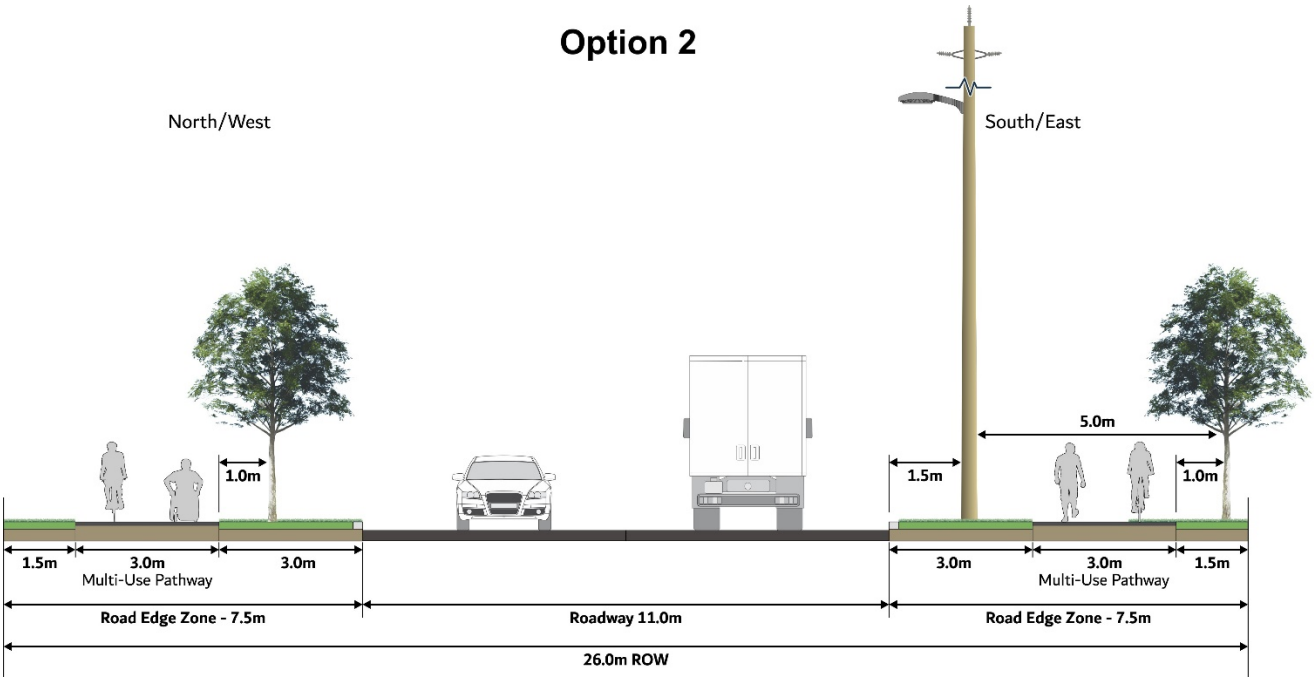

Figure 2: Option 2

Option 2 above features an 11-metre roadway using an MUP on both sides

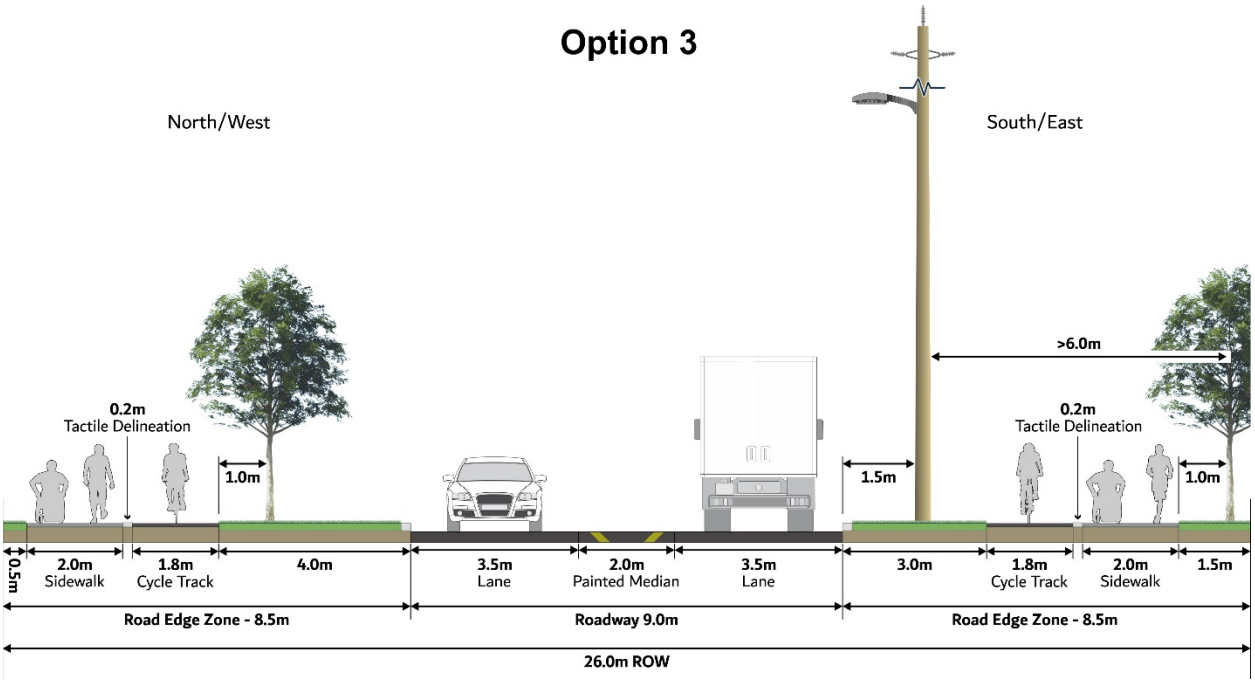

Figure 3: Option 3

Option 3 above features a 9-metre roadway with a painted median and tactile delineation of active transportation modes.

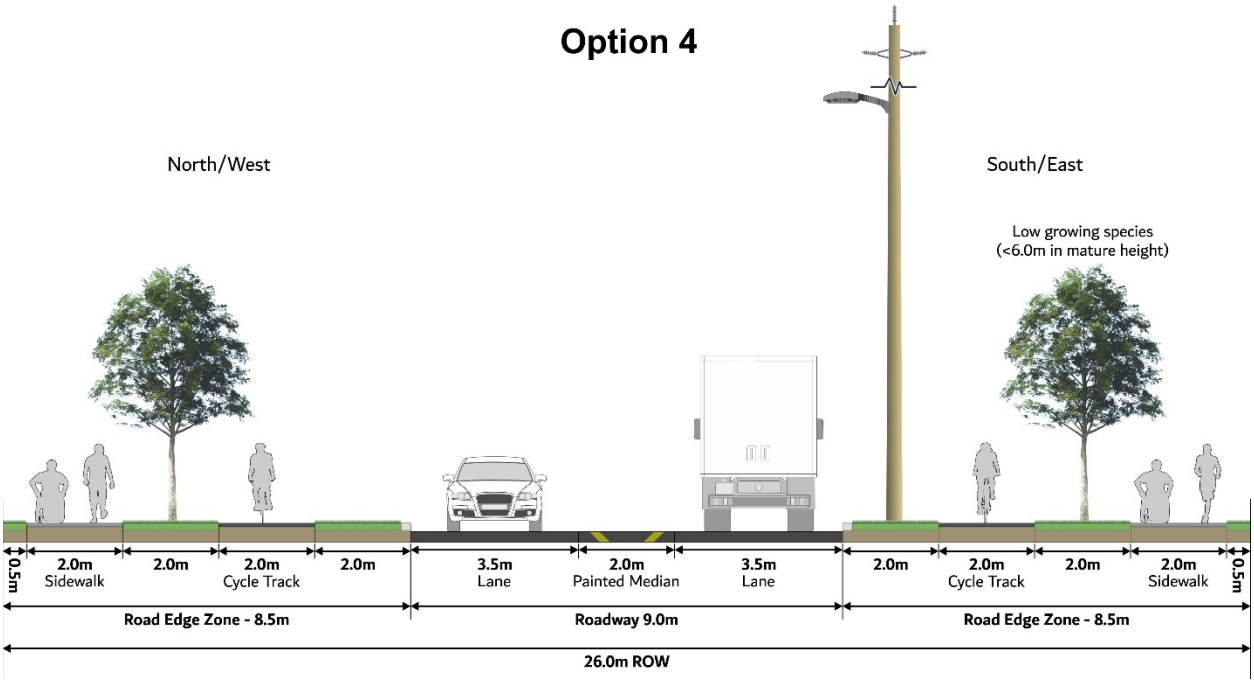

Figure 4: Option 4

Option 4 above features a 9-metre roadway with a painted median. Option 4 features active transportation modes delineated by tree boulevards.

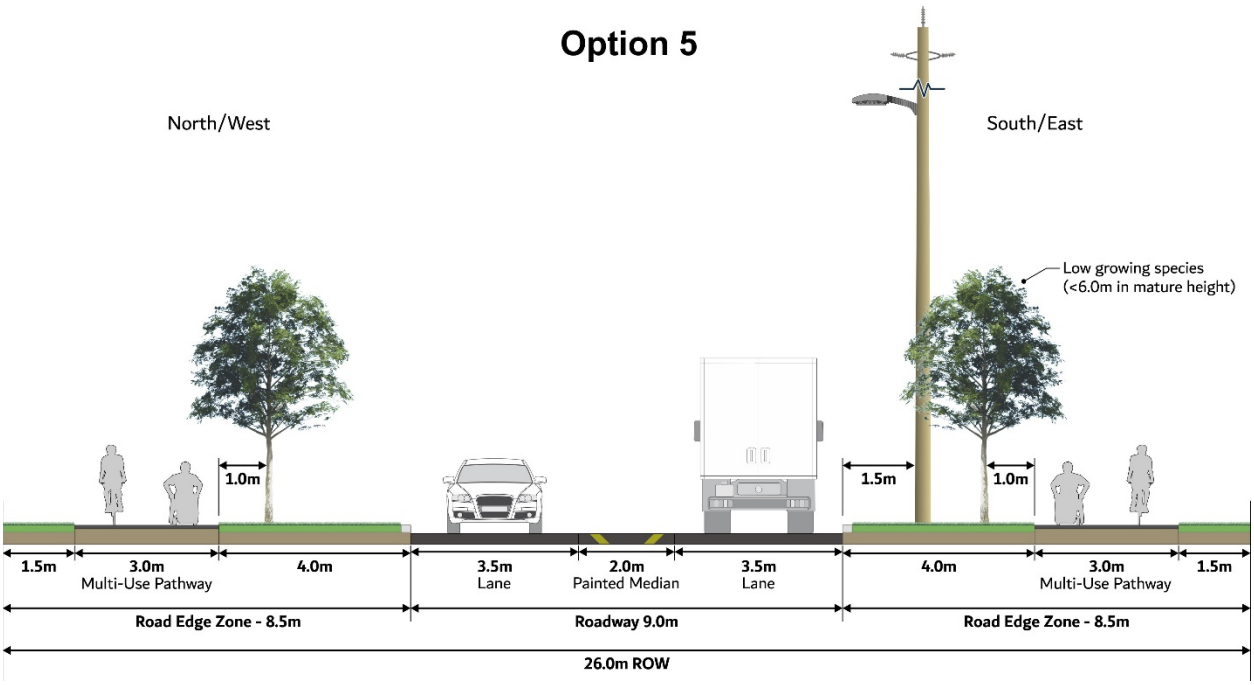

Figure 5: Option 5

Option 5 above offers an alternative configurations where active transportation modes use a MUP instead of delineation, with varying tree and snow storage/boulevard placements.

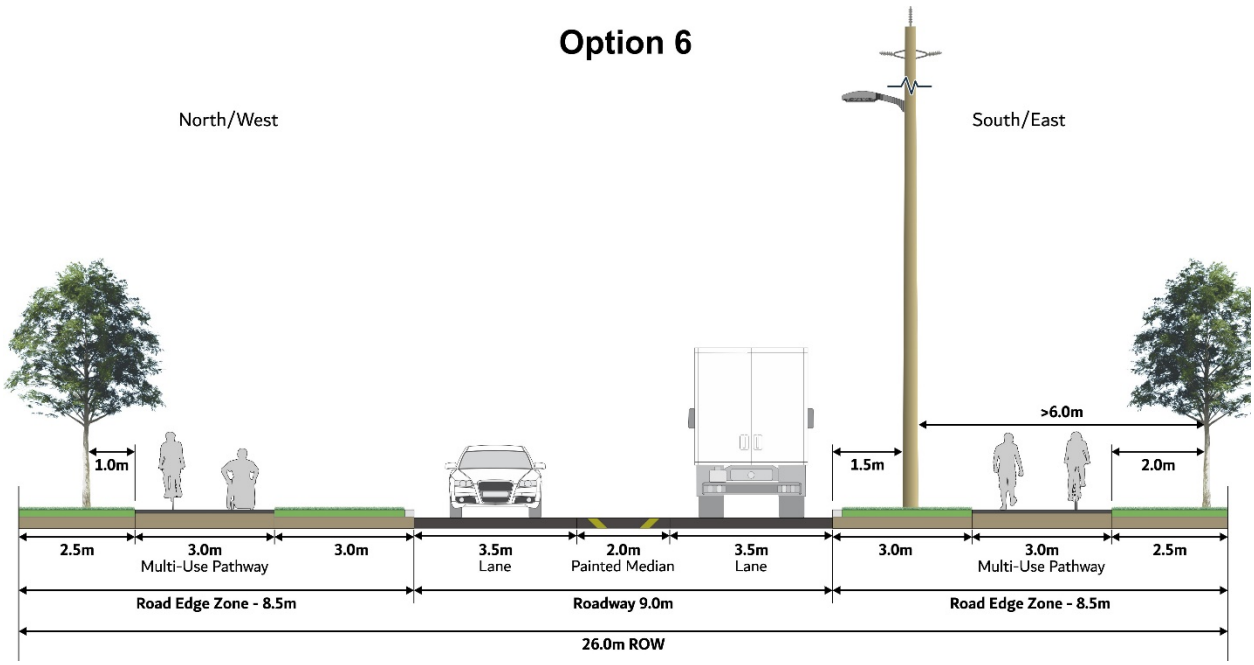

Figure 6: Option 6

Option 6 above also offers an alternative configurations where active transportation modes use a MUP instead of delineation, with varying tree and snow storage/boulevard placements.

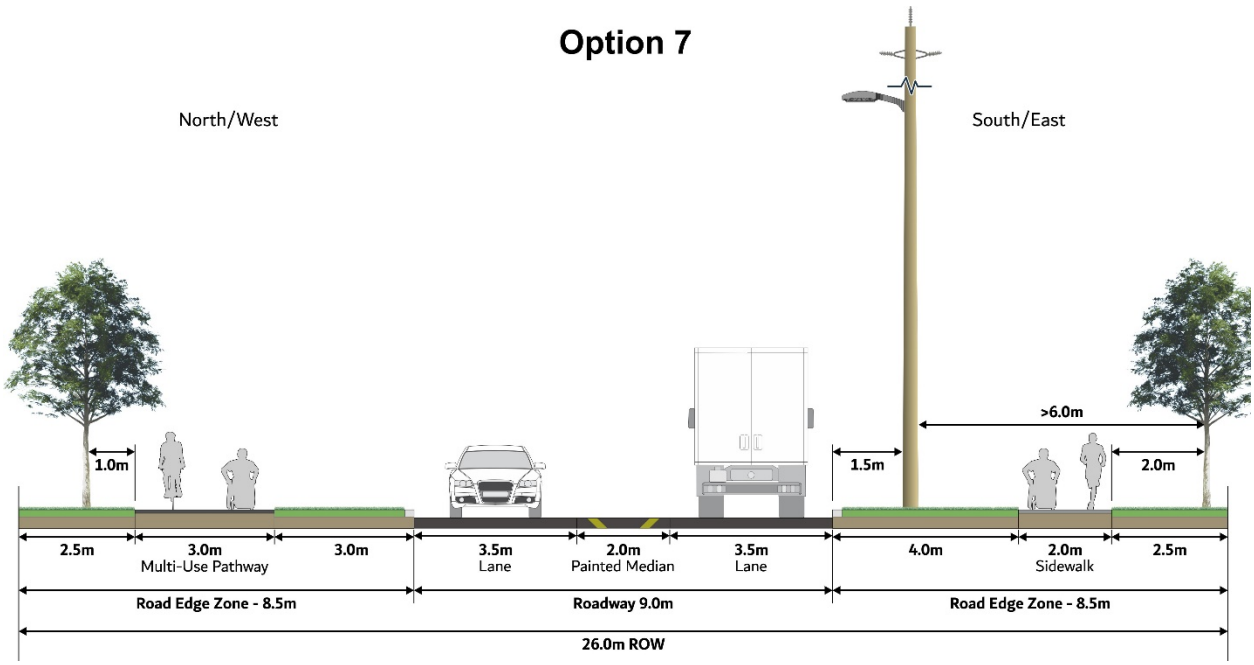

Figure 7: Option 7

Option 7 above offers further alternative cross-sections with varying configurations of boulevards/snow storage.

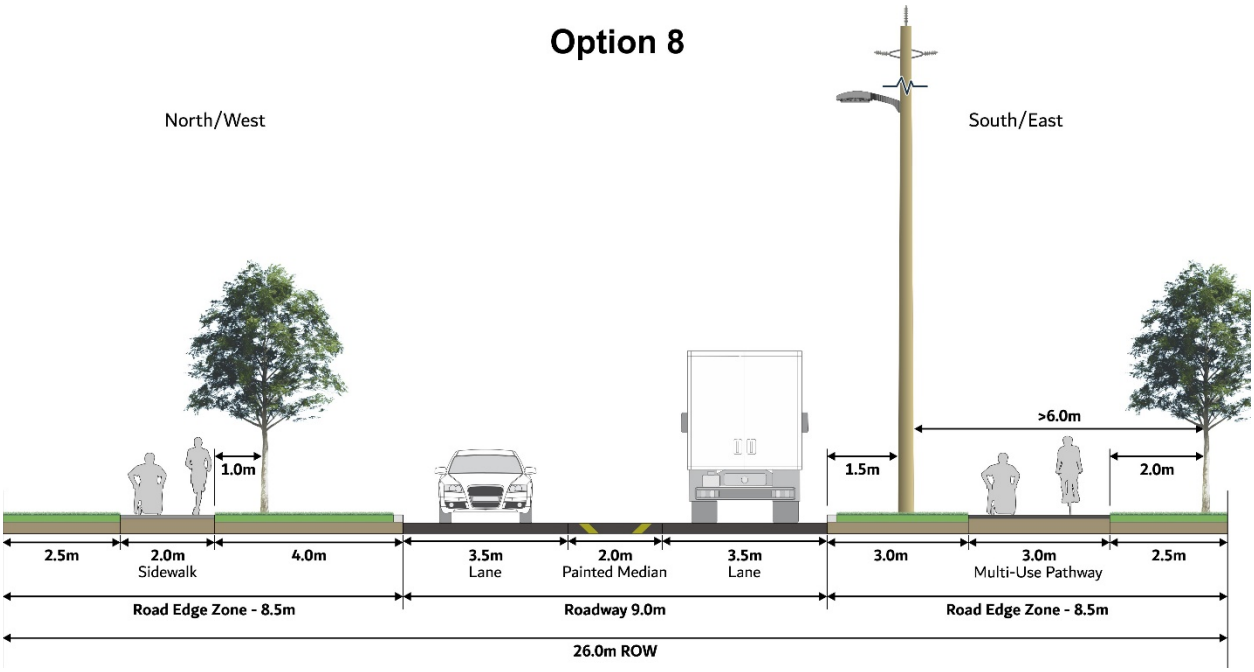

Figure 8: Option 8

Option 8 above also offers further alternative cross-sections with varying configurations of boulevards/snow storage.

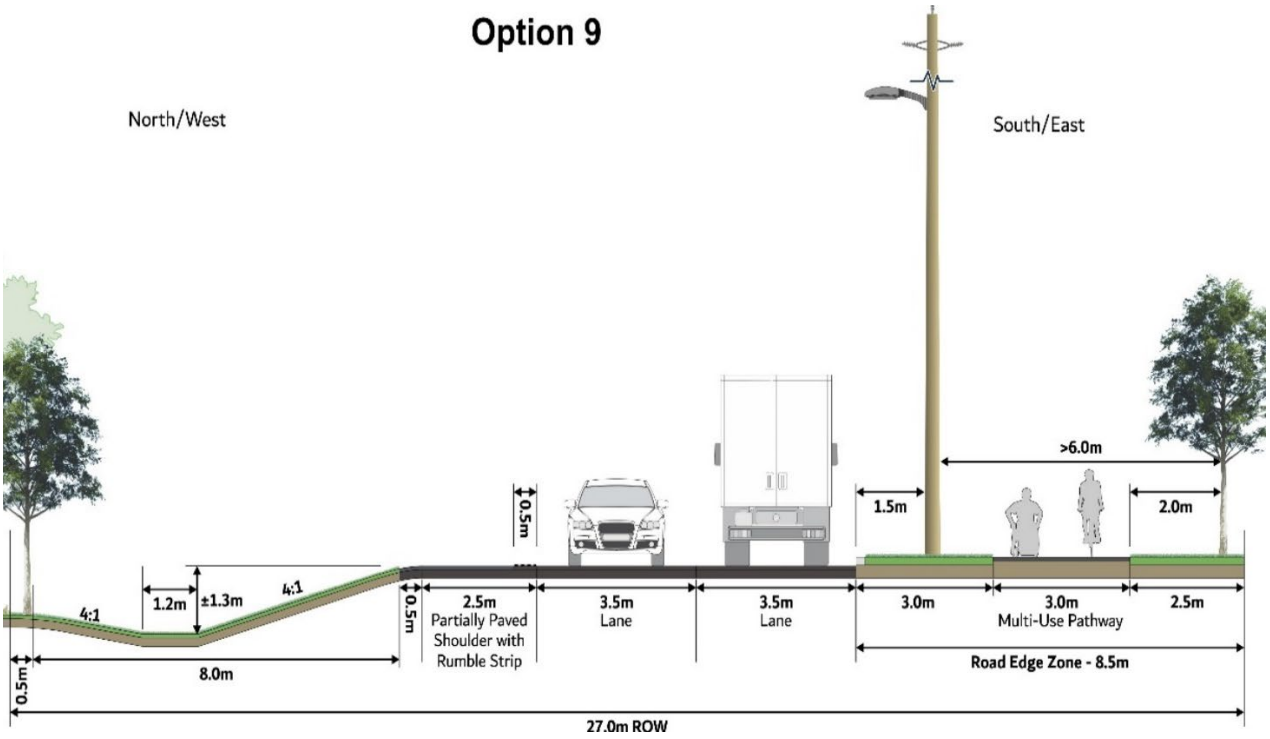

Figure 9: Option 9

Option 9 above uses a rural cross-section on the north/west side (27 metre ROW) featuring a MUP on one side only.

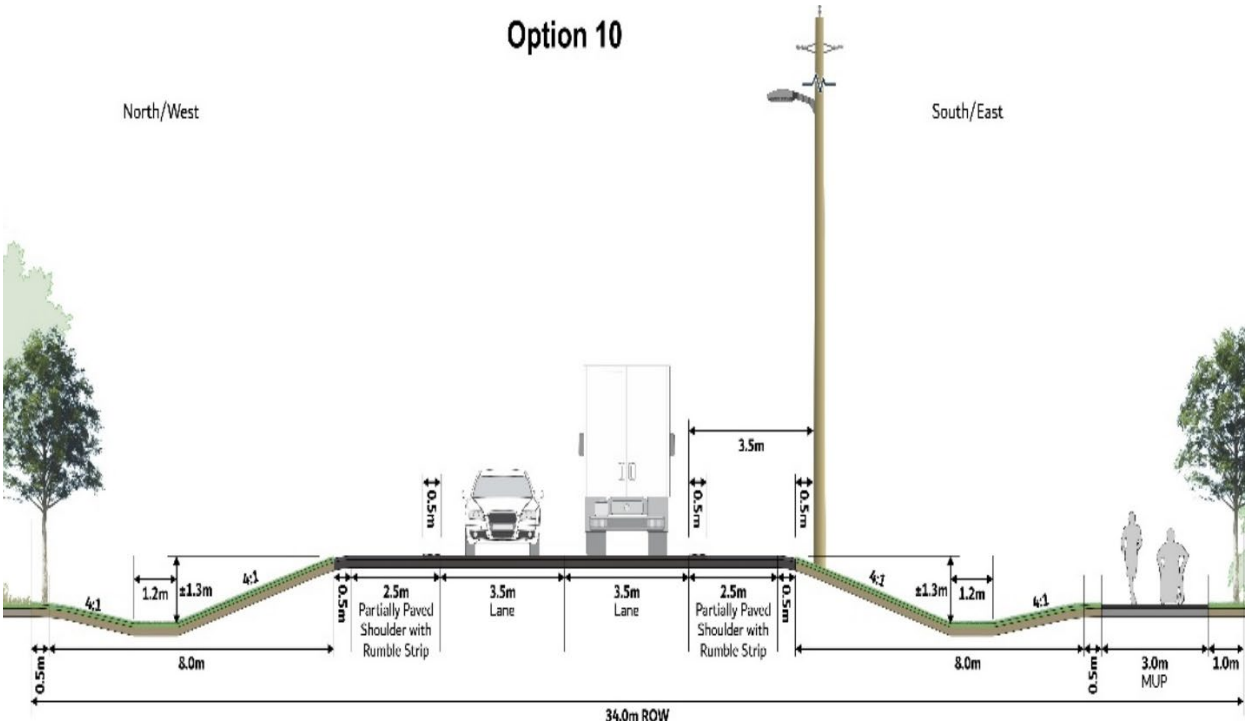

Figure 10: Option 10

Option 10 above features a rural cross-section on both sides (34 metre ROW) featuring a MUP on one side only.

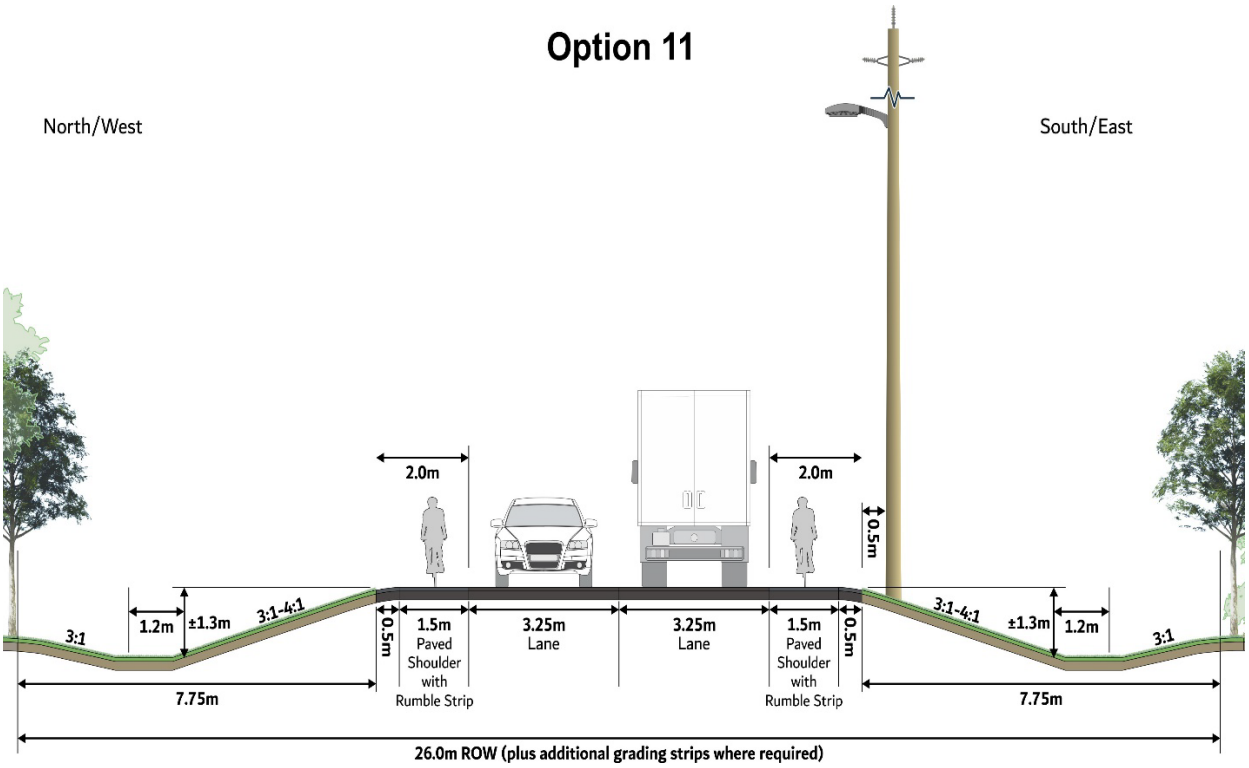

Figure 11: Option 11

Option 11 above offers a modified rural cross-section with cycle paths but no sidewalks/MUPs that fit in a 26 metre ROW.

Alternative Alignment Analysis

The eight roadway alignment alternatives are presented here, in contrast to the 1991 recommended alignment.

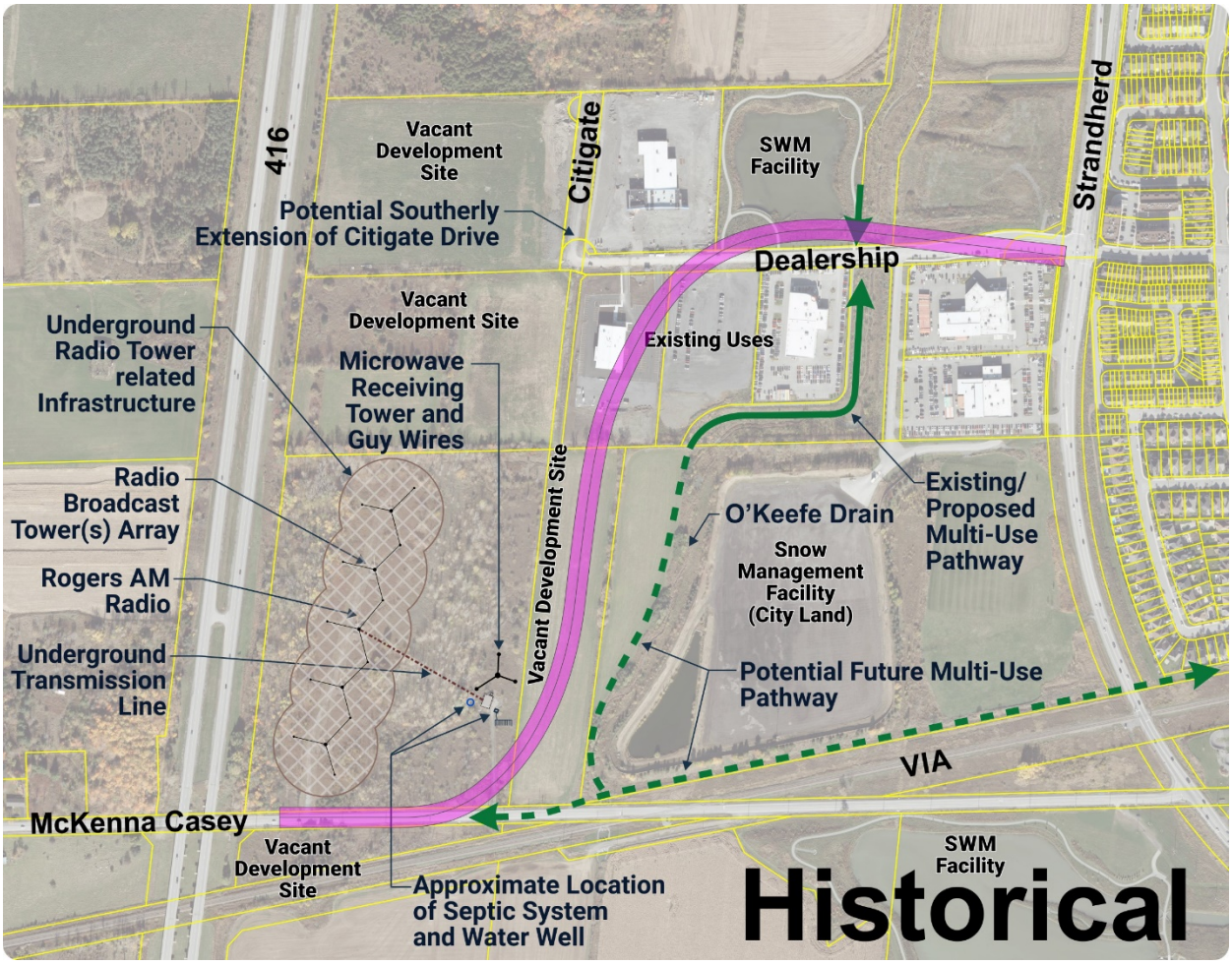

Figure 12: Historical Alignment

The historical alignment from the 1991 EA (Strandherd Drive Highway 416 to Jockvale Road Environmental Assessment Study) achieves the primary mandate of the current EA Addendum by connecting existing McKenna Casey Drive northerly to Strandherd Drive via Dealership Drive. However, due to development along Dealership Drive (e.g. car dealerships, stormwater management ponds), the historical alignment fragments this development and is no longer parallel to present-day Dealership Drive. The alignment also fragments the privately-owned narrow 8-acre lot as it extends northerly. The historical alternative uses a curvilinear alignment that avoids stop intersections at both turn points.

Alignment Alternatives

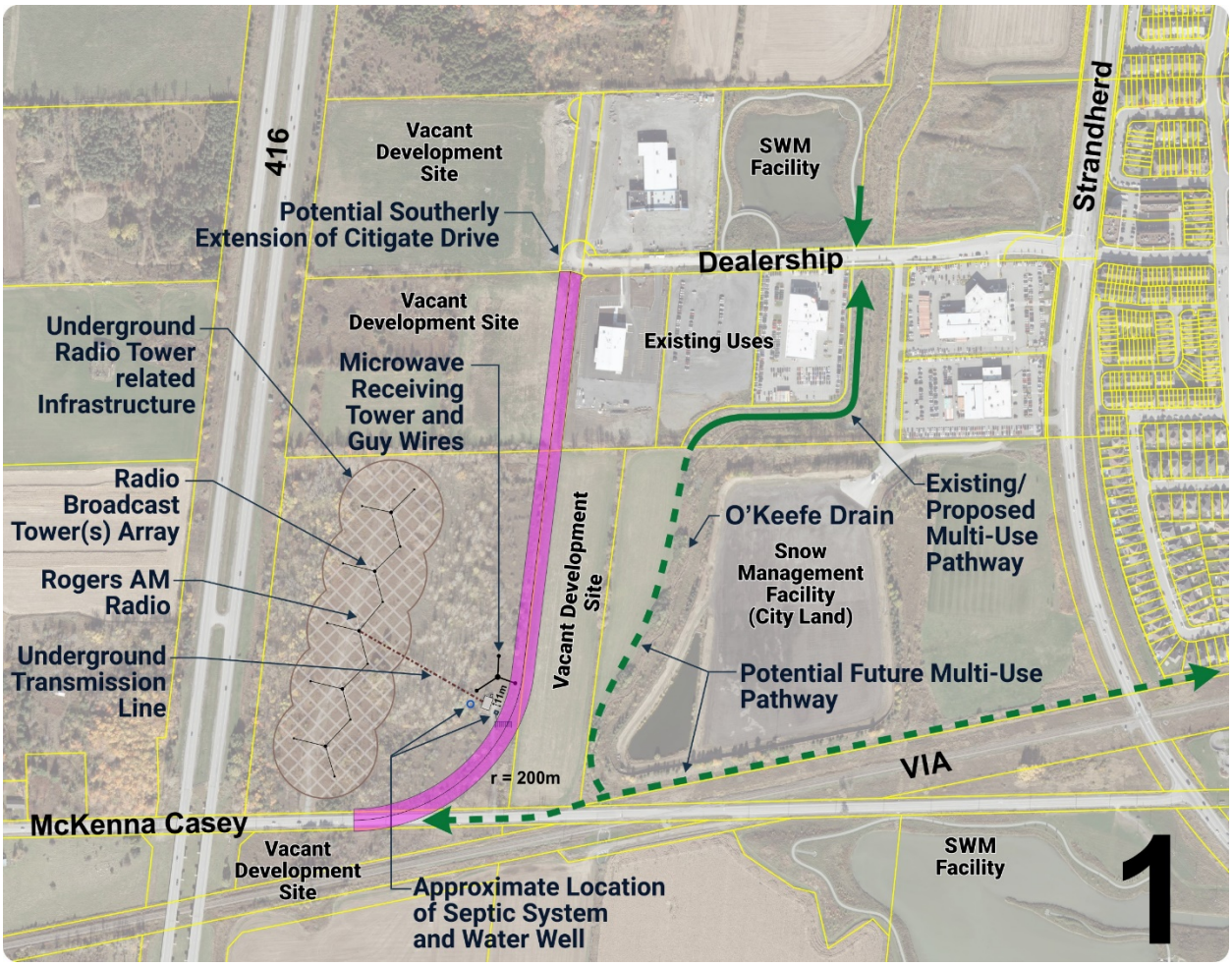

Figure 13: Alternative 1

Alternative 1 above curves from existing McKenna Casey Drive and require no southern intersection. Alternative 1 extends northerly at the midpoint between the two property lines.

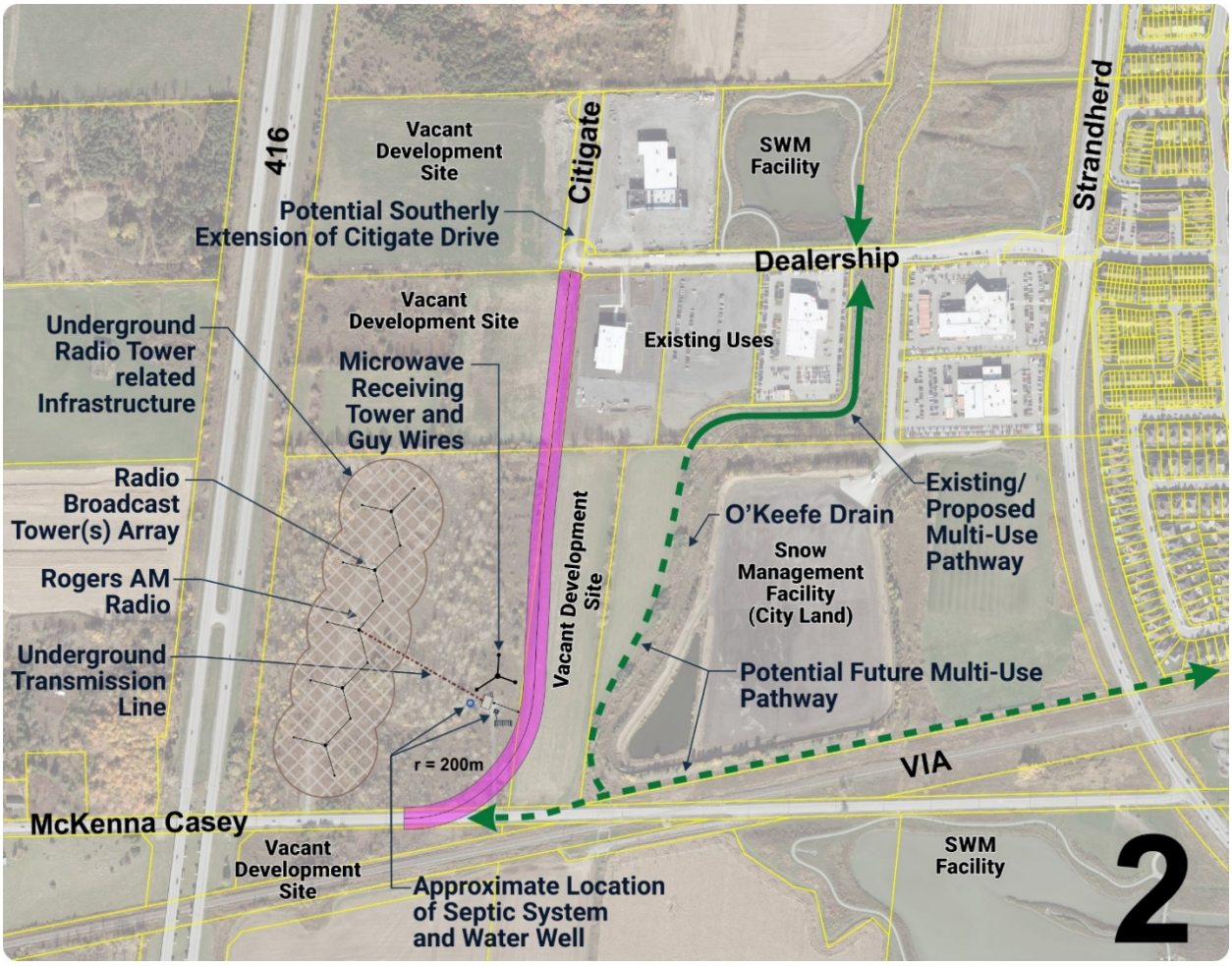

Figure 14: Alternative 2

Alternative 2 above curves from existing McKenna Casey Drive and require no southern intersection. Alternative 2 curves eastward to avoid radio infrastructure.

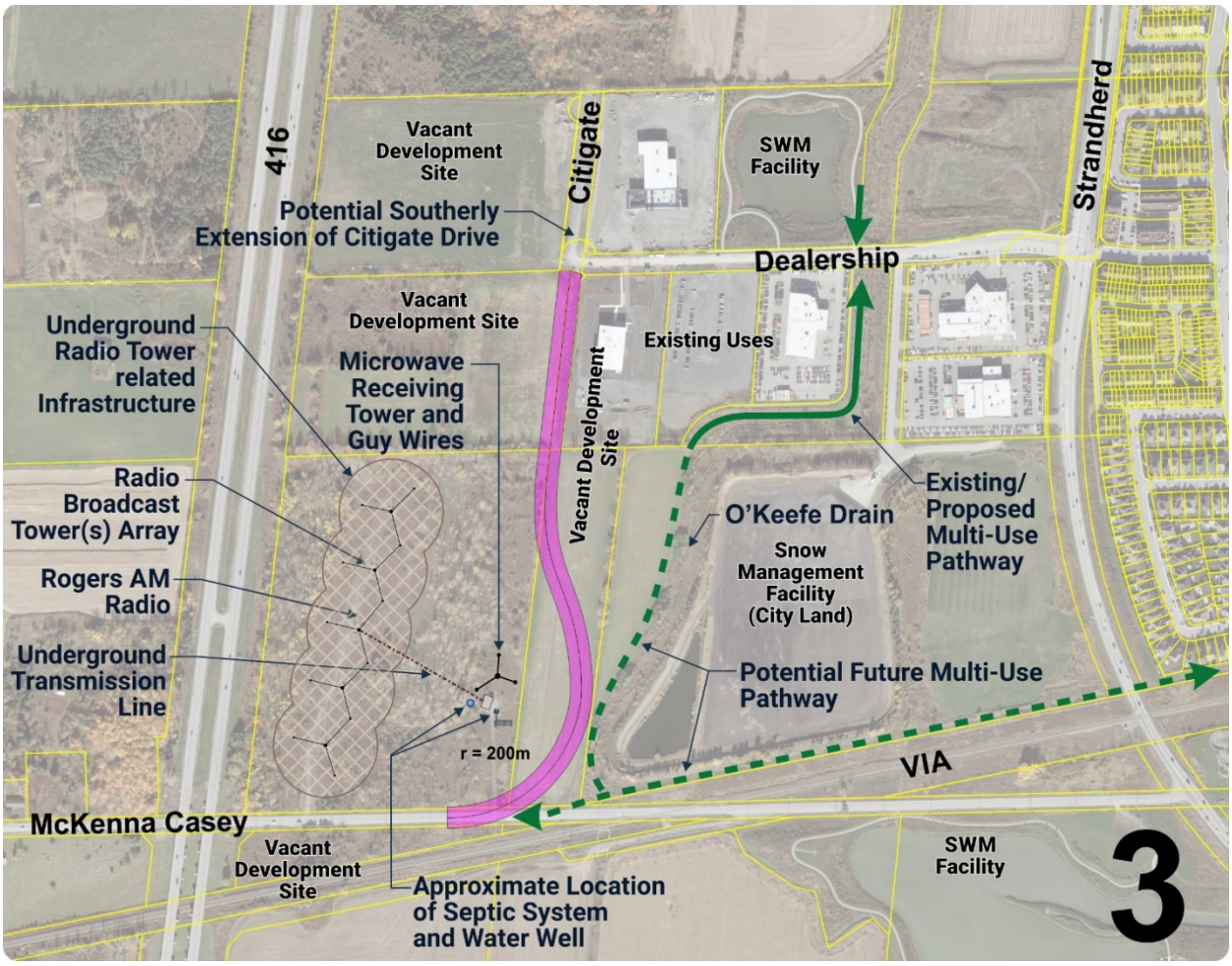

Figure 15: Alternative 3

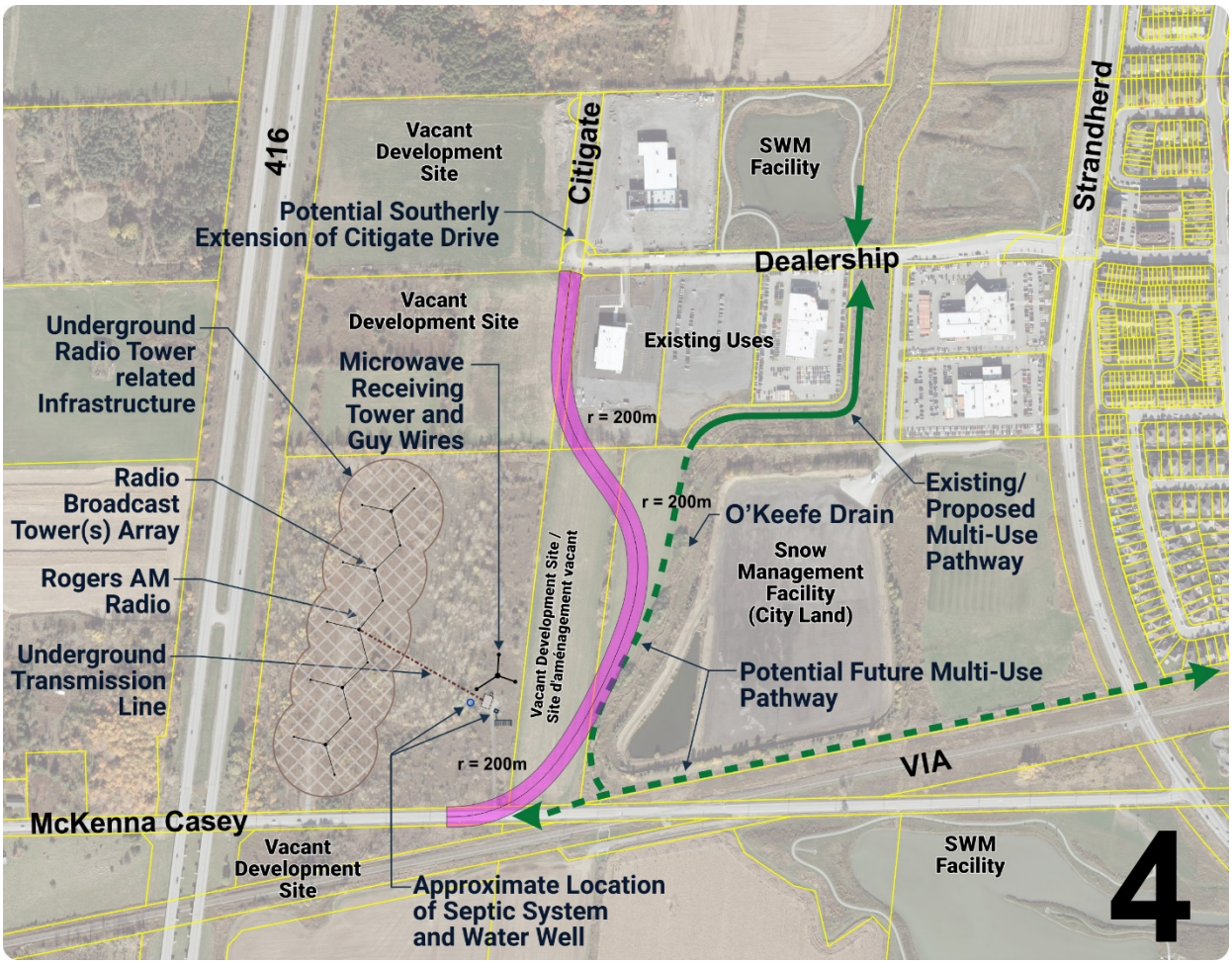

Figure 16: Alternative 4

Alternatives 3 and 4 above offer varying ways to avoid the radio infrastructure on the eastern portion of the Rogers AM Radio site and each create new/alternative development parcels south of Dealership Drive.

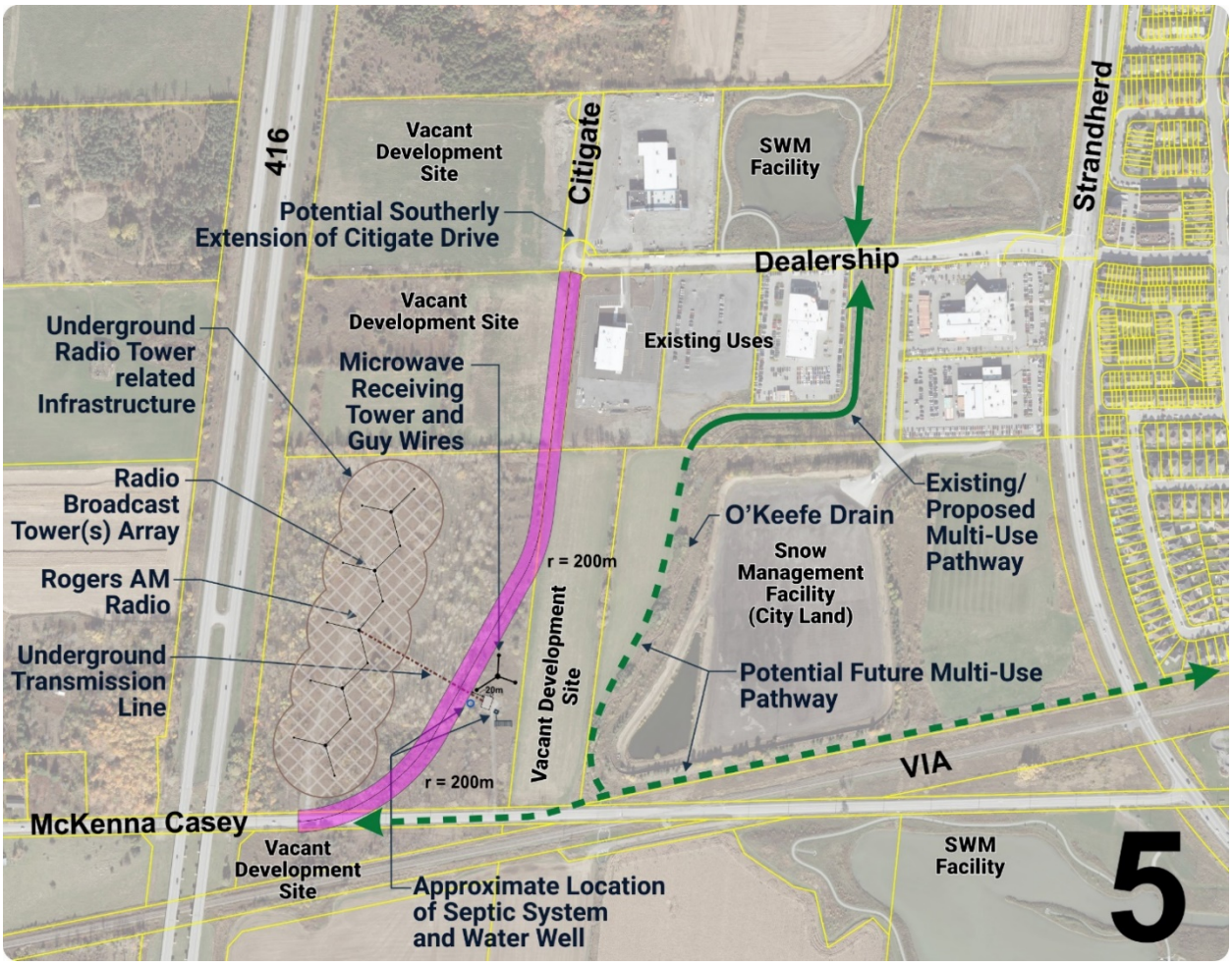

Figure 17: Alternative 5

Alternative 5 above avoids the radio infrastructure to the west of the microwave tower and offers a direct route to Dealership Drive but fragments the radio lot.

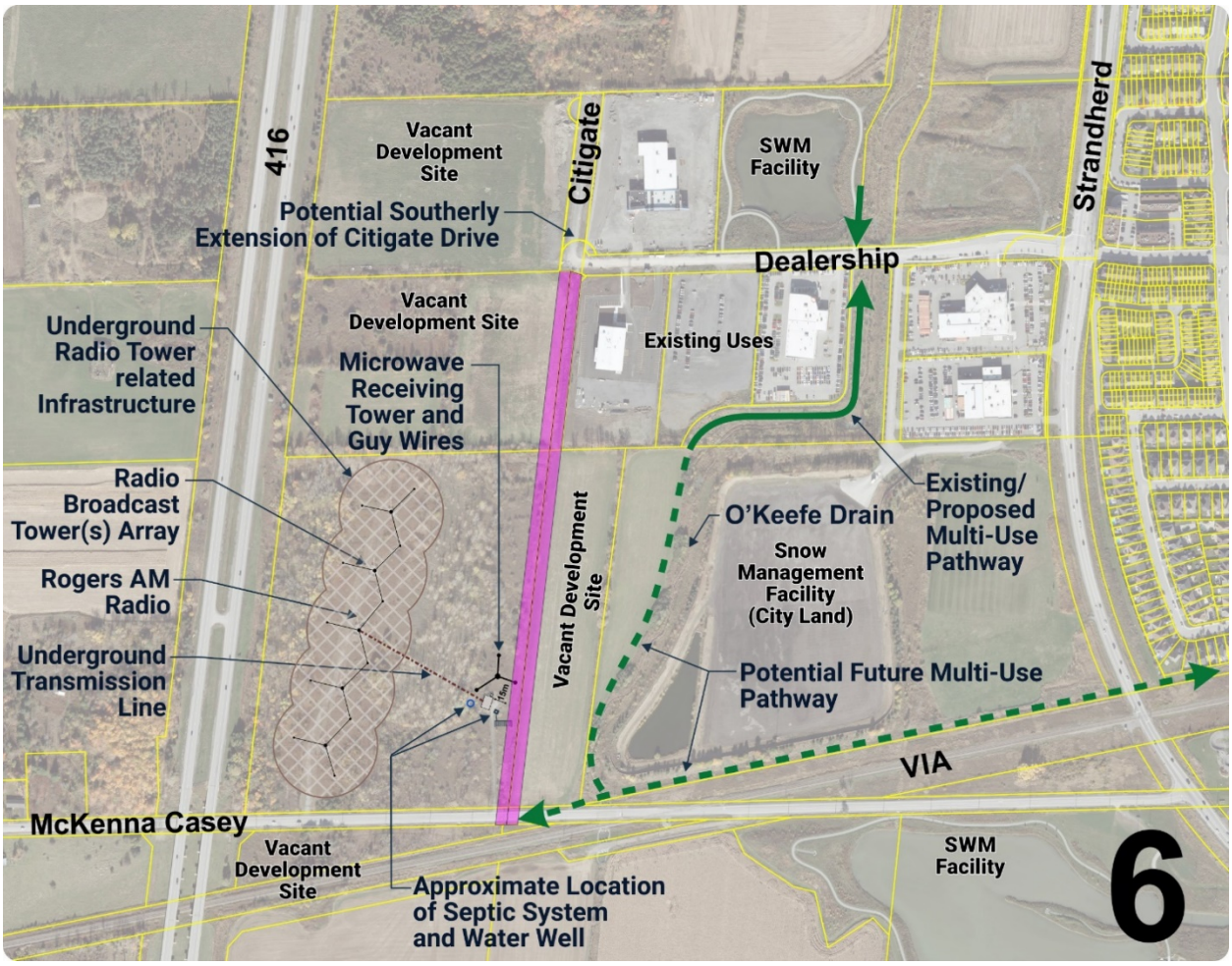

Figure 18: Alternative 6

Alternative 6 above uses a stop intersection at existing McKenna Casey Drive. Alternative 6 follows the property line much like Alternative 1.

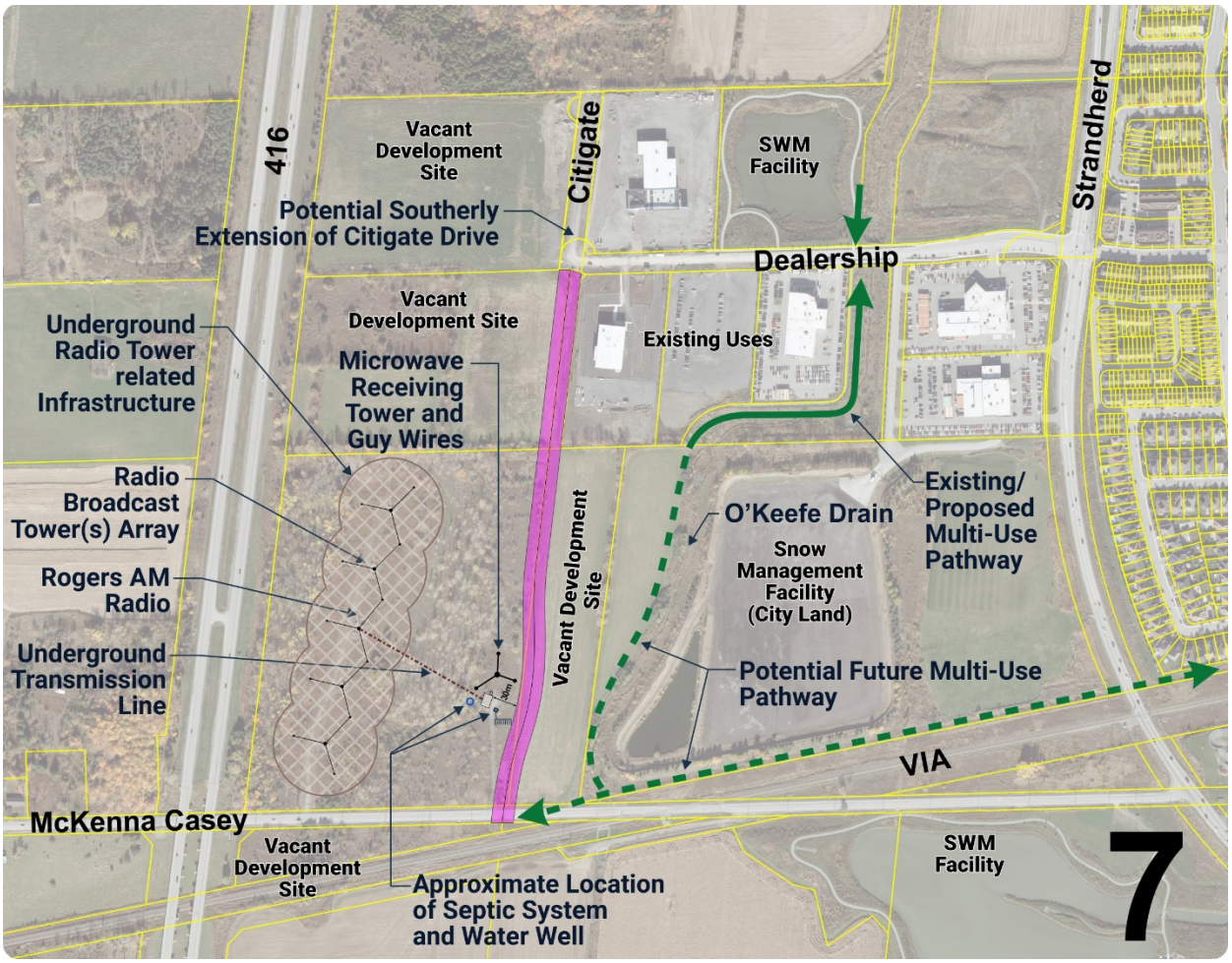

Figure 19: Alternative 7

Alternative 7 differs from Alternative 6 in that it curves eastward to avoid radio infrastructure.

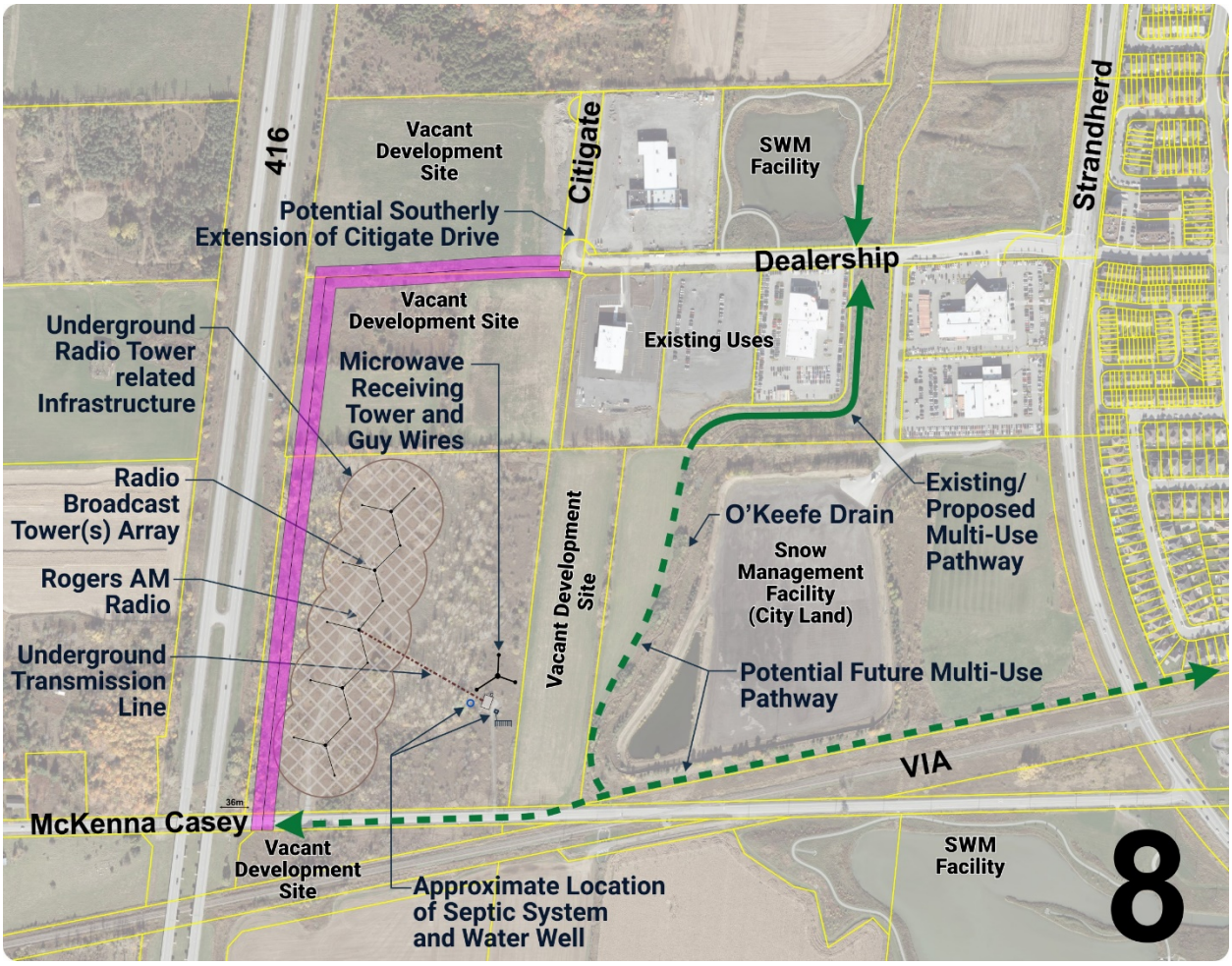

Figure 20: Alternative 8

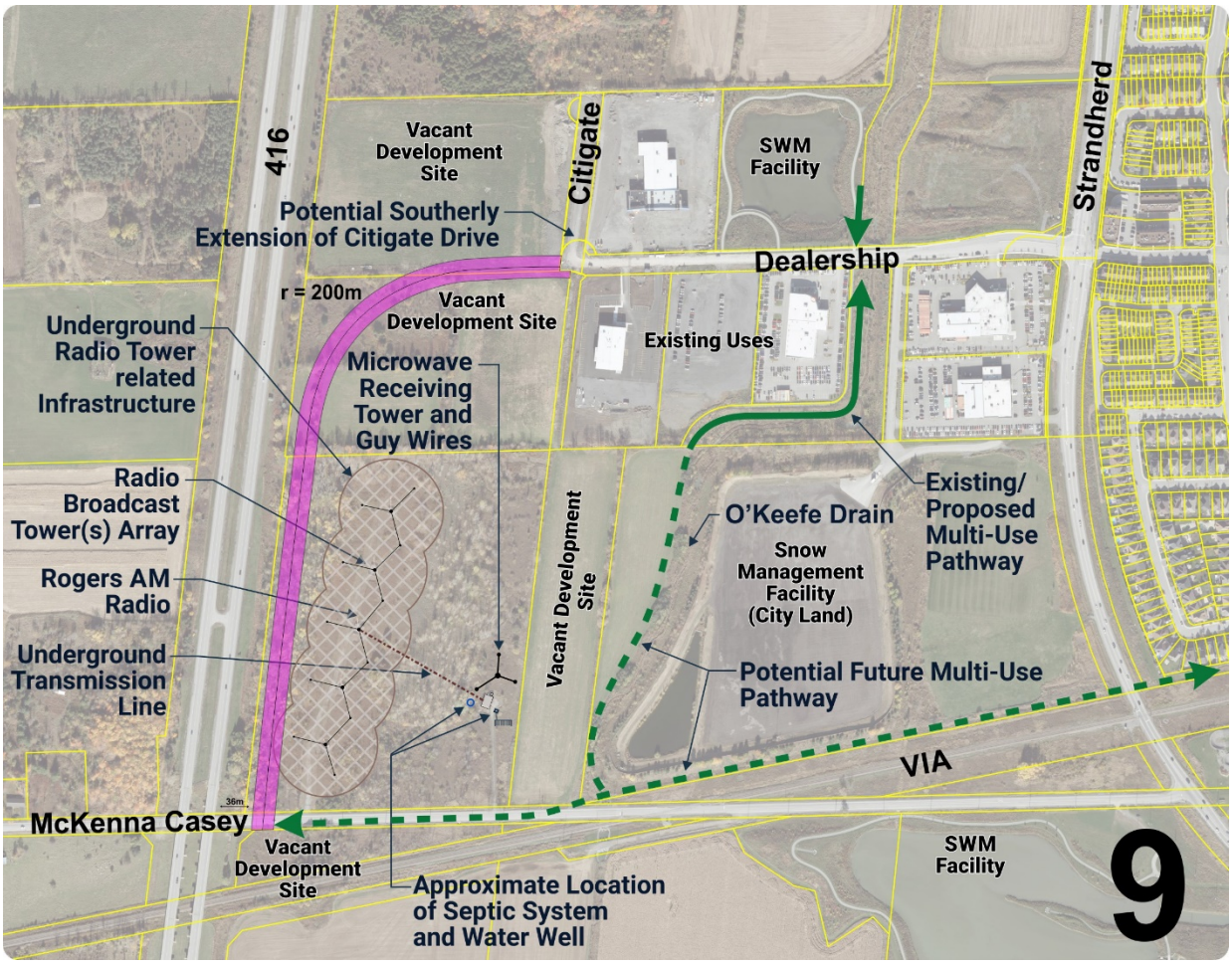

Figure 21: Alternative 9

Alternatives 8 and 9 above deviate most from the historical preferred alignment and from the Secondary Plan proposed collector road plan. Alternatives 8 and 9 offer alternate routes to avoid radio infrastructure and extend northerly at a more westward point along existing McKenna Casey Drive, running parallel to Highway 416 and would extend Dealership Drive westerly by connecting to Dealership Drive from the west.

Evaluation of Alternatives

The nine roadway alignment alternatives are evaluated here according to the Evaluation Criteria and Indicators presented in **Table 1.**

Table 1: Evaluation Matrix of Alignments 1-9

Criteria		Indicators	Roadway Alignment Alternative									Comments
			1	2	3	4	5	6	7	8	9	
	Transportation System Sustainability											
1	Accessibility and Inclusion	a) Consistent with Federal, Provincial and Municipal laws, standards, and best practices.	4	4	4	4	4	4	4	4	4	All alternatives would be designed to federal, provincial, and municipal standards and best practices.
		b) Provides accessible routes for persons of all abilities along the corridor, and at crossings.	4	4	4	4	4	4	4	4	4	All alternatives are accessible, and all feature the same preferred cross-section.
2	Active Transportation	a) Provides the opportunity to connect to existing or proposed pedestrian and cycling facilities	2	2	2	2	2	4	4	2	2	North/South pedestrian/cycling connection is poor for Alternatives 1-5. Safer connection in Alternatives

		within the Study Area										8 and 9 but wrong location.
		b) Provides a direct and efficient pedestrian and cycling travel route through the Study Area	4	4	3	3	4	3	3	1	1	Alternatives 8 and 9 are not efficient in connecting to some development parcels.
3	Transit Network	a) Maximizes opportunity potential for a possible future bus route that captures new ridership	4	4	4	4	4	4	4	0	0	Alternatives 8 and 9 do not capture new ridership due to not aligning through land with development potential.
		b) Maximizes opportunity potential for a possible future bus route that minimizes travel time and	4	4	4	4	4	3	3	1	1	Alternatives 6-9 require getting through at least 1 additional intersection compared to 1-5.

		maximizes reliability										
4	Arterial and Collector Road Network	a) Provides an efficient travel route between existing McKenna Casey Drive right-of-way to Strandherd Drive via Dealership Drive	4	4	4	4	4	3	3	1	3	Alternative 8 has two extra intersections, Alternative 6, 7, and 9 have one extra intersection. Travel time would be increased by the need to travel through additional intersections.
		b) Results in a continuous north-south Collector Road network through the Citigate Area that connects to Moodie Drive	4	3	2	2	3	1	1	0	0	This criteria encompasses number of intersections, spine, network, wayfinding, etc. Alternatives 8 and 9 fail because their alignment is not "through" Citigate. Alternative 2 and 6 are less "continuous" than Alternative 1. Alternatives 6 and 7 have intersections on existing McKenna Casey Drive. Alternatives

												3 and 4 are also not continuous/direct compared to others.
		c) Provides connectivity between the urban and rural truck route network	4	4	2	2	4	3	3	2	3	All alternatives fulfill this criteria. The extra intersections are not highly favourable for trucks, they will be slow/generally less desirable to navigate once we layer on the necessary measures for general safety of the intersection.
		d) Enables choice and design of familiar intersection types that will operate safely	4	4	3	2	4	0	0	0	0	Alternatives 6-9, with intersections at existing McKenna Casey, are not familiar/intuitive for drivers. The resulting intersection designs would fall short of best practices, with respect to both familiarity and safety.
		e) Provides choices for the location of vehicular	3	3	3	2	3	4	4	0	0	Criteria implies without the need for additional street construction. Access at a curve not desirable. 7 and

		accesses to adjacent development lands										8 far from development lands.
Subtotal Transportation System Sustainability			**41**	**40**	**35**	**33**	**40**	**33**	**33**	**15**	**18**	**Alternatives 1, 2, and 5 score best.**
	Ecological and Physical Sustainability											
6	Protection of Existing Vegetation	a) Optimizes the incorporation of existing valued natural/vegetated areas	4	4	4	4	2	4	4	2	2	Wooded areas are generally located internal to the Rogers property (Alternative 5) and along Highway 416 (Alternative 8 and 9).
7	Surface Water and Aquatic Habitat	b) Minimizes impact to watercourses in the Study Area Minimizes impact on or loss of existing aquatic habitat	4	4	1	1	3	4	4	2	2	Alternatives 1 and 2 require a culvert to cross an intermittent stream. Alternatives 8 and 9 will require stream relocation.
8	Stormwater Management	a) Minimizes or Avoids changes/impacts	4	4	2	2	4	4	4	4	4	There are no anticipated impacts to the O'Keefe

		on the O'Keefe Municipal Drain										Municipal Drain with any of the alternatives.
		b) Minimizes the need for additional SWM facilities	4	4	4	3	4	3	3	1	1	Alternatives 1-3 provide space for planned SWM facility at the south end of the Rogers/McKenna Property. Alternatives 8 and 9 may require the need for additional SWM Facility. Alternatives 6 and 7 may require additional lands on the McKenna Casey Drive property to construct planned SWM facility.
9	Wildlife	a) Minimizes disruption to wildlife connection and movements	4	4	4	4	2	4	4	2	2	Alternatives that fragment wooded areas (Alternatives 5, 8, 9) score lower here.
10	Floodplains	a) Minimizes impacts to the Jock River	4	4	4	4	4	4	4	4	4	None of the alternatives are located with the Jock River Floodplain.

		floodplain within the Study Area										
11	Physical Environment	a) Minimizes risk to human health on areas of known contaminated soils and/or groundwater	4	4	4	4	4	4	4	4	4	None of the alignments are known areas of contamination (to be confirmed by Phase 1 ESA).
Subtotal Ecological and Physical Sustainability			**28**	**28**	**23**	**22**	**23**	**27**	**27**	**19**	**19**	**Alternatives 1 and 2 and 6 and 7 score best.**
	Land Use and Community Sustainability											
12	Community Planning & Design	a) Consistent with area plans for South Nepean Areas 9 and 10 Secondary Plan	4	4	3	2	4	3	3	1	1	Alternatives 1, 2 and 3, match the anticipated road network and parcel layout in the Secondary Plan
		b) Supports the efficient development of land and	3	3	0	0	2	4	3	1	0	Alternatives 3-5, 8 and 9 result in the most land fragmentation. Alternatives 1 and 2 create a small fragmented piece in the southeast corner of the

		diminishes lot fragmentation										Rogers Property. Straight Alternatives 6 and 7 create the least fragmentation.
		c) Minimizes impacts on existing buildings and associated infrastructure	1	3	4	3	2	2	4	3	3	Alternatives 1 and 3 will require relocation of existing hydro service to the Rogers building along existing access road. Alts 1 and 5 disrupt Rogers septic bed. Wells should remain untouched with all options.
		d) Minimizes impacts on existing and planned built infrastructure	1	3	4	2	2	3	4	1	1	(E.g. Microwave towers, Underground tower-related infrastructure, Storm ponds.) Alternatives 8 and 9 have potential to alter locations for SWM ponds or additional ponds and may disrupt underground infrastructure. Alternative 5 may disrupt underground infrastructure. Alternative

												1 disrupts microwave tower anchor.
		e) Minimizes impacts to future development plans	4	3	2	1	1	4	3	2	1	Alternative 5 cuts cross country on the Rogers lot impacting available lands at the north end of the property. Alternative 9 most impacts anticipated development plans on the Hill property.
		f) Maximizes community benefit and street network connectivity through opportunities for potential future northerly extension	4	4	3	2	4	4	4	2	2	Alternatives 8 and 9 make additional 90 degree turns before extending north.
13		a) Avoids or minimizes impact on existing	4	4	4	4	3	4	4	4	4	Alternative 5 is located within an area with Archaeological Potential

	Cultural Heritage Resources	archaeological resources or areas with potential										(to be confirmed by Stage 1 AA).
		b) Avoids or minimizes impact on designated or potential built heritage resources	4	4	4	4	4	4	4	4	4	There are no known built heritage resources within the study area (as per CHER).
		c) Avoids or minimizes impact on designated or potential cultural heritage landscapes	4	4	4	4	4	4	4	4	4	There are no designated cultural heritage landscapes with the study area (as per CHER).
14	Noise & Vibration	a) Maximizes separation between the roadway (a potential noise and vibration source) and	4	4	4	4	4	4	4	4	4	There are no sensitive receivers (e.g. residential areas, daycares, churches adjacent.

		sensitive receivers										
		b) Minimizes the need for noise mitigation.	4	4	4	4	4	3	3	1	2	There are no sensitive receivers (e.g. residential areas, daycares, churches) adjacent. Noise mitigation is not anticipated.
15	Air Quality	a) Maximizes fuel efficient driving behavior	4	4	3	3	4	3	3	1	2	Alignments with more intersections score lower here.
		b) Minimizes travel distance and associated infrastructure	4	4	4	2	4	3	3	2	3	Alternatives with a curved alignment minimize travel distance.
Subtotal Land Use and Community Sustainability			**45**	**48**	**43**	**35**	**42**	**45**	**46**	**30**	**31**	**Alternative 2 scores best here, with Alternatives 1, 6 and 7 also high.**
	Climate Change Mitigation and Adaptation											
16	Climate Change Mitigation (Effect of	a) Promotes a reduction in vehicle kilometres	4	4	4	3	4	3	3	2	2	All alignments will include parallel active transportation facilities.

	Project on Climate Change)	travelled and modal shift towards active modes										Shorter alternatives will score better.
		b) Potential for protecting and/or enhancing carbon sinks	4	4	4	4	2	4	4	2	2	Alternatives that pass through wooded areas (Alternatives 5, 8 and 9) score lower here.
		c) Minimizes effects on climate change from the amount of materials used in construction	4	4	3	3	4	3	3	1	2	Longer alignments and those with the most Intersections require more construction materials.
		d) Minimizes the life cycle maintenance and operation requirements	4	4	4	3	4	3	3	1	2	Those requiring alternatives with increased amount of infrastructure will be most costly.
		e) Minimizes the propensity for creation of heat island effect	4	4	3	3	4	3	3	1	2	Heat island effect is impacted by the amount of pavement used overall.

17	Climate Change Adaption (Effect of Climate Change on Project)	a) Minimizes risk of extreme cold temperatures on the project	4	4	4	3	4	3	3	1	2	These criteria relate to length of the facility to be affected by extreme cold events including pavement durability and propensity for ice on the roads.
		b) Minimizes risk of extreme hot temperatures on the project	4	4	3	3	4	3	3	1	2	These criteria relate to length of the facility to be affected by extreme heat events including pavement durability and propensity for asphalt buckling and pitting.
		c) Minimizes risk of extreme precipitation events on the project	4	4	4	4	4	4	4	4	4	This criteria relates to the design for stormwater management and ability to effectively drain the road and parallel active transportation facilities. Each alignment can be designed to account for effective road drainage.

		d) Minimizes risk of flooding on the project	4	4	4	4	4	4	4	4	4	This criteria relates to the elevation of the roadway in proximity to waterbodies and their floodplains and the design of the road. All alternatives are outside significant floodplains.
		e) Minimizes the risk of freezing rain events on the project	4	4	3	3	4	3	3	1	2	These criteria relate to length of the facility to be affected by freezing rain and effective stormwater management.
		f) Minimizes risk of extreme wind on the project	3	3	3	3	4	3	3	4	4	These criteria relate the openness of the roadway. Alternatives adjacent to the elevated Highway 417 facility may provide some additional protection from winds originating in the west and Alternative 5 that could maintain some adjacent vegetation for some length.

		g) Minimizes risk of wildfire on the project	4	4	4	4	2	4	4	2	2	Alternatives that pass through wooded areas (Alternatives 5, 8 and 9) score lower here.
		h) Maximizes the safety and comfort of corridor users exposed to the environment	3	3	3	2	4	2	2	3	4	Shorter alternatives and those adjacent to Highway 417 that offer some protection from wind events would score best for this criteria.
Subtotal Climate Change Mitigation and Adaptation			**50**	**50**	**46**	**42**	**48**	**42**	**42**	**27**	**34**	**Alternatives 1 and 2 score best.**
	Economic Sustainability											
18	Phasing and Implementation	a) Maximizes the ability to phase the project	4	4	4	4	4	4	4	4	4	The project includes connecting existing McKenna Casey to Strandherd which would be completed in one phase.
		b) Maximizes the ability to coordinate with the Strandherd Widening and	4	4	4	4	4	4	4	4	4	All alternatives could be coordinated with the Strandherd Rehabilitation Project.

		Realignment Project										
		c) Minimizes the propensity for traffic diversion during construction	4	4	4	4	4	4	4	4	4	The project is a new roadway and no road closures would be required to construct. No traffic diversion is anticipated.
19	Life Cycle Cost	a) Minimizes the capital infrastructure cost including minimizing the need to alter or abandon existing road infrastructure	4	4	4	3	3	3	3	1	2	Shorter routes with less intersection designs will score better for this criteria. Alternatives 6-9 include additional intersections with Alternative 8 having the most (3) intersections.
		b) Minimizes infrastructure design and construction costs	4	4	3	3	3	3	3	1	2	Shorter routes with less intersection designs will score better for this criteria. Alternatives 6-9 include additional intersections with

												alternative 8 having the most (3) intersections.
		c) Minimizes maintenance and operation costs	4	4	3	2	3	3	3	1	2	Shorter routes with less intersection designs will score better for this criteria. Alternatives 6-9 include additional intersections with alternative 8 having the most (3) intersections.
		d) Minimizes property acquisition cost	3	2	1	1	2	4	4	1	2	Alternatives with the least property requirements and number of property owners implicated will score best for this criteria.
Subtotal Economic Sustainability			**27**	**26**	**23**	**21**	**23**	**25**	**25**	**16**	**20**	**Alternatives 1 and 2 score best here.**
Total Score			**191**	**192**	**171**	**153**	**176**	**172**	**173**	**107**	**122**	**Alternative 2 scores best overall, with Alternative 1 very close.**

Alternative Intersection Type Analysis

The intersection options are:

- Stop controlled
- Roundabout; and,
- Traffic Signal.

The design considerations for intersection type analysis/decision-making are:

- Route consistency;
- ROW requirements;
- Pedestrian and bicycle crossings; and,
- Traffic volumes, traffic flow balance.

All nine alignment alternatives require an intersection type upon connecting with Dealership Drive.

Intersection Point at Dealership Drive

Figure 22: Intersection Point at Dealership Drive