



Appendix I

Alternative Solutions Memo

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DATE : March 10, 2023

SUBJECT: B001539 Burleigh Hill Drive MCEA - Alternative Solutions

1. Introduction

Niagara Region has initiated a Municipal Class Environmental Assessment (MCEA) for the reconstruction of Burleigh Hill Drive to address existing issues and to improve conditions for all modes of transportation. The EA study will evaluate the need to maintain the existing truck climbing lane, assess the feasibility of providing enhancement to active transportation through improved pedestrian and cyclist facilities, provide improved stormwater drainage and adapt a complete streets approach that caters to all road users. The following memo summarizes the alternative solutions developed during Phase 2 of the MCEA process.

2. Problems and Opportunities Statement

Regional Road 56 (Burleigh Hill Drive) between Regional Road 89 (Glendale Avenue) and Regional Road 71 (St. David's Road) is an arterial road connecting the City of St. Catharines to the City of Thorold. It is the only Regional Road crossing the Niagara Escarpment in the area between Highway 406 and the Welland Canal and serves as an important link between the City of St. Catharines and City of Thorold. Based on findings from the traffic analysis, safety assessment and stormwater management review, existing issues identified on Burleigh Hill Drive include inadequate active transportation facilities, speeding concerns, sight distance concerns, poor stormwater drainage, aging pavement condition, as well slope erosion concerns due to the proximity to the Niagara Escarpment. Therefore, Niagara Region is carrying out a Schedule B Municipal Class

Environmental Assessment (MCEA) Study for Burleigh Hill Drive between Glendale Avenue and St. David's Road to address the above noted issues.

3. Alternative Planning Solutions

In Phase 2 of an MCEA study, alternative planning solutions are identified and evaluated based on various criteria. The following alternative planning solutions were developed in Phase 2 of the Burleigh Hill Drive MCEA Study to address the problems and opportunities statement:

1. Do Nothing: Maintain existing corridor conditions with no changes.
2. Stormwater management improvements on Burleigh Hill Drive, with no road/operational improvements or active transportation improvements. Stormwater management improvements would include:
 - a. Rehabilitation of existing channels
 - b. Ditch replacement/improvements
 - c. Storm sewer rehabilitation/improvements:
3. Stormwater management improvements on Burleigh Hill Drive, with no road/operational improvements, with an alternative route for active transportation improvements.
4. Stormwater management improvements and operational improvements on Burleigh Hill Drive without removing the truck climbing lane, with no active transportation improvements. Operational improvements would include:
 - a. Intersection improvements
 - b. Road resurfacing
 - c. Sidewalk rehabilitation
 - d. Speed management treatments
 - e. Pedestrian crossing improvements
 - f. Roadside safety improvements
5. Stormwater management and operational improvements on Burleigh Hill Drive without removing the truck climbing lane, with an alternative route for active transportation improvements.

6. Stormwater management and operational improvements, with removal of the truck climbing lane to accommodate active transportation improvements on Burleigh Hill Drive.

Table 1 Identified Alternative Planning Solutions

#	Alternative Planning Solution	Stormwater Management Improvements	Active Transportation Improvements	Operational Improvements	Remove Truck Climbing Lane
1	Do Nothing	✗	✗	✗	✗
2	SWM Improvement on Burleigh Hill Dive	✓ <ul style="list-style-type: none"> Rehabilitate existing channels, Rehabilitation stormwater ditches Storm sewer rehabilitation Peak flow control facility 	✗	✗	✗
3	SWM Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	✓ <ul style="list-style-type: none"> Rehabilitate existing channels, Rehabilitation stormwater ditches Storm sewer rehabilitation Peak flow control facility 	✓ MS Provide active transportation facilities on Mountain Street parallel to Burleigh Hill Drive	✗	✗
4	SWM and Operational Improvements on Burleigh Hill Drive	✓ <ul style="list-style-type: none"> Rehabilitate existing channels, Rehabilitation stormwater ditches Storm sewer rehabilitation Peak flow control facility 	✗	✓ <ul style="list-style-type: none"> Intersection improvements Road resurfacing Sidewalk rehabilitation Speed management treatments Pedestrian crossing improvements Roadside safety improvements 	✗
5	SWM and Operational Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	✓ <ul style="list-style-type: none"> Rehabilitate existing channels, Rehabilitation stormwater ditches Storm sewer rehabilitation Peak flow control facility 	✓ MS Provide active transportation facilities on Mountain Street parallel to Burleigh Hill Drive	✓ <ul style="list-style-type: none"> Intersection improvements Road resurfacing Sidewalk rehabilitation Speed management treatments Pedestrian crossing improvements Roadside safety improvements 	✗
6	SWM, Active Transportation, Operational Improvements and Cross Section Modifications on Burleigh Hill Drive	✓ <ul style="list-style-type: none"> Rehabilitate existing channels, Rehabilitation stormwater ditches Storm sewer rehabilitation Peak flow control facility 	✓ BHD Active transportation facilities on Burleigh Hill Drive	✓ <ul style="list-style-type: none"> Intersection improvements Road resurfacing Sidewalk rehabilitation Speed management treatments Pedestrian crossing improvements Roadside safety improvements 	✓ Remove truck climbing lane from Escarpment section
Note: ✓ MS – Active Transportation Improvements on Mountain Street ✓ BHD – Active Transportation Improvements on Burleigh Hill Drive					

4. Evaluation Criteria

Table 2 presents the evaluation criteria that was utilized to select an alternative planning solution, grouped into broad categories, subcategories, and the corresponding evaluation criteria.

Table 2: Evaluation Criteria

Category	Subcategory	Evaluation Criteria
Socio-Economic Environment	<ul style="list-style-type: none"> Property and access 	<ul style="list-style-type: none"> Impact to Properties Impact to Accesses
	<ul style="list-style-type: none"> Community mobility and connectivity 	<ul style="list-style-type: none"> Connection to existing and planned active transportation facilities
	<ul style="list-style-type: none"> Noise 	<ul style="list-style-type: none"> Improve to noise generated by traffic
	<ul style="list-style-type: none"> Transportation and health equity 	<ul style="list-style-type: none"> Benefit to equity priority groups <ul style="list-style-type: none"> People with mobility restrictions Students not yet of driving age Low income individuals/families
	<ul style="list-style-type: none"> Provincial, Regional and Municipal Policies and Priorities 	<ul style="list-style-type: none"> Consistency with Provincial, Regional and Municipal planning policies <ul style="list-style-type: none"> Provincial Policy Statement and A Place to Grow Niagara Region OP and TMP City of St. Catharines OP and TMP City of Thorold OP and TMP
	<ul style="list-style-type: none"> Streetscape opportunities 	<ul style="list-style-type: none"> Opportunities to enhance the streetscape (furnish street with functional and aesthetic items that provide amenities and utility to users)
Cultural Environment	<ul style="list-style-type: none"> Built heritage resources 	<ul style="list-style-type: none"> Impacts to Cultural Heritage Landscapes (CHL) and Built Heritage Resources (BHR)
	<ul style="list-style-type: none"> Archaeological resources 	<ul style="list-style-type: none"> Impacts to Archaeological Features
	<ul style="list-style-type: none"> Indigenous interests and rights 	<ul style="list-style-type: none"> Impacts to areas of Indigenous interest / right
Natural Environment	<ul style="list-style-type: none"> Niagara Escarpment <ul style="list-style-type: none"> Niagara Escarpment Plan Green Belt Plan Potential Impact to Niagara Escarpment 	<ul style="list-style-type: none"> Consistency with Provincial planning policies and objectives: Impact to Niagara Escarpment
	<ul style="list-style-type: none"> Natural Environment Features 	<ul style="list-style-type: none"> Potential impacts to natural environment features (environmentally sensitive areas,

Category	Subcategory	Evaluation Criteria
		terrestrial and aquatic species and habitats including Species at Risk) <ul style="list-style-type: none"> • Potential changes to watercourses and protection of surface and groundwater
	<ul style="list-style-type: none"> • Climate change considerations 	<ul style="list-style-type: none"> • Qualitative assessment of how the option contributes to lower emissions targets • Opportunities to improve infrastructure resiliency to changing climatic conditions
Stormwater Management	<ul style="list-style-type: none"> • Conformance to Provincial, Regional and NPCA guidelines and standards <ul style="list-style-type: none"> ○ MTO Highway Drainage Design Standards ○ Niagara Stormwater Management Guidelines ○ NPCA Stormwater Management Guidelines ○ St. Catharines Engineering Standards Manual 	Consistency with Provincial guidelines and standards: <ul style="list-style-type: none"> ○ MTO Highway Drainage Design Standard (2008) ○ MECP Stormwater Management Planning and Design Manual (2003) Consistency with Regional guidelines and standards: <ul style="list-style-type: none"> ○ Stormwater Management Guidelines (2022) ○ Consistency with the NPCA guidelines and standards: ○ Stormwater Management Guidelines (2010) Consistency with Municipal guidelines and standards: <ul style="list-style-type: none"> ○ Engineering Standard Manual (2015)
Transportation	<ul style="list-style-type: none"> • Traffic operations 	<ul style="list-style-type: none"> • Ability to improve traffic operations and/or potential to improve and/or impact on existing and future traffic congestion and level of service
	<ul style="list-style-type: none"> • Road safety 	<ul style="list-style-type: none"> • Ability to improve road safety
	<ul style="list-style-type: none"> • Active transportation network (pedestrians, cyclists) 	<ul style="list-style-type: none"> • Ability to provide facilities that accommodate a range of users (pedestrians, cyclists, mobility device users)
	<ul style="list-style-type: none"> • Transit efficiency and amenities 	<ul style="list-style-type: none"> • Ability to accommodate planned transit improvements and improve efficiency
Technical	<ul style="list-style-type: none"> • Operations and Maintenance 	<ul style="list-style-type: none"> • Impact to operations and maintenance
	<ul style="list-style-type: none"> • Potential impact to utilities 	<ul style="list-style-type: none"> • Impact to Utilities
	<ul style="list-style-type: none"> • Cost (order of magnitude) 	<ul style="list-style-type: none"> • High-Level Cost Comparison

5. Alternative Solutions Evaluation Table

Table 3 documents the evaluation of the six proposed alternative solutions in accordance with the above criteria. For each specific criterion, the bolded text indicates the preferred alternative. Based on the above, Alternative 6 has been identified as the preferred planning alternative, as it best addresses the problems and opportunities identified in the Problem and Opportunity statement.

Table 3: Alternative Solutions Evaluation Table

Factors	Criteria	Alt 1 Do Nothing	Alt 2 SWM Improvement on Burleigh Hill Dive	Alt 3 SWM Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 4 SWM and Operational Improvements on Burleigh Hill Drive	Alt 5 SWM and Operational Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 6 SWM, Active Transportation, Operational Improvements and Removal of Truck Climbing Lane on Burleigh Hill Drive
Socio-Economic Environment							
Private Property	Impact to Private Properties	No property impacts.	No property impacts anticipated.	There may be property impacts on Mountain Street, subject to active transportation facilities identified in the alternative corridor.	None to minimal property impacts anticipated	There may be property impacts on Mountain Street, subject to active transportation facilities identified in the alternative corridor.	None to minimal property impacts anticipated
Access Management	Impact to Accesses	No access impacts.	No access impacts.	No access impacts	May result in some access modifications to commercial plazas.	May result in some access modifications to commercial plazas.	May result in some access modifications to commercial plazas.
Noise	Impact to Noise Generated by Traffic	No impact to noise generated by traffic	No change in noise generated by traffic	No change in noise generated by traffic	No change in noise generated by traffic	No change in noise generated by traffic	No change in noise generated by traffic
Community Mobility and Connectivity	Connection to existing and planned active transportation facilities	No opportunity to enhance connections to existing active transportation facilities.	No opportunity to enhance connections to existing active transportation facilities.	Improved connectivity to active transportation facilities, however, through a longer indirect route with no access on Burleigh Hill Drive.	No opportunity to enhance connections to existing active transportation facilities.	Improved connectivity to active transportation facilities, however, through a longer indirect route with no access on Burleigh Hill Drive.	Improved connectivity to active transportation facilities through a direct route on Burleigh Hill Drive with connections to other facilities along St. David's Road.
Transportation and Health Equity	Benefit to equity priority groups	Does not address existing barriers to travel for equity priority groups, including students and people with mobility restrictions.	Does not address existing barriers to travel for equity priority groups, including students and people with mobility restrictions.	Opportunity to address some existing barriers through improved cycling connectivity (though indirect route).	Opportunity to address some existing barriers through improvement of pedestrian facilities and accessibility.	Opportunity to address some existing barriers through improvement of pedestrian facilities and accessibility, improved cycling connectivity (though indirect route).	Opportunity to address several existing barriers through improvement of pedestrian facilities, accessibility and cycling connectivity.
Provincial, Regional and Municipal Policies and Priorities	Consistency with Provincial planning policies: <ul style="list-style-type: none"> o A Place to Grow (Consolidated 2020) o Provincial Policy Statements (2020) 	Does not support Growth Plan due to lack of connection to multi-modal network connection. Does not support the Policy Statement which refers to the need to mitigate SWM impacts to property.	Does not support Growth Plan due to lack of connection to multi-modal network connection.	Supportive of Provincial planning policies.	Does not support Growth Plan due to lack of connection to multi-modal network connection.	Supportive of Provincial planning policies.	Supportive of Provincial planning policies.

Factors	Criteria	Alt 1 Do Nothing	Alt 2 SWM Improvement on Burleigh Hill Dive	Alt 3 SWM Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 4 SWM and Operational Improvements on Burleigh Hill Drive	Alt 5 SWM and Operational Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 6 SWM, Active Transportation, Operational Improvements and Removal of Truck Climbing Lane on Burleigh Hill Drive
Provincial, Regional and Municipal Policies and Priorities	Consistency with Regional planning policies and objectives: <ul style="list-style-type: none"> o Official Plan (2014) o Transportation Master Plan (2017) o Complete Streets Design Manual (2023) 	Not consistent with the OP that classifies Burleigh Hill Drive as part of the strategic cycling network. No opportunity to re-design the roadway to better align with Complete Streets objectives.	Not consistent with the OP that classifies Burleigh Hill Drive as part of the strategic cycling network. No opportunity to re-design the roadway to better align with Complete Streets objectives.	Not consistent with the OP that classifies Burleigh Hill Drive as part of the strategic cycling network. No opportunity to re-design the roadway to better align with Complete Streets objectives.	Not consistent with the OP that classifies Burleigh Hill Drive as part of the strategic cycling network. Limited opportunity to re-design the roadway to better align with Complete Streets objectives.	Not consistent with the OP that classifies Burleigh Hill Drive as part of the strategic cycling network. Limited opportunity to re-design the roadway to better align with Complete Streets objectives.	Consistent with the Regional policies, and provides best opportunity to achieve Regional planning objectives.
Provincial, Regional and Municipal Policies and Priorities	Consistency with City of St. Catharines planning policies and objectives: <ul style="list-style-type: none"> o Official Plan (2010) o Transportation Master Plan (2021) 	Does not comply with the St. Catharines TMP which requires roads to have sidewalks on both sides for Regional Roads.	Does not comply to the St. Catharines TMP which requires roads to have sidewalks on both sides for Regional Roads.	Does not comply to the St. Catharines TMP which requires roads to have sidewalks on both sides for Regional Roads. Supportive of St. Catharines OP which identifies Mountain Road (proposed alternative AT Route) as part of their strategic bicycle plan. However, improvements are expected to be carried out under City of St. Catharines.	Does not comply to the St. Catharines TMP which requires roads to have sidewalks on both sides for Regional Roads.	Does not comply to the St. Catharines TMP which requires roads to have sidewalks on both sides of the street for Regional Roads. Supportive of St. Catharines OP which identifies Mountain Road (proposed alternative AT Route) as part of their strategic bicycle plan.	May comply to the St. Catharines TMP which requires roads to have sidewalks on both sides for Regional Roads, if preferred design solutions results in sidewalks on both sides of Burleigh Hill Drive.
	Consistency with City of Thorold planning policies and objectives: <ul style="list-style-type: none"> o Official Plan (2016) o Transportation Master Plan (2020) 	Not supportive of the TMP which classifies Collier Road North (Burleigh Hill Drive continues southerly as Collier Road North south of St. David's Road) as part of their strategic cycling network. The lack of active transportation facilities improvements on Burleigh	Not supportive of the TMP which classifies Collier Road North (Burleigh Hill Drive continues southerly as Collier Road North south of St. David's Road) as part of their strategic cycling network. The lack of active transportation	Not supportive of the TMP which classifies Collier Road North (Burleigh Hill Drive continues southerly as Collier Road North south of St. David's Road) as part of their strategic cycling network. The lack of	Not supportive of the TMP which classifies Collier Road North (Burleigh Hill Drive continues southerly as Collier Road North south of St. David's Road) as part of their strategic cycling network. The lack of active transportation	Not supportive of the TMP which classifies Collier Road North (Burleigh Hill Drive continues southerly as Collier Road North south of St. David's Road) as part of their strategic cycling network. The lack of	Supportive of Thorold's municipal policies.

Factors	Criteria	Alt 1 Do Nothing	Alt 2 SWM Improvement on Burleigh Hill Dive	Alt 3 SWM Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 4 SWM and Operational Improvements on Burleigh Hill Drive	Alt 5 SWM and Operational Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 6 SWM, Active Transportation, Operational Improvements and Removal of Truck Climbing Lane on Burleigh Hill Drive
		Hill Drive would not support the continued development of the active transportation network in the area.	facilities improvements on Burleigh Hill Drive would not support the continued development of the active transportation network in the area.	active transportation facilities improvements on Burleigh Hill Drive would not support the continued development of the active transportation network in the area.	facilities improvements on Burleigh Hill Drive would not support the continued development of the active transportation network in the area.	active transportation facilities improvements on Burleigh Hill Drive would not support the continued development of the active transportation network in the area.	
Streetscape	Opportunities to enhance the streetscape (furnish street with functional and aesthetic items that provide amenities and utility to users)	No opportunity to enhance the streetscape.	No opportunity to enhance the streetscape.	No opportunity to enhance the streetscape.	Limited opportunity to enhance the streetscape and pedestrian environment due to constrained ROW crossing the escarpment.	Limited opportunity to enhance the streetscape and pedestrian environment due to constrained ROW crossing the escarpment.	Opportunity to enhance the streetscape and pedestrian environment throughout the Burleigh Hill Drive corridor due to removal of truck climbing lane.
Cultural Environment							
Built Cultural Heritage	Impacts to Cultural Heritage Landscapes (CHL) and Built Heritage Resources (BHR)	Not expected to impact CHL and BHR.	Not expected to impact CHL and BHR.	Not expected to impact CHL and BHR.	Not expected to impact CHL and BHR.	Not expected to impact CHL and BHR.	Not expected to impact CHL and BHR.
Archaeological	Impacts to Archaeological Features	No impacts to archeological features	No impacts to archeological features	No impacts to archeological features	No impacts to archeological features	No impacts to archeological features	No impacts to archeological features
Indigenous interests and rights	Impacts to areas of Indigenous interest / rights	No impacts to areas of Indigenous interest /rights	No impacts to areas of Indigenous interest /rights	No impacts to areas of Indigenous interest /rights	No impacts to areas of Indigenous interest /rights	No impacts to areas of Indigenous interest /rights	No impacts to areas of Indigenous interest /rights
Natural Environment							
Niagara Escarpment	Consistency with Provincial planning policies and objectives: <ul style="list-style-type: none"> o Niagara Escarpment Plan o Greenbelt Plan 	Conforms to existing policy.	Will determine conformance to NECP policy when evaluating design alternatives	Will determine conformance to NECP policy when evaluating design alternatives	Will determine conformance to NECP policy when evaluating design alternatives	Will determine conformance to NECP policy when evaluating design alternatives	Will determine conformance to NECP policy when evaluating design alternatives
	Impact to Niagara Escarpment	No changes to the escarpment, rock face will continue to erode onto sidewalk causing drainage issues and potential injury to pedestrians.	May have small impact on the rock face, depending on design solution, which may prevent further erosion of rock face.	May have small impact on the rock face, depending on design solution, which may prevent further erosion of rock face.	May have small impact on the rock face, depending on design solution, which may prevent further erosion of rock face.	May have small impact on the rock face, depending on design solution, which may prevent further erosion of rock face.	May have small impact on the rock face, depending on design solution, which may prevent further erosion of rock face.

Factors	Criteria	Alt 1 Do Nothing	Alt 2 SWM Improvement on Burleigh Hill Dive	Alt 3 SWM Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 4 SWM and Operational Improvements on Burleigh Hill Drive	Alt 5 SWM and Operational Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 6 SWM, Active Transportation, Operational Improvements and Removal of Truck Climbing Lane on Burleigh Hill Drive
Natural Environment Features	Potential impacts to natural environment features (environmentally sensitive areas, terrestrial and aquatic species and habitats including Species at Risk)	No impacts to terrestrial and aquatic species and habitats expected.	No impacts to terrestrial and aquatic species and habitats expected.	No impacts to terrestrial and aquatic species and habitats expected.	No impacts to terrestrial and aquatic species and habitats expected.	No impacts to terrestrial and aquatic species and habitats expected.	No impacts to terrestrial and aquatic species and habitats expected.
	Potential changes to watercourses and protection of surface and groundwater	No changes to watercourses, surface and groundwater.	Improve surface water flow due to rehabilitated/reconstructed stormwater conveyance system. No impact to groundwater.	Improve surface water flow due to rehabilitated/reconstructed stormwater conveyance system. No impact to groundwater.	Improve surface water flow due to rehabilitated/reconstructed stormwater conveyance system. No impact to groundwater.	Improve surface water flow due to rehabilitated/reconstructed stormwater conveyance system. No impact to groundwater.	Improve surface water flow due to rehabilitated/reconstructed stormwater conveyance system. No impact to groundwater.
Climate Change Considerations	Qualitative assessment of how the option contributes to lower emissions targets	Corridor remains as auto centric with narrow sidewalks that do not meet accessibility requirements, and no cycling facilities. No enhancement to or provision of sustainable transport options. High reliance on vehicles and increased traffic congestion will result in increased emissions.	Corridor remains as auto centric with narrow sidewalks that do not meet accessibility requirements, and no cycling facilities. No enhancement to or provision of sustainable transport options. High reliance on vehicles and increased traffic congestion will result in increased emissions.	Alternative route for cyclists made available however, for pedestrians and cyclists living on or next to Burleigh Hill Drive, corridor remains auto centric with narrow sidewalks that do not meet accessibility requirements, and no cycling facilities. No enhancement to of sustainable transport options on Burleigh Hill Drive. High reliance on vehicles and increased traffic congestion will result in increased emissions.	Corridor remains as auto centric with narrow sidewalks that do not meet accessibility requirements, and no cycling facilities. May lead to some enhancement of sustainable transport options (transit facilities) on Burleigh Hill Drive.	Alternative route for cyclists made available however, for pedestrians and cyclists living on or next to Burleigh Hill Drive, corridor remains auto centric with narrow sidewalks that do not meet accessibility requirements, and no cycling facilities. May lead to some enhancement to of sustainable transport options (transit facilities) on Burleigh Hill Drive.	Best opportunity to provide sustainable transport options in Burleigh Hill Drive. Transit facility enhancement as well as active transportation network improvements may lead to a reduction in emissions as more trips move to sustainable transport options on Burleigh Hill Drive.
Climate Change Considerations	Opportunities to improve infrastructure resiliency to changing climatic conditions	No change to existing roadway and therefore no opportunity to improve resiliency to climate change. With increased risk of flooding, SMW	No change to existing roadway and therefore no opportunity to improve resiliency to climate change. Improvements to SWM help protect road corridor	No change to existing roadway and therefore no opportunity to improve resiliency to climate change.	Opportunity to improve resiliency of road to climate change, however, no improvement to active transportation facilities.	Opportunity to improve resiliency of road to climate change, however, no improvement to active transportation facilities.	Best opportunity to improve resiliency of infrastructure to changing climate conditions.

Factors	Criteria	Alt 1 Do Nothing	Alt 2 SWM Improvement on Burleigh Hill Dive	Alt 3 SWM Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 4 SWM and Operational Improvements on Burleigh Hill Drive	Alt 5 SWM and Operational Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 6 SWM, Active Transportation, Operational Improvements and Removal of Truck Climbing Lane on Burleigh Hill Drive	
		infrastructure is not resilient to changing climatic conditions.	from future increased flooding events.	Improvements to SWM help protect road corridor from future increased flooding events.	Improvements to SWM help protect road corridor from future increased flooding events.	Improvements to SWM help protect road corridor from future increased flooding events.		
Stormwater Management								
Stormwater Management and Conformance with Drainage and SWM Standards	Consistency with Provincial Regional, Municipal and NPCA Guidelines and Standards	No changes to existing drainage conditions: surface or groundwater. Due to extremely poor channel condition, flooding concern is not resolved. Does not conform with the existing SWM Standards and Guidelines.	Improvement of stormwater management system will improve the drainage condition and surface water flow due to the rehabilitated/reconstructed stormwater conveyance system. Improvement of existing channels on the east and west side of Burleigh Hill Drive will control the spill from the channel which will eliminate the flooding concern on the valley. Improvement of runoff collection system such as catchbasin and ditch inlets will help to reduce the overland flow along the roadway which will improve the driving condition of Burleigh Hill Drive during the rainfall event. Improvement of storm sewer condition will reduce the existing surcharge condition. The groundwater table, which was encountered near Glendale Avenue, will not be impacted by the improvement of the stormwater management system as the ground water level is more than 4.5 m depth below the surface. The improved SWM system will conform Provincial, Regional, Municipal and NPCA Guidelines and Standards.					
Transportation								
Traffic Operations	Ability to improve traffic operations	Does not improve traffic operations.	Does not improve traffic operations.	Does not improve traffic operations.	Opportunity to improve traffic operations, reducing congestion and delay at signalized intersections.	Opportunity to improve traffic operations, reducing congestion and delay at signalized intersections.	Opportunity to improve traffic operations, reducing congestion and delay at signalized intersections. Removal of truck climbing lane will at times slightly increase delay for southbound motorists travelling uphill.	
Safety	Ability to improve road safety	Does not improve road safety.	Does not improve road safety.	Does not improve road safety.	Opportunity to improve road safety through pavement rehabilitation, speed calming measures and other safety recommendations, however maintaining the truck climbing lane and wider overall road width may continue to contribute to higher operating speeds.	Opportunity to improve road safety through pavement rehabilitation, speed calming measures and other safety recommendations, however maintaining the truck climbing lane and wider overall road width may continue to contribute to higher operating speeds.	Greatest opportunity to improve road safety through road diet (removal of passing lane), pavement rehabilitation, speed calming measures, separate cycling facilities and other safety recommendations.	

Factors	Criteria	Alt 1 Do Nothing	Alt 2 SWM Improvement on Burleigh Hill Drive	Alt 3 SWM Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 4 SWM and Operational Improvements on Burleigh Hill Drive	Alt 5 SWM and Operational Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 6 SWM, Active Transportation, Operational Improvements and Removal of Truck Climbing Lane on Burleigh Hill Drive
Active Transportation	Ability to provide facilities that accommodate a range of users (pedestrians, cyclists, mobility device users)	Does not address multi-modal needs on Burleigh Hill Drive.	Does not address multi-modal needs on Burleigh Hill Drive.	Does not address multi-modal needs on Burleigh Hill Drive. Provides community with alternative route with connection to the cycle network.	Does not address multi-modal needs on Burleigh Hill Drive.	Does not address multi-modal needs on Burleigh Hill Drive. Provides community with alternative route with connection to the cycle network.	Facilitates pedestrians and cyclists with improved active transportation facilities on Burleigh Hill Drive through the addition of wider sidewalks and bike lanes or a multi-use path.
Transit	Ability to accommodate planned transit improvements and improve efficiency	No improvements to transit facilities	No improvements to transit facilities.	No improvements to transit facilities.	Opportunity to improve transit facilities.	Opportunity to improve transit facilities.	Opportunity to improve transit facilities.
Feasibility							
Operations and Maintenance	Impact to operations and maintenance	Without improvements, operations and maintenance of drainage concern will continue to grow. Road maintenance requirements expected to continue to worsen due to aging pavement condition.	Operations and maintenance of SWM will be improved. Road maintenance requirements expected to continue to worsen due to aging pavement condition.	Operations and maintenance of SWM will be improved. Road maintenance requirements expected to continue to worsen due to aging pavement condition and maintenance of new active transportation facility on alternative route will be required.	Operations and maintenance of SWM will be improved. Road maintenance requirements expected to improve with resurfacing for Burleigh Hill Drive.	Operations and maintenance of SWM will be improved. Road maintenance requirements expected to improve with resurfacing for Burleigh Hill Drive however maintenance of new active transportation facility on alternative route will be required.	Operations and maintenance of SWM will be improved. Road maintenance requirements expected to improve with resurfacing for Burleigh Hill Drive. New maintenance of pedestrian and cyclist facilities expected (including winter maintenance).
Utilities	Impact to Utilities	No impact to existing utilities	May impact utilities, subject to SWM improvements identified.	May impact utilities, subject to SWM improvements identified.	May impact utilities, subject to SWM and operational improvements identified.	May impact utilities, subject to SWM and operational improvements identified.	May impact utilities, subject to SWM and operational improvements identified.
Cost	High-Level Cost Comparison	-- No capital costs.	\$ Capital cost expected for SWM improvements.	\$\$\$ Capital cost expected for SWM improvements with additional cost of providing a cycling facility on an alternative route. There may be additional cost associated with	\$\$ Higher capital cost expected for SWM improvements with additional cost of operational improvements.	\$\$\$\$ Highest capital cost expected for SWM improvements with additional cost of operational improvements as well as additional cost of providing a cycling facility on an alternative route. There may be	\$\$\$ Higher capital cost expected for SWM improvements with additional cost of operational improvements and cross section modifications.

Factors	Criteria	Alt 1 Do Nothing	Alt 2 SWM Improvement on Burleigh Hill Dive	Alt 3 SWM Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 4 SWM and Operational Improvements on Burleigh Hill Drive	Alt 5 SWM and Operational Improvements on Burleigh Hill Drive with Alternative Active Transportation Route	Alt 6 SWM, Active Transportation, Operational Improvements and Removal of Truck Climbing Lane on Burleigh Hill Drive
				improvements to another corridor that was not originally planned for modification.		additional cost associated with improvements to another corridor that was not originally planned for modification.	
Overall Evaluation		Not recommended	Not recommended on its own. However, the SMW improvements will be carried forward as part of Alternative 6.	Not recommended. However, the SMW improvements will be carried forward as part of Alternative 6.	Not recommended on its own. However, the SMW and operational improvements will be carried forward as part of Alternative 6	Not recommended. However, the SMW and operational improvements will be carried forward as part of Alternative 6.	Recommended This option best addresses all identified concerns and opportunities.

6. References

References	Notes
<p>Provincial Policies - A Place to Grow: Growth plan for the Greater Golden Horseshoe (Consolidated 2020)</p>	<ul style="list-style-type: none"> • Burleigh Hill Drive is designated as part of a transportation system. • The transportation system for the GGH must be planned and managed for the safe and efficient movement of goods and people, and to reduce greenhouse gas emissions and other negative environmental impacts. • Policy 3.2.2 Transportation – General (Excerpt) <ul style="list-style-type: none"> ○ The transportation system within the GGH will be planned and managed to: <ul style="list-style-type: none"> • offer a balance of transportation choices that reduces reliance upon the automobile and promotes transit and active transportation • be sustainable and reduce greenhouse gas emissions by encouraging the most financially and environmentally appropriate mode for trip-making and supporting the use of zero- and low-emissions vehicles; • offer multimodal access to jobs, housing, schools, cultural, and recreational opportunities; and goods and services • Policy 3.2.3 Moving People (Excerpt) <ul style="list-style-type: none"> ○ Public transit will be the first priority for transportation infrastructure planning and major transportation investments ○ Municipalities will ensure that active transportation networks are comprehensive and integrated into transportation planning to provide: <ul style="list-style-type: none"> • safe, comfortable travel for pedestrians, bicyclists, and other users of active transportation;
<p>Provincial Policies – Provincial Policy Statement (2020)</p>	<ul style="list-style-type: none"> • Policy 1.6.6.7 Stormwater <ul style="list-style-type: none"> ○ Planning for stormwater management shall: <ul style="list-style-type: none"> • c. minimize erosion and changes in water balance, and prepare for the <i>impacts of a changing climate</i> through the effective management of stormwater, including the use of <i>green infrastructure</i>; • d. mitigate risks to human health, safety, property and the environment; • e. maximize the extent and function of vegetative and pervious surfaces; and ○ f. promote stormwater management best practices, including stormwater attenuation and re-use, water conservation and efficiency, and low impact development. • Policy 1.6.7 Transportation Systems <ul style="list-style-type: none"> ○ 1.6.7.3 As part of a multimodal transportation system, <i>connectivity within and among transportation systems and modes should be maintained and, where possible, improved</i> including connections which cross jurisdictional boundaries ○ 1.6.7.4 A land use pattern, density and mix of uses should be promoted that minimize the length and number of vehicle trips and support current and future use of transit and active transportation. • Policy 2.6 Cultural Heritage and Archaeology

References	Notes
	<ul style="list-style-type: none"> ○ 2.6.1 <i>Significant built heritage resources and significant cultural heritage landscapes shall be conserved.</i> ○ 2.6.2 <i>Development and site alteration shall not be permitted on lands containing archaeological resources or areas of archaeological potential unless significant archaeological resources have been conserved.</i> <p>2.6.5 Planning authorities shall engage with Indigenous communities and consider their interests when identifying, protecting and managing cultural heritage and archaeological resources.</p>
<p>Provincial Policies – Niagara Escarpment Plan (2017)</p>	<ul style="list-style-type: none"> ● 1.3 Escarpment Natural Area <ul style="list-style-type: none"> ○ Escarpment features that are in a relatively natural state and associated valleylands, wetlands and woodlands that are relatively undisturbed are included within this designation. These are the most sensitive natural and scenic resources of the Escarpment. The policies aim to protect and enhance these natural areas. ○ 1.3.2 Criteria for Designation <ol style="list-style-type: none"> 1. Escarpment slopes and Escarpment Related Landforms associated with the underlying bedrock that are in a relatively natural state. 2. Where woodlands abut the Escarpment, the designation includes the woodlands 300 metres back from the brow of the Escarpment slopes. 3. Provincially significant Areas of Natural and Scientific Interest (Life Science). 4. Significant valleylands, provincially significant wetlands and wetlands greater than 20 hectares in size. ● 1.7 Urban Area <ul style="list-style-type: none"> ○ This designation identifies Urban Areas in which the Escarpment and closely related lands are located. In some areas, the Escarpment is still largely undeveloped although surrounded by existing development. In other areas, urban growth already has encroached substantially on the Escarpment. ○ 1.7.1 Objective: <ol style="list-style-type: none"> 1. To minimize the impact and prevent further encroachment of urban growth on the Escarpment environment. ○ 1.7.2 Criterion for Designation and List of Urban Areas <ol style="list-style-type: none"> 1. Urban development and committed urban areas on or adjacent to the Escarpment as provided for in municipal official plans and/or secondary plans. 2. Urban Area designations are found within the following municipalities: <p>City of St. Catharines</p>
<p>Provincial Policies – Greenbelt Plan (2017)</p>	<ul style="list-style-type: none"> ● 2.2 Lands within the Niagara Escarpment Plan Area The requirements of the NEP, established under the Niagara Escarpment Planning and Development Act, continue to apply and the Protected Countryside policies do not apply, with the exception of section 3.3.
<p>Provincial Policy - Niagara Escarpment Planning and Development Act (2021)</p>	<ul style="list-style-type: none"> ● Regulations <ul style="list-style-type: none"> ○ The Minister may make regulations designating any area or areas of land within the Niagara Escarpment Planning Area as an area of development control. R.S.O. 1990, c. N.2, s. 22.

References	Notes
<p>Regional Policies (Niagara Region) – Official Plan (2014)</p>	<ul style="list-style-type: none"> ○ The Minister may make regulations, <p>(b) providing for the issuance of development permits and prescribing terms and conditions of permits;</p> <hr/> <p>From Schedule A – Burleigh Hill Drive is identified as being within the Greenbelt Plan Area and the Niagara Escarpment Plan Area. It is also identified as being in a “Built Up Area”.</p> <p>5.1 Multimodal Transportation System</p> <ul style="list-style-type: none"> ○ The Region will work with Local Area Municipalities, partnering agencies, and other public entities to provide for a multimodal transportation system that allows all users to travel in a safe, accessible, convenient, and affordable manner regardless of their chosen method of transportation. <p>5.1.2 A Connected Public Transit Network</p> <p>Policy 5.1.2.1</p> <ul style="list-style-type: none"> ○ Public transit will be a priority for transportation planning and investments to address the impacts of climate change; ○ assist in achieving social equity; ○ provide multimodal access to major transit station areas and other major trip generators identified in Policy 5.1.2.2.; and ○ reduce dependence on the automobile. <p>Policy 5.1.2.2</p> <p>The expansion of public transit across the region will be supported by:</p> <ul style="list-style-type: none"> ○ improving accessibility to public transit, including to and from active transportation networks; <p>Policy 5.1.2.5</p> <p>Lands near existing or planned frequent transit service or higher order transit facilities, including facilities within the Greenbelt Plan that have been approved through a Municipal Class Environmental Assessment, and where such lands are located within settlement areas, will be planned to:</p> <ul style="list-style-type: none"> ○ provide transit-supportive uses that enable opportunities for improved transit service integration; ○ facilitate multimodal connections that encourage a more evenly distributed modal share; and ○ support active transportation. <p>Policy 5.1.2.8</p> <ul style="list-style-type: none"> ○ The Region will work with the Province, Local Area Municipalities, and Metrolinx, where applicable, to support the integration of active transportation and public transit, such as: permitting bicycles on transit vehicles, providing bicycle racks on buses, and providing bicycle infrastructure at and to transit facilities, public and institutional areas, and employment lands. <p>5.1.3 Interconnected Active Transportation System</p> <p>Policy 5.1.3.1</p> <p>Comprehensive active transportation networks will be integrated into the transportation system to:</p> <p>enable safe and convenient inter-municipal and intra-municipal travel for active transportation users; and</p>

References	Notes
	<ul style="list-style-type: none">○ provide continuous linkages from neighbourhoods to strategic growth areas, major trip generators, employment land, tourism destinations, public service facilities, post-secondary institutions and transit stations, including sidewalks and dedicated lane space for cyclists on the major street network, or other safe and convenient alternatives.
	<p>Policy 5.1.3.2</p> <ul style="list-style-type: none">○ Implementation of the Strategic Cycling Network as identified in the Region's Transportation Master Plan will be prioritized to advance the implementation of the Niagara Bikeways Master Plan as shown in Schedule J2.
	<p>Policy 5.1.3.3</p> <ul style="list-style-type: none">○ The Region will support Local Area Municipalities in implementing sections of the Strategic Cycling Network that are within their jurisdiction.
	<p>Policy 5.1.3.4</p> <ul style="list-style-type: none">○ Local Area Municipalities are encouraged to support the use of bicycle infrastructure to ensure a connected and extended bicycle network within the region.
	<p>5.1.4 Complete Streets at Regional and Local Levels</p>
	<p>Policy 5.1.4.1</p> <ul style="list-style-type: none">○ The Niagara Region's Complete Streets Design Manual and Guidelines shall be used in the design, refurbishment and reconstruction of the Region's transportation system to ensure the needs and safety of all road users are considered and appropriately accommodated.
	<p>Policy 5.1.4.2</p> <ul style="list-style-type: none">○ Local Area Municipalities will adopt a complete streets approach in the design or reconstruction of the planned or existing Local street network.
	<p>Policy 5.1.4.4</p> <ul style="list-style-type: none">○ The Niagara Region's Complete Streets Design Manual and Guidelines shall be included as a reference document within the Request for Proposal (RFP) process for Municipal Class Environmental Assessments and detailed design projects.
	<p>5.2.5 Stormwater Management and the Planning Process</p>
	<p>Policy 5.2.5.2</p> <ul style="list-style-type: none">○ The Region will collaborate with the Local Area Municipalities for the provision of adequate storm drainage facilities.
	<p>Policy 5.2.5.3</p>

References	Notes
Regional Policies (Niagara Region) – Transportation Master Plan (2017)	<ul style="list-style-type: none"> ○ Local Area Municipalities shall implement sustainable stormwater management plans and strategies as part of development and redevelopment.
	<p>In Schedule 1, Burleigh Hill Drive is classified as a Regional Road. In Schedule 2, Burleigh Hill Drive is identified to be part of the strategic cycling network for the Region.</p> <p>5.1 Policy and Design</p> <ul style="list-style-type: none"> ● tools to reflect an integrated consideration of land use and transportation issues. ● Implement Complete Streets design guidelines and standards as part of road rehabilitation and reconstruction projects <p>5.2 Accessibility</p> <ul style="list-style-type: none"> ● In keeping with the Accessibility Ontarians with a Disability Act (AODA), it is essential for all transportation infrastructure to adhere to accessibility standards in order to serve customers with mobility, cognitive, hearing and vision impairments, including the accommodation of mobility aids and service animals. ● For Niagara Region to move forward in an accessible, age-friendly and inclusive manner, the following indicators should be considered: <ul style="list-style-type: none"> ○ Bus stops/shelters are safe and accessible (e.g., with seating, well lit, covered, snow removed, close to seniors’ residences). ○ Streets have clear and appropriate street signage and lane markers. ○ Appropriate rest places and distance between rest places. ○ Crosswalks are safe (e.g., with appropriate crossing times, mid-block crosswalks on long streets, median rest stops, good visibility). ○ Sidewalks, trails and walkways exist and are in safe condition (e.g., have smooth surfaces, curb cuts, separate bike lanes, are wide, well lit, clear of ice and snow). <p>6.1 Active Transportation</p> <ul style="list-style-type: none"> ● Recommended actions <ul style="list-style-type: none"> ○ Implement the Strategic Cycling Network Concept, as part of the Council-approved Bikeways Master Plan, giving priority to projects with the greatest cycling impact, balance complexity of work to be undertaken, and taking advantage of opportunities to work jointly with local area municipalities. ○ Invest in cycling facilities and supporting infrastructure to promote active lifestyles and healthy communities. ○ Encourage pedestrian- and cycling-supportive site design that provides safe pedestrian and cycling opportunities for all ages and abilities in all new developments. ○ Complete the Niagara Bikeways Master Plan network. <p>6.4 Transportation Demand and Systems Management</p>

References	Notes
	<ul style="list-style-type: none"> • TDM aims to influence travel by: <ul style="list-style-type: none"> ○ Providing more travel choices and options; ○ Providing incentives to take transit, cycle, walk, or carpool for school and work travel; ○ Providing disincentives to discourage single-occupant car trips, especially during peak commuting hours; ○ Providing active or transit-based alternatives to single-occupant car trips.
<p>Municipal Policies (St. Catharines) - Official Plan (2010)</p>	<p>Schedule D identifies Burleigh Hill Drive as Urban Area. Schedule D1 highlights the land use around Burleigh Hill Drive as natural area, residential area and commercial area.</p> <p>5.0 Transportation</p> <ul style="list-style-type: none"> • Policy 5.1.4 <ul style="list-style-type: none"> ○ The City will encourage and facilitate alternative forms of transportation that promote energy conservation and a healthy lifestyle. • Policy 5.1.6 <ul style="list-style-type: none"> ○ To implement the findings of the Transportation Impact Study, the City will include conditions of approval that support safe and functional pedestrian and cyclist movement, including: <ul style="list-style-type: none"> a) The acquisition of easements and dedication of land for sidewalks, bicycle trails, transit stops, or other facilities; b) The provision of associated amenities such as transit shelters, bicycle parking facilities, and lighting; c) Site, building, and road designs that meet the needs of pedestrians, cyclists, and transit users. • Policy 5.1.7 <ul style="list-style-type: none"> ○ The City shall consider various traffic calming and transportation demand management measures to reduce the negative impacts of traffic, and to promote safer streets and the concept of complete streets. • 5.2.1 Road Classification <ul style="list-style-type: none"> ○ Regional Roads: <ul style="list-style-type: none"> • Sidewalks shall be provided on both sides of the road. <p>Transit</p> <ul style="list-style-type: none"> • Policy 5.3.1.4 <ul style="list-style-type: none"> ○ Major new or redeveloped activity nodes or corridors shall incorporate transit and pedestrian systems that reduce reliance on the automobile. • Policy 5.3.1.5 <ul style="list-style-type: none"> ○ Major transit stops and transfer stations shall provide comfort amenities such as sitting areas, weather protection, and lighting <p>Cycling</p> <ul style="list-style-type: none"> • Policy 5.3.2.1 <ul style="list-style-type: none"> ○ The City shall require, provide, and maintain a continuous, well signed, clearly visible, and attractively landscaped network of cycling trails and facilities. • Policy 5.3.2.5 <ul style="list-style-type: none"> ○ Cycling routes shall be separated from motor vehicles on major roadways where feasible. Where not possible, shared use

References	Notes
	<p>roadways and bicycle route roadway markings and signage will be provided.</p> <ul style="list-style-type: none"> • Policy 5.3.2.6 Bicycle Route Network <ul style="list-style-type: none"> ○ The City supports the development of a system level bicycle network on all arterial and collector roads identified on Schedule C ‘Transportation Network’ of this Plan. ○ Where possible and practical, all arterial and collector roads should have bicycle lanes or shared use lanes, or a combination of both. ○ Where possible and practical, bicycle facilities should be incorporated on all arterial and collector roads as part of planned road reconstruction, rehabilitation or resurfacing. <p>Pedestrians</p> <ul style="list-style-type: none"> • Policy 5.3.3.1 <ul style="list-style-type: none"> ○ The City shall ensure that the transportation system will be designed to provide continuous and direct access by sidewalks and walkways to schools, recreation and cultural destinations, community services, major activity centres, and other high volume pedestrian centres. • Policy 5.3.3.2 <ul style="list-style-type: none"> ○ Streetscape design shall provide safe, convenient, and attractive pedestrian ways and connections. • Policy 5.3.3.4 Pedestrian safety will be enhanced on sidewalks and walkways through the provision of lighting and /or public visibility, where feasible.
<p>Municipal Policies (St. Catharines) – Transportation Mater Plan (2021)</p>	<p>Chapter 4.0 Complete Street Initiatives</p> <ul style="list-style-type: none"> • Will accommodate safe and attractive pedestrian and cyclist travel in a “context sensitive” manner taking into account the capacity and speed of the road (sidewalks and bike facilities on higher speed and volume arterials should be buffered from motorists) • Complete streets should support the connectivity and integration of modes throughout the City’s local road network. Whenever possible, connectivity and integrations should be facilitated • A continuous sidewalk network • A continuous on and off-road bicycle or multi-use trail network to support utility or recreational trips. The networks should connect natural areas and popular destination points such as schools, shopping centres, sports complexes, offices and other amenities. Given the St. Catharines context, which often was narrow or varying rights-of-way, shared facilities, such as sharrows, are encouraged whenever dedicated facilities are infeasible • Sidewalks are required on both sides of the street where feasible, in order to promote walkable neighbourhoods and have regard for the AODA.
<p>Municipal Policies (Thorold) – Official Plan (2016)</p>	<p>D2.7 Active Transportation</p> <ul style="list-style-type: none"> • The City will encourage diversity in transportation modes. It is anticipated that through development of the Secondary Plans and redevelopment in areas within and proximate to the Downtown,

References	Notes
	<p>there will be opportunities to support active transportation modes as well as transit-supportive neighbourhoods. The City is ideally suited to show leadership on this emerging need in urban planning and will, in partnership with the Region, prepare an Active Transportation Plan to develop policies and zone regulations that support and foster active forms of transportation in all industrial, commercial, and residential development by requiring design elements such as pedestrian trails and linkages and bicycle storage and parking.</p>
Municipal Policies (Thorold) – Transportation Master Plan (2020)	<p>Map B from the TMP classifies Collier Road North (Burleigh Hill Drive continues southerly as Collier Road North south of St. David’s Road) as a “Quick Win” as part of their Ultimate Cycling Network Phasing Plan and is proposed to have painted bike lanes and implemented in the short term. Winter maintenance standards are also proposed to be upgraded to encourage winter cycling.</p>
Niagara Region Stormwater Management Guidelines, December 2022	<ul style="list-style-type: none"> • Impact of climate change • Requirements of flood control, erosion control and water budget • Enhanced level of TSS removal, filtration units need to be designed for Canadian Environmental Technology Verification (ETV) particle size distribution
City of St. Catharines, Engineering Standard Manual, June 2015	<ul style="list-style-type: none"> • Minor system needs to convey the 5-year storm and major system should convey 100-year storm • Quantity control from post- to pre-development condition • Minimum cover for storm sewer shall be 1.40m • Minimum time of concentration to be used for storm sewer design is 10 minutes • The degree quality control must meet MECP requirements
NPCA, Stormwater Management Guidelines, March 2010	<ul style="list-style-type: none"> • SWM controls required are to match or reduce post-development peak flows to pre-development peak flows for flood control • In accessing the pre- and post-development flows, the design storm which yields the lowest pre-development flows and the highest post-development flows among the multiple storm duration (3-hr, 12-hr and 24-hr and multiple storm distributions • A minimum of “Normal” level of water quality treatment, as defined in the MECP SWM design guidelines (2003) • Required to meet erosion and water balance requirements
MECP (former MOE) Stormwater Management Planning and Design Manual, 2003	<ul style="list-style-type: none"> • Quality, quantity and erosion control requirement • Runoff volume control target
MTO Highway Drainage Design Standard, 2008	<ul style="list-style-type: none"> • Requirements for surface drainage system and roadside ditches