Safety Review of Proposed Intersection of 'Spine Road' and Hurontario Street

Schedule 'C' Class Environmental Assessment for Widening of McLaughlin Road and Construction of East-West Spine Road (Mayfield West Phase 2)

TPB166090

Prepared for:

Town of Caledon
6311 Old Church Road, Caledon, ON L7C 1J6

12/3/2018

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Prepared by:

Wood Environment & Infrastructure Solutions
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12/3/2018

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Table of Contents

List of tables

1.0 Introduction

The purpose of this report is to present the findings of an independent road safety audit conducted on the conceptual design of a proposed at-grade intersection associated with revisions to the Highway 410 / Hurontario Street interchange.

1.1 Project Description

The Town of Caledon (Town) initiated a Municipal Class Environmental Assessment (Class EA) for the widening of McLaughlin Road and construction of the new East-West Spine Road (Mayfield West Phase 2) (Figure 1).

The intent of this project is to widen McLaughlin Road and construct the new East-West Spine Road. The requirement for the EA Study has been triggered by the network requirements set out in the approved Mayfield West Phase 2 Transportation Master Plan (MW2-TMP) which fulfilled the requirements of Phases 1 and 2 of the Municipal Class EA process. The MW2-TMP was a comprehensive transportation strategy accommodating both vehicular traffic and provisions for the pedestrian/cyclist communities and to service the new development. Mayfield West Phase 2 (MW2) development is anticipated to accommodate 16,138 residents and 4,449 jobs. In the MW2 TMP, the Spine Road was proposed to connect to Hurontario Street / Valleywood Boulevard immediately south of the interchange with Highway 410, thus prompting modifications to the interchange of Highway 410 / Valleywood Boulevard / Hurontario Street.

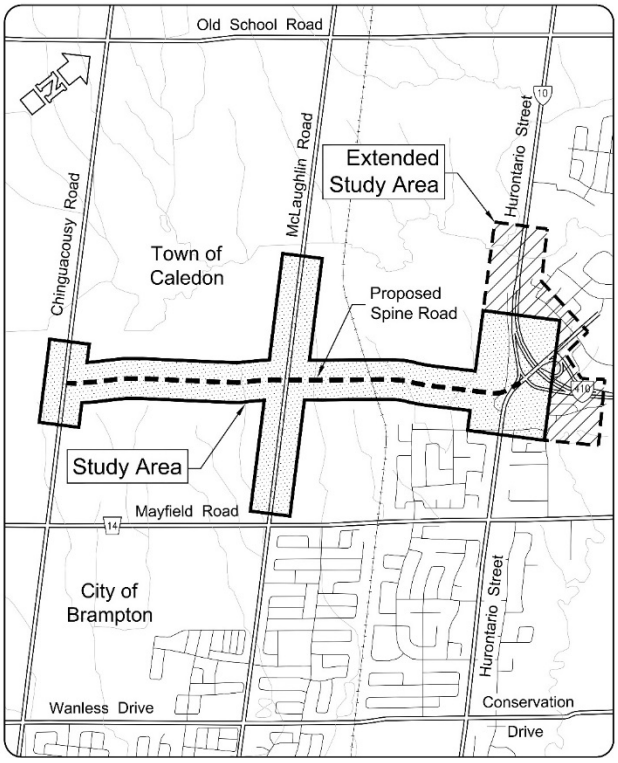


Figure 1: McLaughlin Road EA Study Limits.

The proposed modifications include the following (not all of which is subject to this safety review):

- Widening of Valleywood Boulevard from two to four lane cross-section;
- Westerly extension of Valleywood Boulevard, to southwest of Hurontario Street (section known as Spine Road);
- Maintain the westbound access to the existing S-W loop ramp;
- Construction of a new N-E loop ramp;
- Realignment of Hurontario Street and the N-E/W Ramp to intersect at a new at-grade intersection of Hurontario Street and Spine Road;
- Construction of a new S-E Ramp from Hurontario Street; and
- Construction of a new E/W-N flyover ramp.

1.2 Limitations

The audit team has conducted this audit to the best of its professional abilities within the time available, and by referring to available information provided by the design team. While we have made every attempt to identify significant safety issues, the design team and the project owner are reminded that responsibility for the design, construction, and performance of the project remains with the Engineers of Record.

1.3 Scope

The review is limited solely to Design Version 2 of the intersection of 'Spine Road' and Hurontario Street, as illustrated in the copies of the review documents provided in **Appendix A** to this report. The review does not consider design of adjacent intersections, nor new and/or modified ramps. Additionally, it should also be noted that the scope of the review did not include review of proposed signage, drainage, grading, illumination, active transportation or construction staging.

Document file names were as follows:

- NC_1 v2 R1.pdf, horizontal layout dated November 21, 2018; and
- NC_1 v2 R1 Profiles.pdf, profile drawings, dated November 23, 2018

Additional design details provided to the review team included the following:

- Posted speed limits on affected roadways is to be 60 km/h;
- Design speed limits are 70 km/h for Spine Road and 80 km/h for Hurontario Street;
- No modification to the Highway 410 overpass structure will be considered; and
- No modification to the identified property limits will be considered unless necessary.

Directional nomenclature for the intersection is as follows:

- Hurontario Street – eastbound / westbound traffic.
- Valleywood Boulevard/Spine Road – northbound/southbound traffic.

1.4 Applicable Guidelines

The safety review was completed using the following applicable guidelines:

- Transportation Association of Canada's Geometric Design Guide for Canadian Roads, 2017; and
- Ministry of Transportation Ontario's Design Supplement for the TAC Geometric Design Guide for Canadian Roads, 2017.

1.5 Audit Team and Process

The audit team consisted of Maria King, P.Eng. and John McGill, P.Eng., PTOE of Wood, both of whom have had no involvement in this project to date. The project materials on which the review was based are provided in **Appendix A**.

The review team met briefly with Jason Stahl, P.Eng., Wood Assistant Project Manager for the EA, to review design constraints, lane requirements and preliminary MTO concerns. As this project is a complete new build, no site visit was considered necessary.

The audit follows the general guidelines and procedures of the *Canadian Road Safety Audit Guide,* published by the Transportation Association of Canada in 2001. A road safety audit framework that further develops the concepts in the Guide was applied in both the audit analysis and presentation of findings. The expected frequency and severity of crashes caused by each safety issue have been identified and

rated according to the categories shown in **Table 1** and **Table 2**. These two risk elements were then combined to obtain a risk assessment on the basis of the matrix shown in **Table 3**. Consequently, each safety issue is assessed on the basis of a ranking between F (highest risk and highest priority) and A (lowest risk and lowest priority).

For each safety issue identified, possible mitigation measures have been suggested. The suggestions have focused on measures that can be cost-effectively implemented at the current design stage, with minimal impact to the current design and adjacent properties.

Table 1: Frequency Rating

Estimated		Expected Crash Frequency	Frequency Rating
Exposure	**Probability**		
High	High	10 or more crashes per year	*Frequent*
Medium	High		
High	Medium	*1 to 9 crashes per year*	*Occasional*
Medium	Medium		
Low	High		
High	Low	*less than 1 crash per year, but more than 1 crash every 10 years*	*Infrequent*
Low	Medium		
Medium	Low	*less than 1 crash every 10 years*	*Rare*
Low	Low		

Table 2: Severity Rating

Typical Crashes Expected (per audit item)	Expected Crash Severity	Severity Rating
Crashes involving high speeds or heavy vehicles, pedestrians, or bicycles	Probable fatality or incapacitating injury	*High*
Crashes involving medium to high speeds; head-on, crossing, or off-road crashes	Moderate to severe injury	*Medium*
Crashes involving medium to low speeds; left-turn and right-turn crashes	Minor to moderate injury	*Low*
Crashes involving low to medium speeds; rear-end or sideswipe crashes	Property damage only or minor injury	*Negligible*

Table 3: Crash Risk Assessment

Frequency Rating	Severity Rating			
	Negligible	**Low**	**Medium**	**High**
Frequent	C	D	E	F
Occasional	B	C	D	E
Infrequent	A	B	C	D
Rare	A	A	B	C

Crash Risk Ratings:	A: lowest risk level	D: moderate-high risk level
	B: low risk level	E: high risk level
	C: moderate-low risk level	F: highest risk level

2.0 Identified Safety Issues

A total of five (5) potential safety issues were identified with the proposed intersection design, each with various safety ratings. The issues and suggested improvements are expanded on in Sections 2.1 to 2.5, and summarized in **Table 4**.

It should be noted that while the majority of identified safety issues have a risk rating of *C: Moderate-Low Risk*, this review was completed for a proposed new build. As such, the opportunity should be sought to address all of these risks to the extent possible.

Table 4: Summary of Safety Issues and Associated Risk Ratings.

Safety Issue (Number and Description)		Risk Rating
1	Eastbound / Westbound Natural Travel Path Overlap	C
2	Southbound Left Intersection Sight Distance	C
3	Westbound Right Departure Sight Distance	C
4	Southbound Right Departure Sight Distance	C
5	Weaving at W-E Ramp Connection from Valleywood Boulevard	D

2.1 Safety Issue #1: Eastbound/Westbound Natural Travel Paths

2.1.1 Risk Overview

The natural linear travel paths for vehicles heading both eastbound and westbound through the intersection are aligned away from the receiving lanes, with eastbound traffic naturally directed to the outside curb lane, and westbound traffic naturally directed towards the median. This misalignment results from the intersection's location along a relatively small radius curve (250 m). The average angle of offset for both northbound and southbound vehicles is 12 degrees. With the significant travel distance through the intersection, this misalignment could result in vehicles inadvertently switching lanes – resulting in frequent side-swipe collisions. A diagram illustrating the natural paths for the subject movement is provided as Figure B-1 in **Appendix B**.

2.1.2 Risk Rating

The following provides details on how the risk rating was determined for this safety issue:

Frequency Rating	Severity Rating	Crash Risk Assessment
Frequent	Negligible	C

2.1.3 Suggested Mitigation Strategies

A number of solutions are available to address the alignment issue. These include the strategies identified in Table 5, with various degrees of complexity, potential impacts to design constraints, and improvement.

Table 5: Available Mitigation Strategies for Safety Issue #1.

Strategy		Potential Impacts and Limitations	Anticipated Effectiveness
1	Addition of skip lines to direct traffic to appropriate receiving lane.	Strategy is only considered effective if line work is clearly visible, requiring ongoing restriping and dry pavement conditions.	Low
2	Increase radius on curve to the extent possible on Spine Road and add skip lines to direct traffic to appropriate receiving lane.	Strategy partially addresses the misalignment of lanes, reducing the average offset angle between the natural path and receiving lanes by >4 degrees. However, the eastern limit of the increased horizontal curve would then be coincident with the vertical curve southwest of the bridge. In terms of skip lines, pavement markings are only considered effective if line work is clearly visible, requiring ongoing restriping and dry pavement conditions.	Moderate
3	Relocate intersection to linear section of the proposed Spine Road to such that intersection is no longer located on a curve.	Strategy would fully address misalignment of receiving lanes; however, would have significant impacts to properties located in the southwest quadrant of the intersection.	High

2.2 Safety Issue #2: Southbound Left Intersection Sight Distance

2.2.1 Risk Overview

Assuming the intersection does not have dedicated left-turn signals, sight distances for the southbound left are inadequate given visual conflicts with the dual opposing lefts and the curvilinear alignment of the westbound lanes. Sight distances for the subject movement are illustrated in Figure B-2 in Appendix B.

2.2.2 Risk Rating

The following provides details on how the risk rating was determined for this safety issue:

Frequency Rating	Severity Rating	Crash Risk Assessment
Occasional	Low	C

2.2.3 Suggested Mitigation Strategies

A number of solutions are available to address the sight distance issue. These include the strategies identified in Table 6, with various degrees of complexity, potential impacts to design constraints, and improvement.

Table 6: Available Mitigation Strategies for Safety Issue #2

	Strategy	Potential Impacts and Limitations	Anticipated Effectiveness
1	Realign southbound left turn lane into the available median space, aligning the inside edge of the turn lane more closely to outside limit of the northbound lanes. Would require addition of a painted gore area between the left turn lane and the through lanes.	While mitigating issues associated with visual conflict with the northbound left turn lanes, sight distances issues related to the curvilinear alignment of Hurontario Street continue to be an issue.	Low-Moderate
2	Dedicated Left-Turn Phasing	Impact on traffic operations should be confirmed.	High
3	Straighten northbound approach on Hurontario Street and realign southbound left turn lane into the available median space, aligning the inside edge of the turn lane more closely to outside limit of the northbound turn lanes,	Strategy would address visibility issues for left turning vehicles, but would require property acquisition. Potential issues with constructions staging.	High

2.3 Safety Issue #3: Westbound Right Departure Sight Distance

2.3.1 Risk Overview

Decision sight distance for the westbound shared through-right (Valleywood Boulevard) is impeded partially by the northbound inside through and outside left turn lane due to the curvilinear alignment of the Hurontario Street approach. Details regarding the vertical and departure sight distances for this particular movement are summarized in Table 7. Diagrams illustrating the departure sight distance triangles for the subject movement are provided as Figure B-3 in **Appendix B**.

Table 7: Departure and Vertical Sight Distances for Westbound Right Turns

Design Vehicle	Driver's Eye Height (m)		Departure Sight Distance and Station	Vertical Sight Distance Acceptable		Departure Sight Distance Acceptable
	TAC	MTO		TAC	MTO	
Passenger	1.08 m	1.08 m	145 m (~STA 9+874)	Yes	Yes	No
WB20	2.40 m[1]	2.33 m	235 m (~STA 9+782)	Yes	Yes	No

[1] Per December 2011 Update to the 1999 TAC Geometric Design Guide for Canadian Roads.

2.3.2 Risk Rating

The following provides details on how the risk rating was determined for this safety issue:

Frequency Rating	Severity Rating	Crash Risk Assessment
Occasional	Low	C

2.3.3 Suggested Mitigation Strategies

A number of solutions are available to address the sight distance issue. These include the strategies identified in Table 8, with various degrees of complexity, potential impacts to design constraints, and improvement.

Table 8: Available Mitigation Strategies for Safety Issue #3.

	Strategy	Potential Impacts and Limitations	Anticipated Effectiveness
1	Introduce 'Right on Red' restrictions.	If adhered to, would eliminate collision risks.	Moderate
2	Eliminate the westbound right turn and provide westbound access at the existing Valleywood Boulevard loop ramp.	Suitability of providing either a dedicated left or shared left-through at the W-W loop ramp (existing) will need to be examined by the design team. Traffic flow implications should also be considered.	Moderate-High
3	Eliminate curvilinear approach on Hurontario Street.	Would eliminate visual conflict with through and turning lanes. Would require property from private landowners.	High

2.4 Safety Issue #4: Southbound Right Departure Sight Distance

2.4.1 Risk Overview

Right turn departure sight distances were checked for both passenger vehicles and WB20s (design vehicle) – refer to Table 6 . While the sight distances for passenger vehicles are acceptable, the horizontal departure sight distances for the WB20 are not. The departure sight distance triangle for the WB20 extends from Station 10+040 (truck location) to Station 10+258 (decision sight distance), with views impeded by both the N-E Ramp to Highway 410 and the railings of the overpass structure. Diagrams illustrating the departure sight distance triangles for the subject movement are provided as Figure B-4 in **Appendix B**.

Additional consideration for movements made from the inside of a curve include the "over the shoulder" angle of visibility (phi, Φ). 2Φ is approximately equivalent to the angle formed between the mid-line of the departing vehicle and the mid-line of the vehicle approaching from the left (at the departure sight distance). While not explicitly identified within the TAC Geometric Design Guide for Canadian Roads (2017), acceptable phi, Φ angles are identified within TAC's Canadian Roundabout Design Guide (2017). Per Section 6.3.11 of the TAC Roundabout Guide, acceptable angles range from 2Φ = 40 degrees to $2\Phi = 120$ degrees, with the lower end of the range causing issue due to straining and/or requirement to use mirrors to check for vehicles. On the southbound approach, the angle between the natural travel path of the right-turning vehicle and a vehicle at the extent of the departure sight distance is 2Φ = 67 degrees

for passenger vehicles, and 2Φ = 61 degrees for WB20s. While both values are within the acceptable range, they are towards the lower end, with additional strain introduced by the adjacent vertical curve.

Table 9: Departure and Vertical Sight Distances for Southbound Right Turns

Design Vehicle	Driver's Eye Height (m)		Departure Sight Distance and Station	Vertical Sight Distance Acceptable		Departure Sight Distance Acceptable
	TAC	MTO		TAC	MTO	
Passenger	1.08 m	1.08 m	130 m (~STA 10+180)	Yes	Yes	Yes
WB20	2.40 m[2]	2.33 m	205 m (~STA 10+258)	Yes	Yes	No

2.4.2 Risk Rating

The following provides details on how the risk rating was determined for this safety issue:

Frequency Rating	Severity Rating	Crash Risk Assessment
Occasional	Low	C

2.4.3 Suggested Mitigation Strategies

A number of solutions are available to address the sight distance issue. These include the strategies identified in Table 10, with various degrees of complexity, potential impacts to design constraints, and improvement.

Table 10: Available Mitigation Strategies for Safety Issue #4.

Strategy		Potential Impacts and Limitations	Anticipated Effectiveness
1	Provide right turn receiving lane on westbound Spine Road.	While eliminating direct conflicts with through right-turning vehicles, visibility for merging out of the receiving lane would be significantly limited given the anticipated downgrade operating speeds and the minimum radius curve on Spine Road.	Low
2	Introduce 'Right on Red' restrictions.	If adhered to, would eliminate collision risks.	Moderate
3	Relocate intersection further west to move limit of departure sight distance southwest of interference with the bridge and ramp.	Would eliminate visual conflict with bridge and ramp. Would require additional property from private landowners.	High

[2] Per December 2011 Update to the 1999 TAC Geometric Design Guide for Canadian Roads.

2.5 Safety Issue #5: Weaving at W-E Ramp Connection from Valleywood Boulevard

2.5.1 Risk Overview

Safety concerns related to weaving have been identified for vehicles moving into/ out of the outside eastbound lane of Spine Road, which becomes the S-E Ramp for the Highway 410 interchange. This includes northbound right turn vehicles that will be moving into the Highway access lane and will need to move left within the available 90 m length. As a dedicated S-E Ramp is provided for northbound vehicles ahead of the intersection, all right turning vehicles are assumed to have destinations towards Brampton. Additional risk is associated with right turning vehicles turning onto Spine Road from Hurontario Street and slowing significantly to merge into a lane that is not clearly visible for northbound traffic under congested conditions.

2.5.2 Risk Rating

The following provides details on how the risk rating was determined for this safety issue:

Frequency Rating	Severity Rating	Crash Risk Assessment
Frequent	Low	D

2.5.3 Suggested Mitigation Strategies

A number of solutions are available to address the weaving issue associated with the eastbound lanes. These include the strategies identified in Table 11, with various degrees of complexity, potential impacts to design constraints, and improvement.

Table 11: Suggested Mitigation Strategies for Safety Issue # 5.

	Strategy	Potential Impacts and Limitations	Anticipated Effectiveness
1	Enhanced signage and modified pavement markings to indicate outside eastbound lane exits beyond the intersection.	Strategy will partially address issues with eastbound weaving vehicles in the 90 m segment beyond Hurontario Street, but will not address lane changes for vehicles making the northbound right.	Moderate
2	Drop one eastbound (Spine Road) lane before the intersection, and develop an access lane for S-E Ramp beyond Hurontario Street.	Strategy assumes two northbound lanes have sufficient capacity to carry all northbound traffic, and that the 90 m turn lane is sufficiently long for deceleration and storage.	Moderate-High

3.0 Conclusions

Based on the information made available to the review team, the strategies identified in Table 12 are recommended to address safety concerns at the proposed Hurontario Street / Spine Road intersection. It should be noted that Safety Issues 1 (Natural Travel Path), 3 (Westbound Right) and 4 (Southbound Right) could be primarily mitigated through relocation of the intersection.

Table 12: Recommended Strategies to Mitigate Identified Safety Concerns.

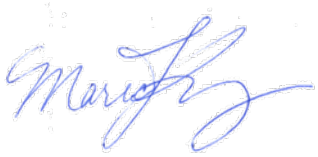
	Safety Issue (Number and Description)	Recommended Strategy
1	Eastbound / Westbound Natural Travel Path Overlap	Strategy 3: Relocate intersection to linear section of the proposed Spine Road to such that intersection is no longer located on a curve.
2	Southbound Left Intersection Sight Distance	Strategy 2: Dedicated Left-Turn Phasing.
3	Westbound Right Departure Sight Distance	Strategy 3: Eliminate curvilinear approach on Hurontario Street.
4	Southbound Right Departure Sight Distance	Strategy 3: Relocate intersection further west to move limit of departure sight distance southwest of interference with the bridge and ramp.
5	Weaving at W-E Ramp Connection from Valleywood Boulevard	Strategy 2: Drop one eastbound (Spine Road) lane before the intersection, and develop access lane for S-E Ramp beyond Hurontario Street.

We trust that the information presented in this report meets your current requirements. Should you have any questions, or concerns, please to not hesitate to contact the undersigned.

Respectfully submitted,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

John McGill, P.Eng., PTOE
Principal, Transportation Planning



Maria E. King, P.Eng.
Senior Engineer, Transportation

Appendix A:
Reviewed Information

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

NEW CONSTRUCTION
HIGHWAY 410 INTERCHANGE
OVERALL PLAN

SHEET
P1

VALLEYWOOD BOULEVARD

N-E RAMP

S-E RAMP

E\W-N RAMP

N-E/W RAMP

SPINE ROAD

HURONTARIO STREET

AMEC Foster Wheeler Environment & Infrastructure PR-#-### ##-##

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Nov 26/18 – jason.stahl

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

NEW CONSTRUCTION
HIGHWAY 410 INTERCHANGE
SPINE ROAD

SHEET
NC1

COLLECTOR ROAD D

LIMIT OF CONSTRUCTION
STA. 9+782

SPINE ROAD

HUTCHINSON FARM LANE (EX)

N-E/W RAMP

E/W-N RAMP

N-E RAMP

HURONTARIO STREET

S-E RAMP

TS: 20+091.13

TS: 20+074.28

SC: 20+073.54

SC: 20+105.72

TS: 20+069.60

SEE SHEET NC2

SCALE
5m 0 10m
Horizontal

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

NEW CONSTRUCTION
HIGHWAY 410 INTERCHANGE
HURONTARIO ST, VALLEYWOOD BLVD

SHEET
NC2

SEE SHEET NC1

SEE SHEET NC4

SEE SHEET NC7

SEE SHEET NC5

SEE SHEET NC3

HUTCHINSON FARM LANE (EX)

HURONTARIO STREET

HURONTARIO STREET (EX)

VALLEYWOOD BOULEVARD

N-E/W RAMP

E/W-N RAMP

N-E RAMP

N-E/W RAMP (EX)

S-E RAMP

HIGHWAY 410

SCALE
5m 0 10m
Horizontal

AMEC Foster Wheeler Environment & Infrastructure PR-#-### ##-##

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METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

NEW CONSTRUCTION
HIGHWAY 410 INTERCHANGE
VALLEYWOOD BOULEVARD

SHEET
NC3

SEE SHEET NC2

SEE SHEET NC2

SEE SHEET NC5

VALLEYWOOD BOULEVARD

HIGHWAY 410

N-E RAMP

E-N/S RAMP

N/S-W RAMP (EX)

SNELCREST DRIVE

ROYAL VALLEY DRIVE

TREEVIEW CRESCENT

LIMIT OF CONSTRUCTION
STA. 10+570

20+300

20+400

20+500

10+300

10+400

10+465

20+301.31

20+325.50

SC: 20+414.55

R=2000

R=2520

R=3435

R=15

3.75

2.50

3.50

4.75

1.30

5.50

SCALE
5m 0 10m
Horizontal

AMEC Foster Wheeler Environment & Infrastructure PR-#-### ##-##

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METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

NEW CONSTRUCTION
HIGHWAY 410 INTERCHANGE
HURONTARIO STREET

SHEET
NC4

SEE SHEET NC2

HUTCHINSON FARM LANE (EX)

HURONTARIO STREET

S-E RAMP

LIMIT OF CONSTRUCTION
STA. 9+773

COLLINGWOOD AVENUE

HIGHWOOD ROAD

9+900

9+800

9+720

TS. 20+069.60

PC. 9+891.69

PT. 9+884.52

PC. 9+877.17

R=300

R=360

3.50
3.75
3.75
3.50
6.00
3.75
3.75

SCALE
5m 0 10m
Horizontal

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METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

NEW CONSTRUCTION
HIGHWAY 410 INTERCHANGE
N-E RAMP, S-E RAMP

SHEET
NC5

SEE SHEET NC3

SEE SHEET NC2

N-E RAMP

S-E RAMP

E-N/S RAMP

HIGHWAY 410

20+400

20+500

20+600

20+614

20+300

20+400

240m S.C.L.

SC: 20+414.53

R=5435

90m TAPER

55m TAPER

1.30

4.75

ST: 20+325.48

160m S.C.L.

PC: 20+434.51

LIMIT OF CONSTRUCTION
STA. 20+642

LIMIT OF CONSTRUCTION
STA. 20+563

DONHERB CRESCENT

LIGHTHEART DRIVE

SCALE
5m 0 10m
Horizontal

AMEC Foster Wheeler Environment & Infrastructure PR-#-### ##-##

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METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

NEW CONSTRUCTION
HIGHWAY 410 INTERCHANGE
E/W-N RAMP

SHEET
NC6

HESKETH COURT

EMERGENCY ACCESS (EX)

LIMIT OF CONSTRUCTION
STA. 20+878

85m TAPER

PI: 20+815.20

PT: 20+744.83

390m

20+895

20+800

20+700

20+600

HURONTARIO STREET

E/W-N RAMP

R=1000

4.75

1.30

SEE SHEET NC7

SCALE
5m 0 10m
Horizontal

AMEC Foster Wheeler Environment & Infrastructure PR-#-### ##-##

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METRIC

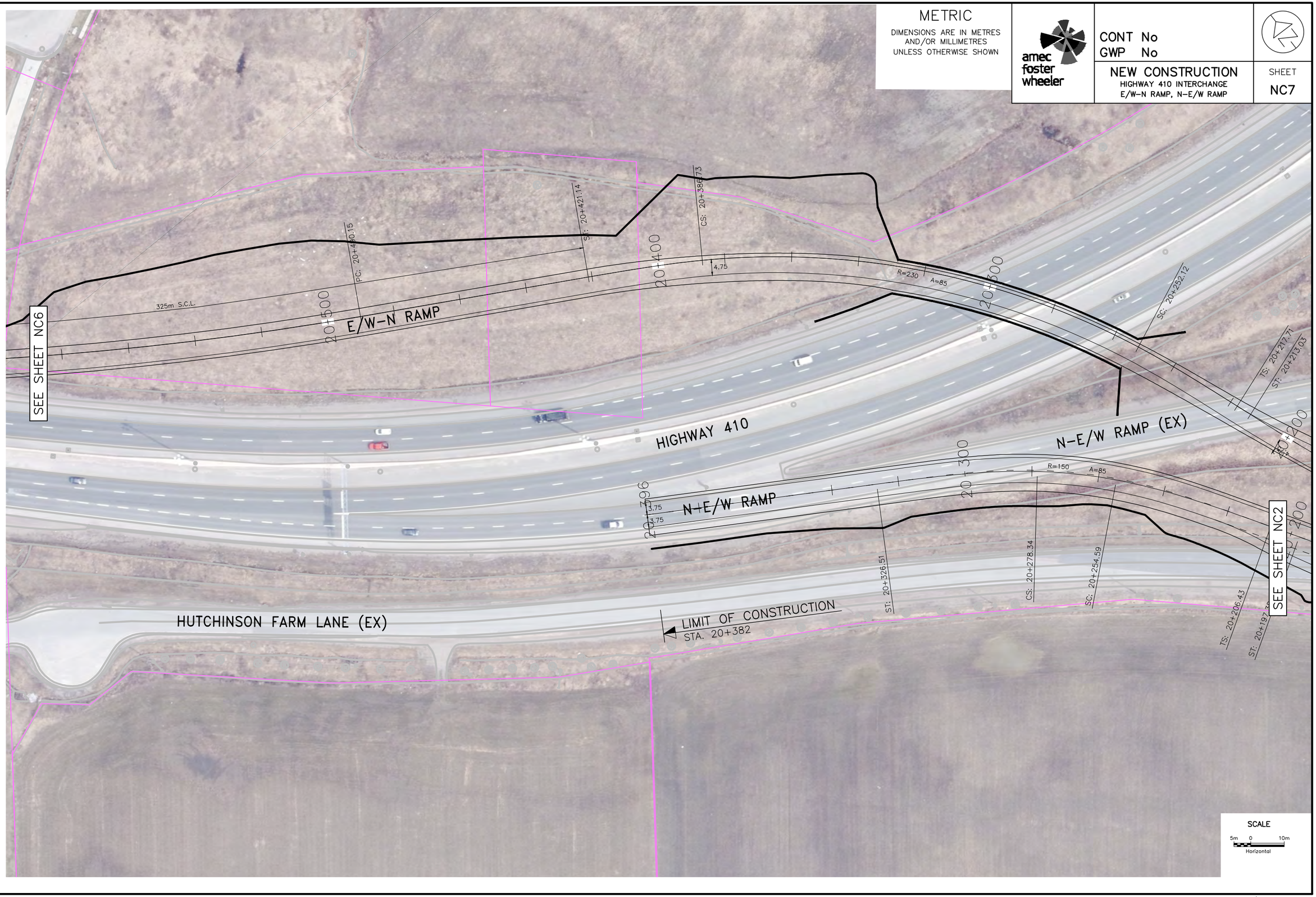
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

NEW CONSTRUCTION
HIGHWAY 410 INTERCHANGE
E/W-N RAMP, N-E/W RAMP

SHEET
NC7



SCALE
5m 0 10m
Horizontal

AMEC Foster Wheeler Environment & Infrastructure PR-#-## #-#

METRIC

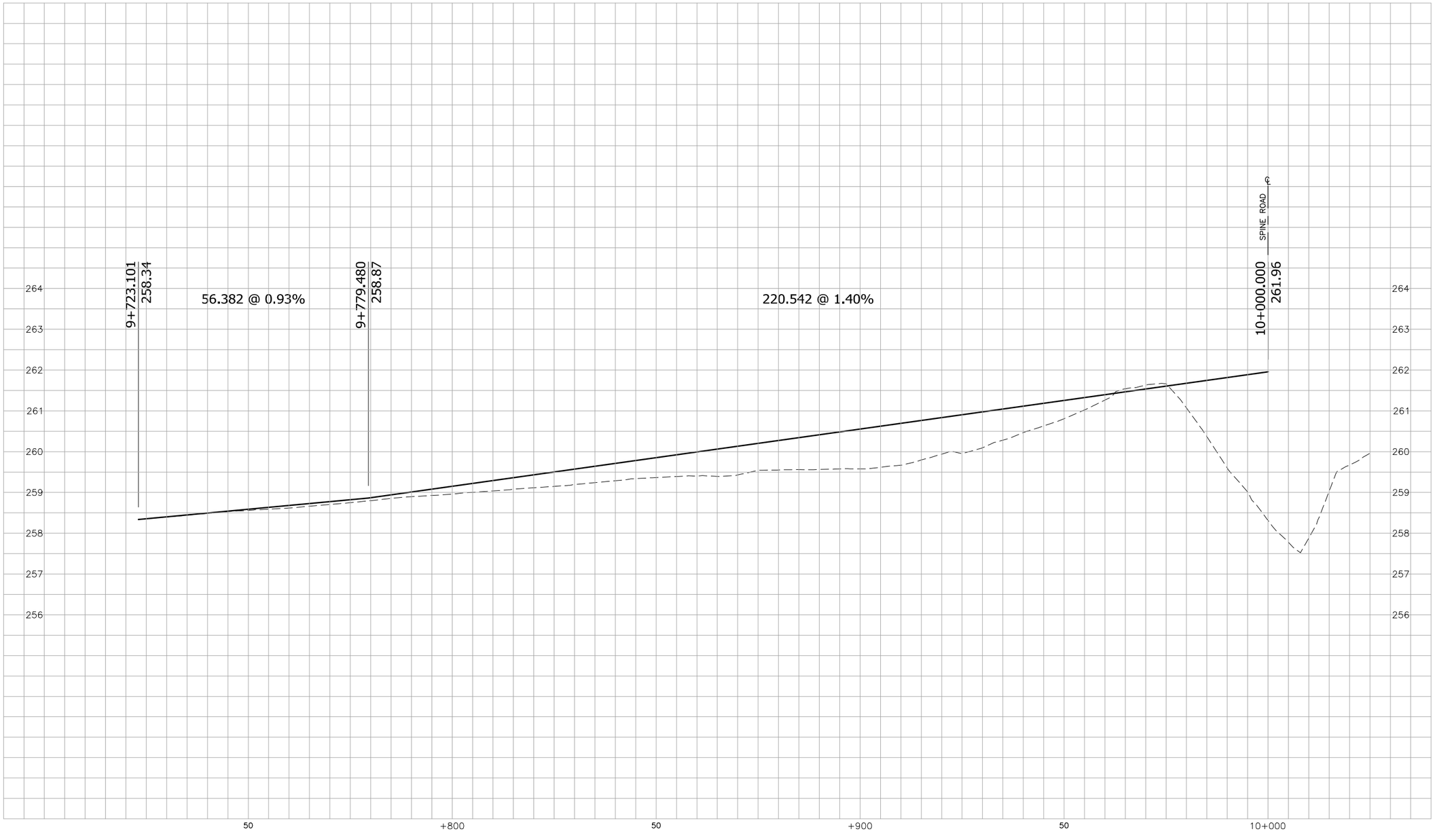
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
HURONTARIO STREET

SHEET
PROF1



METRIC

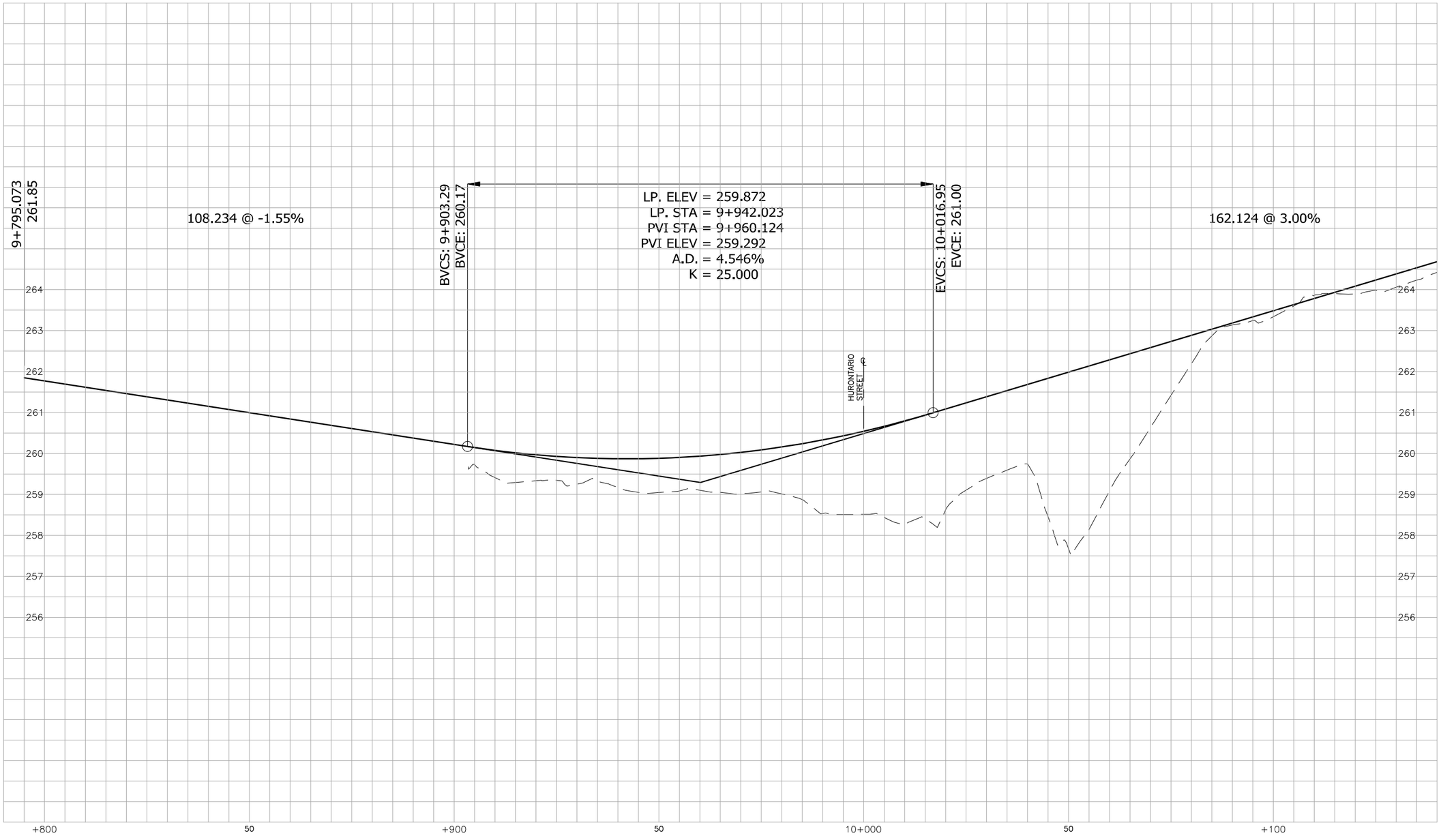
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
SPINE ROAD

SHEET
PROF2



AMEC Foster Wheeler Environment & Infrastructure PR-#-## #-#

METRIC

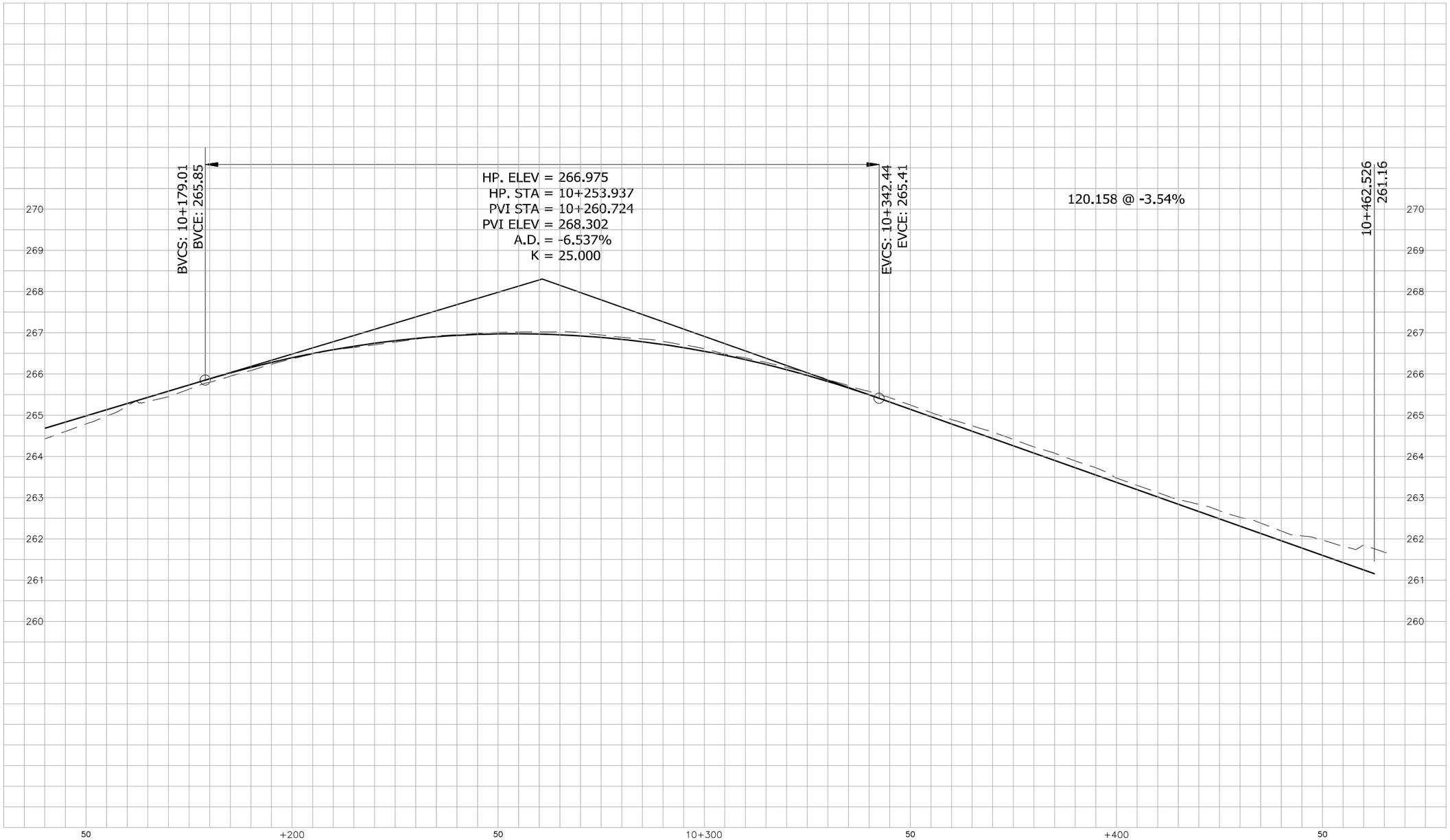
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
VALLEYWOOD BOULEVARD

SHEET
PROF3



SCALES

5m 0 10m
Horizontal

0.5m 0 1m
Vertical

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
N-E RAMP

SHEET
PROF4

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

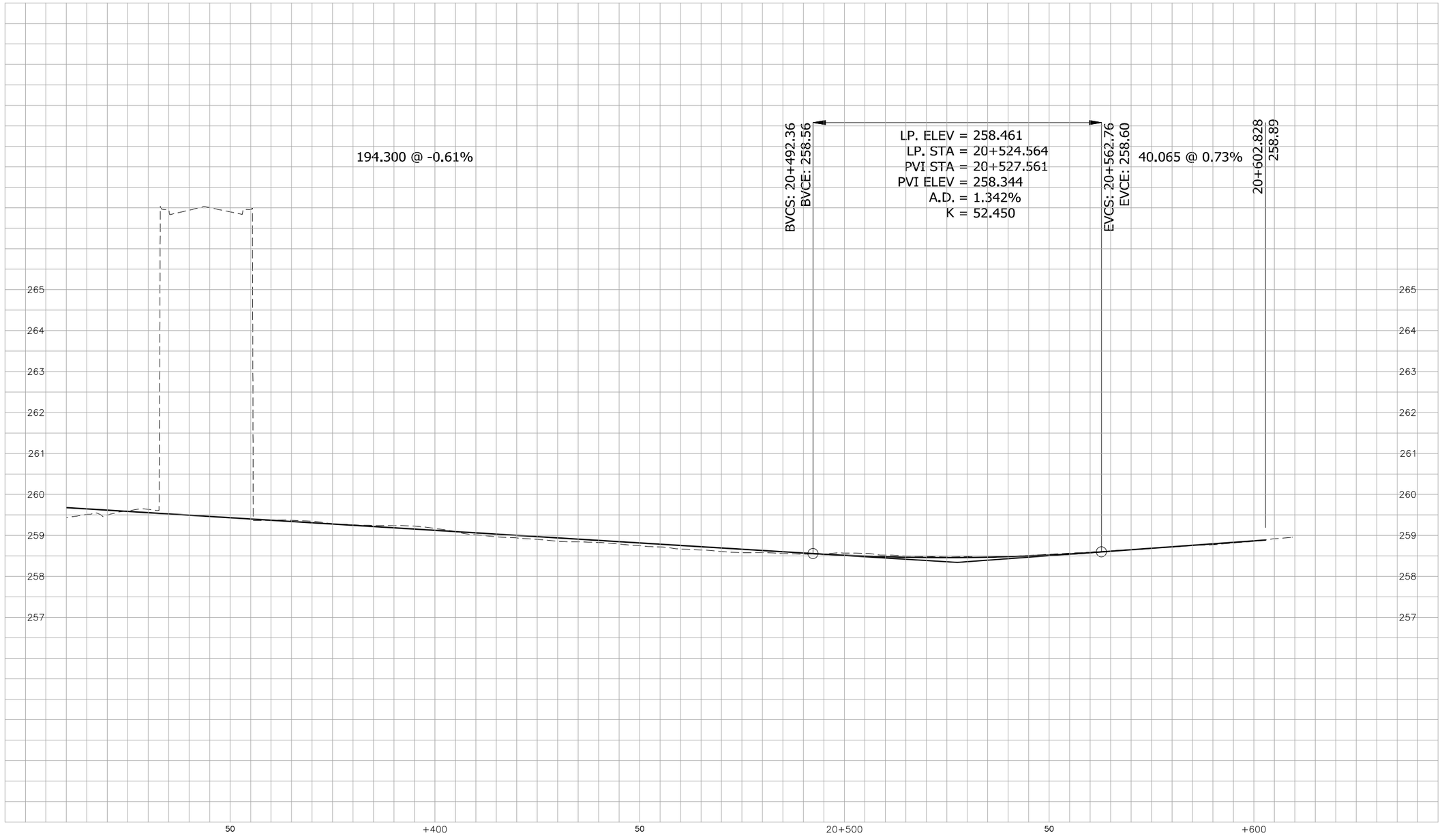
amec foster wheeler

CONT No
GWP No

PROFILE

HIGHWAY 410 INTERCHANGE
N-E RAMP

SHEET
PROF5



METRIC

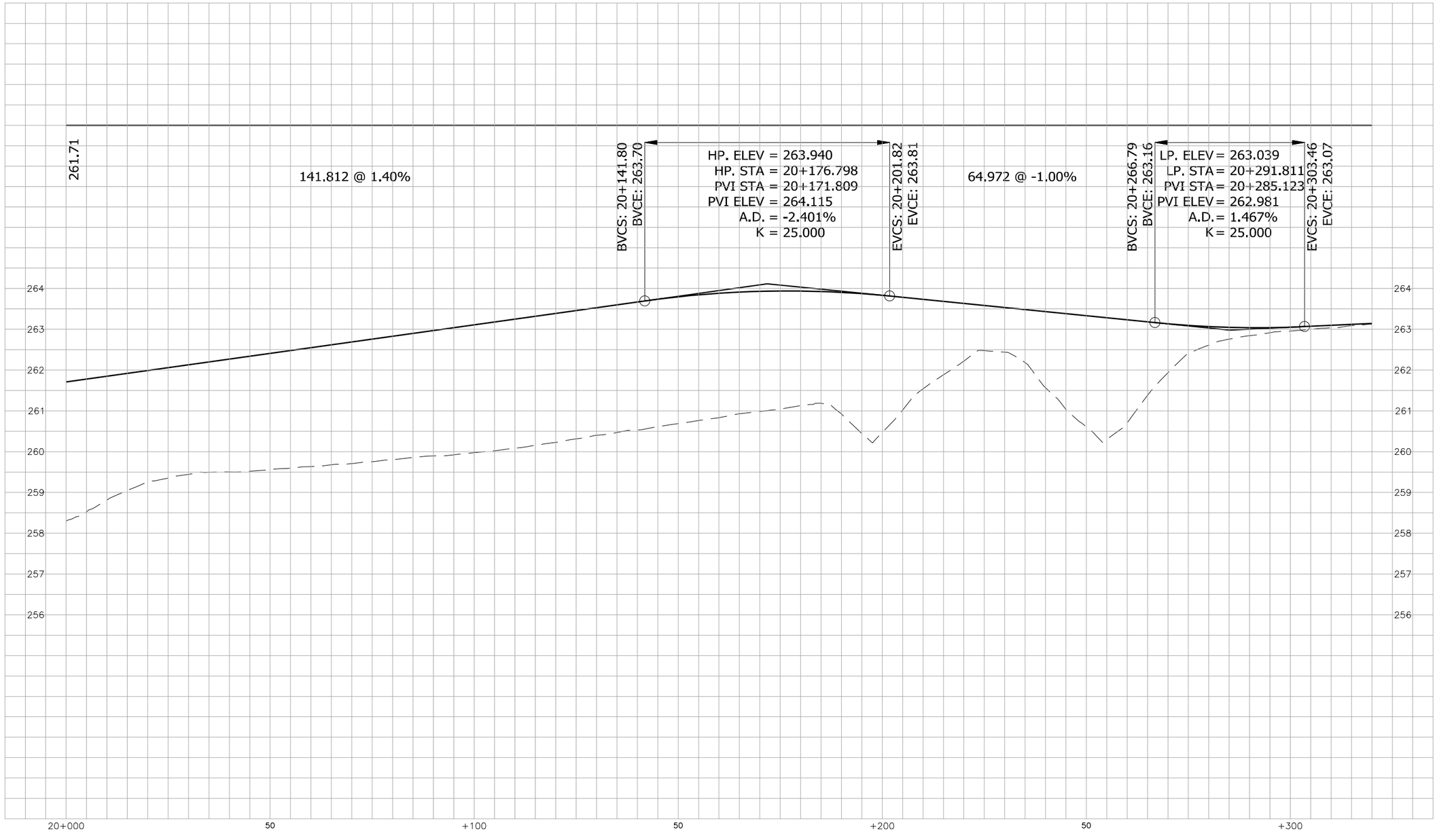
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
N-E/W RAMP

SHEET
PROF6



SCALES

5m 0 10m
Horizontal

0.5m 0 1m
Vertical

METRIC

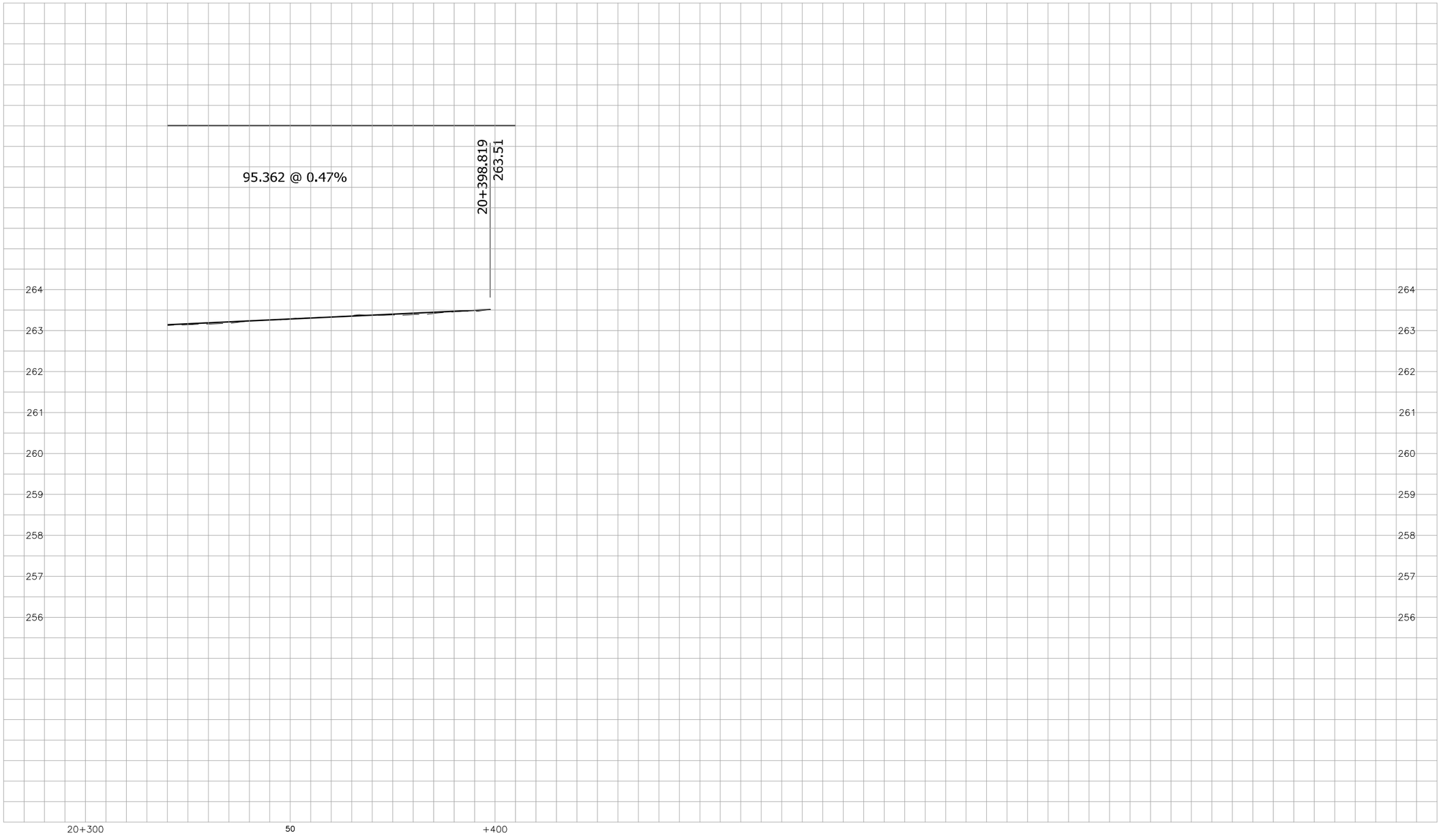
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
N-E/W RAMP

SHEET
PROF7



SCALES

5m 0 10m
Horizontal

0.5m 0 1m
Vertical

AMEC Foster Wheeler Environment & Infrastructure PR-#-## #-#

METRIC

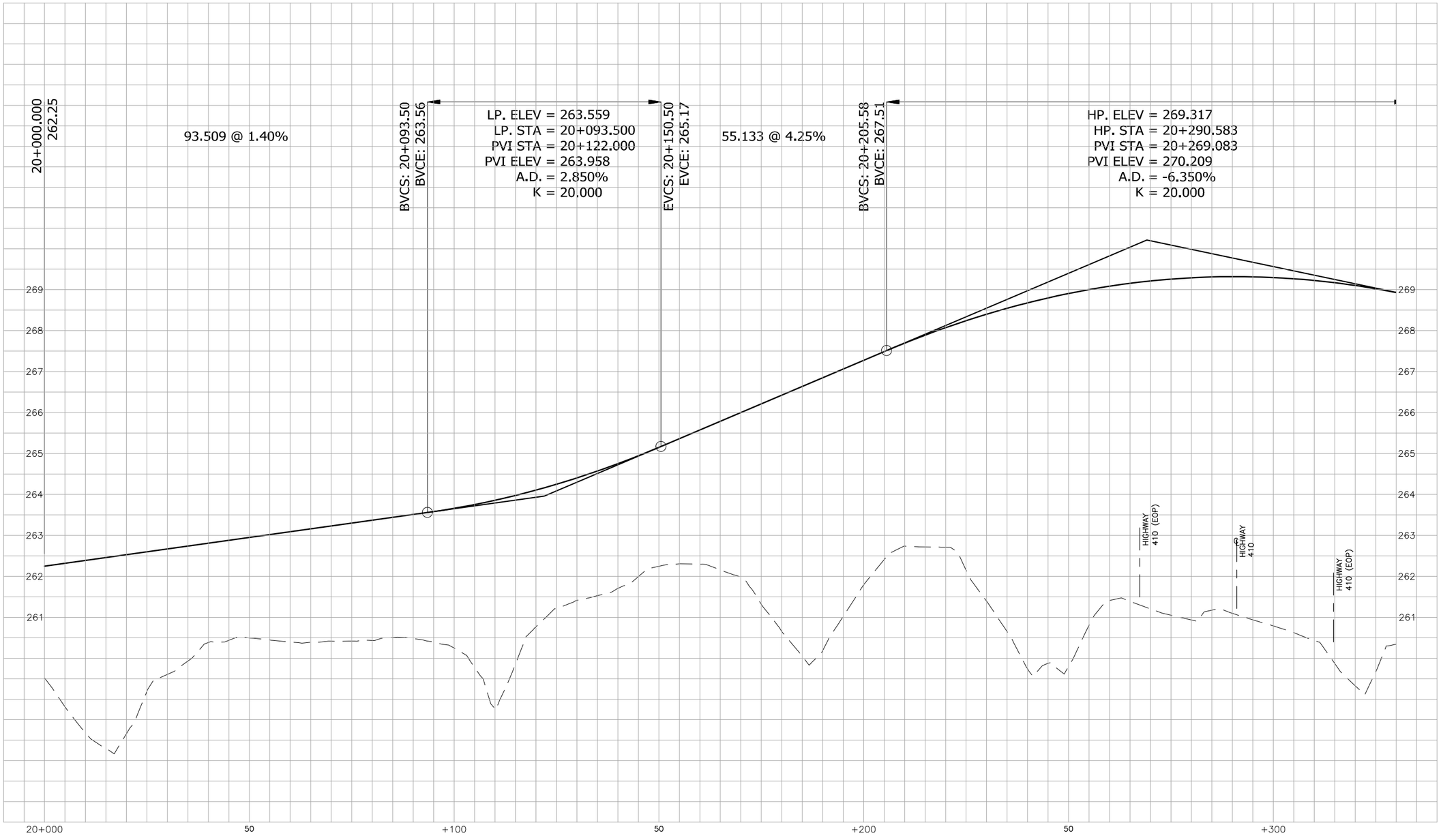
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
E/W-N RAMP

SHEET
PROF8



SCALES

5m 0 10m
Horizontal

0.5m 0 1m
Vertical

METRIC

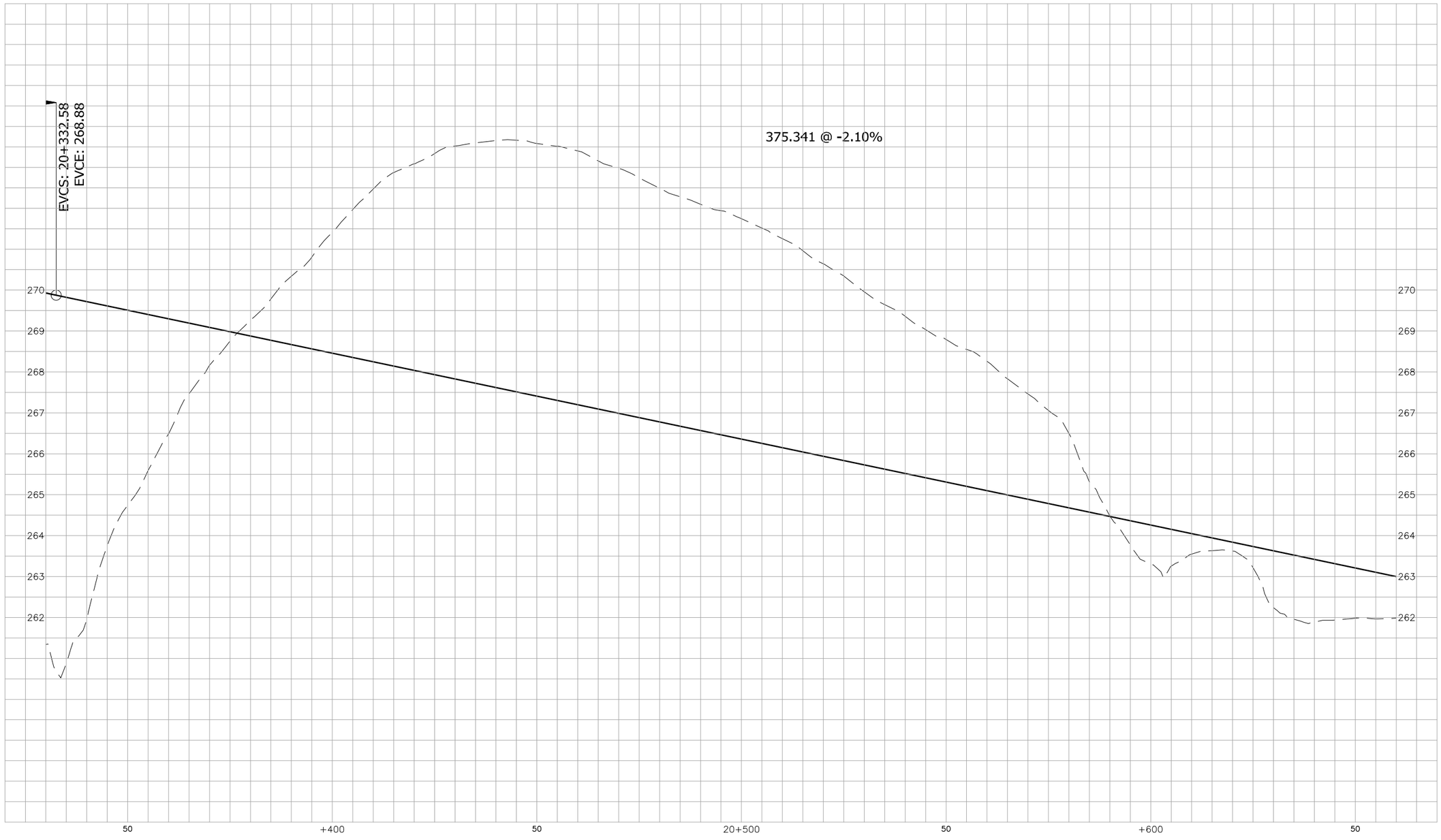
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
E/W-N RAMP

SHEET
PROF9



SCALES

5m 0 10m
Horizontal

0.5m 0 1m
Vertical

METRIC

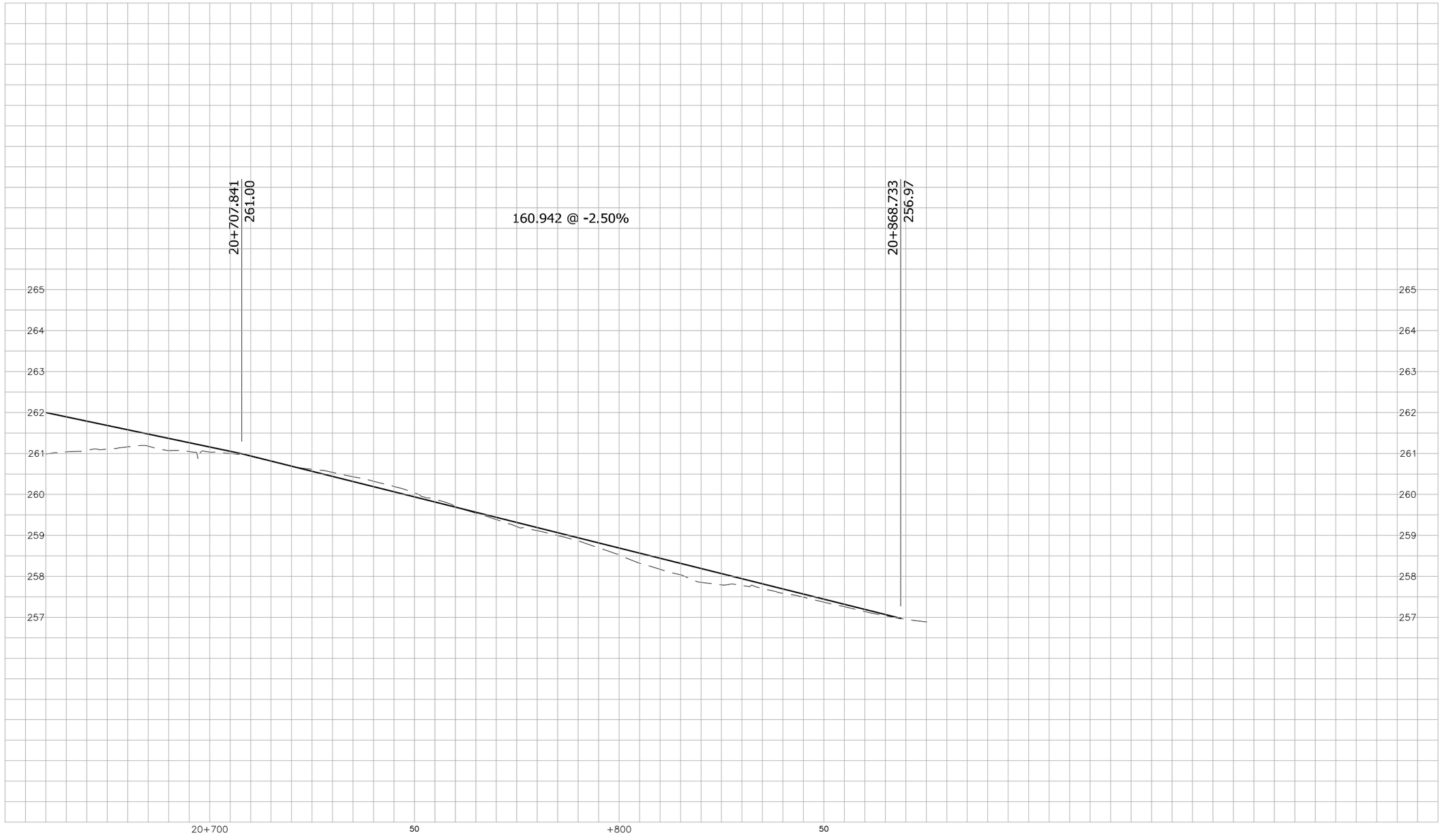
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
E/W-N RAMP

SHEET
PROF10



SCALES

5m 0 10m
Horizontal

0.5m 0 1m
Vertical

AMEC Foster Wheeler Environment & Infrastructure PR-#-## #-#

METRIC

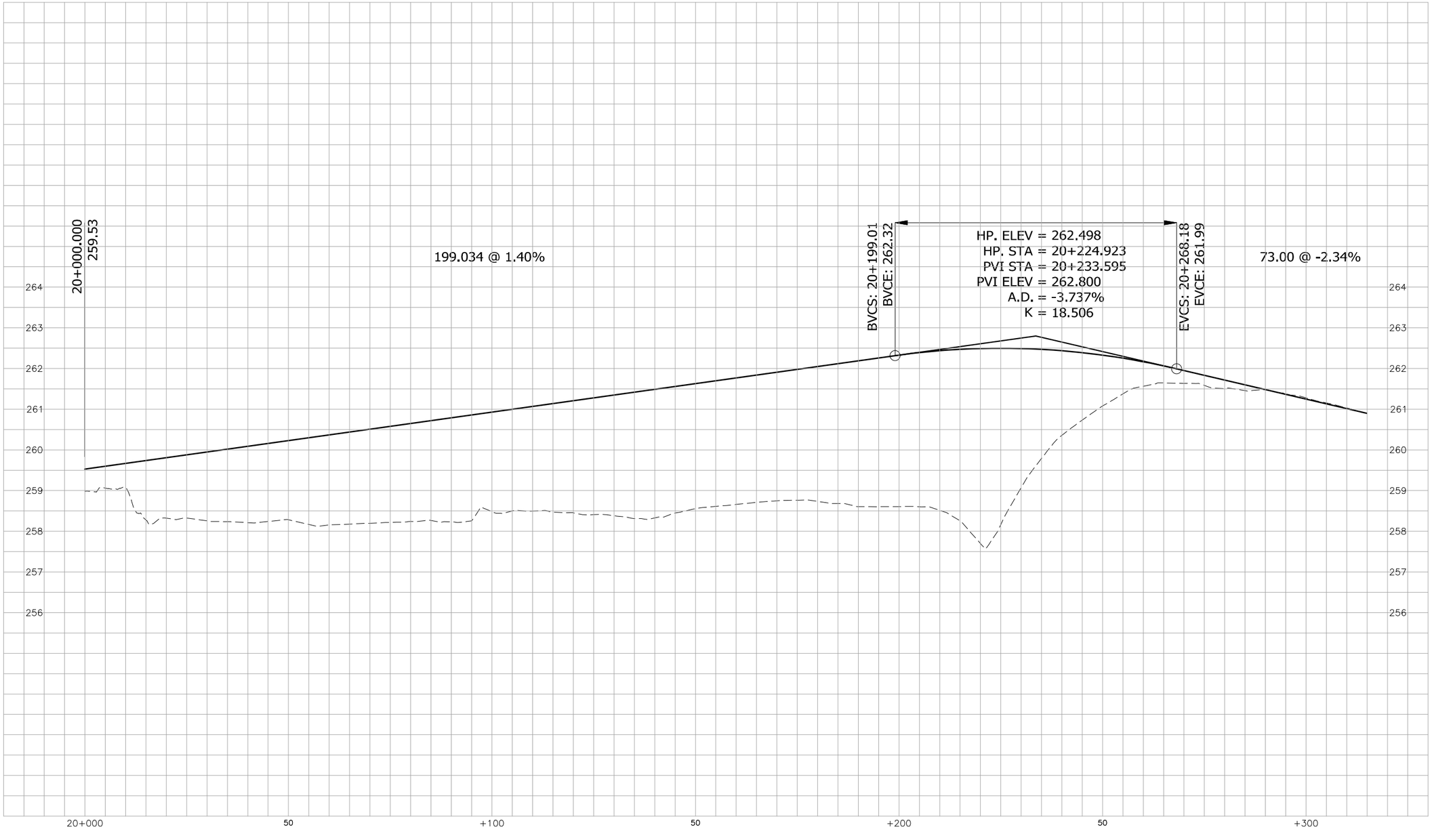
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
S-E RAMPS

SHEET
PROF11



SCALES

5m 0 10m
Horizontal

0.5m 0 1m
Vertical

METRIC

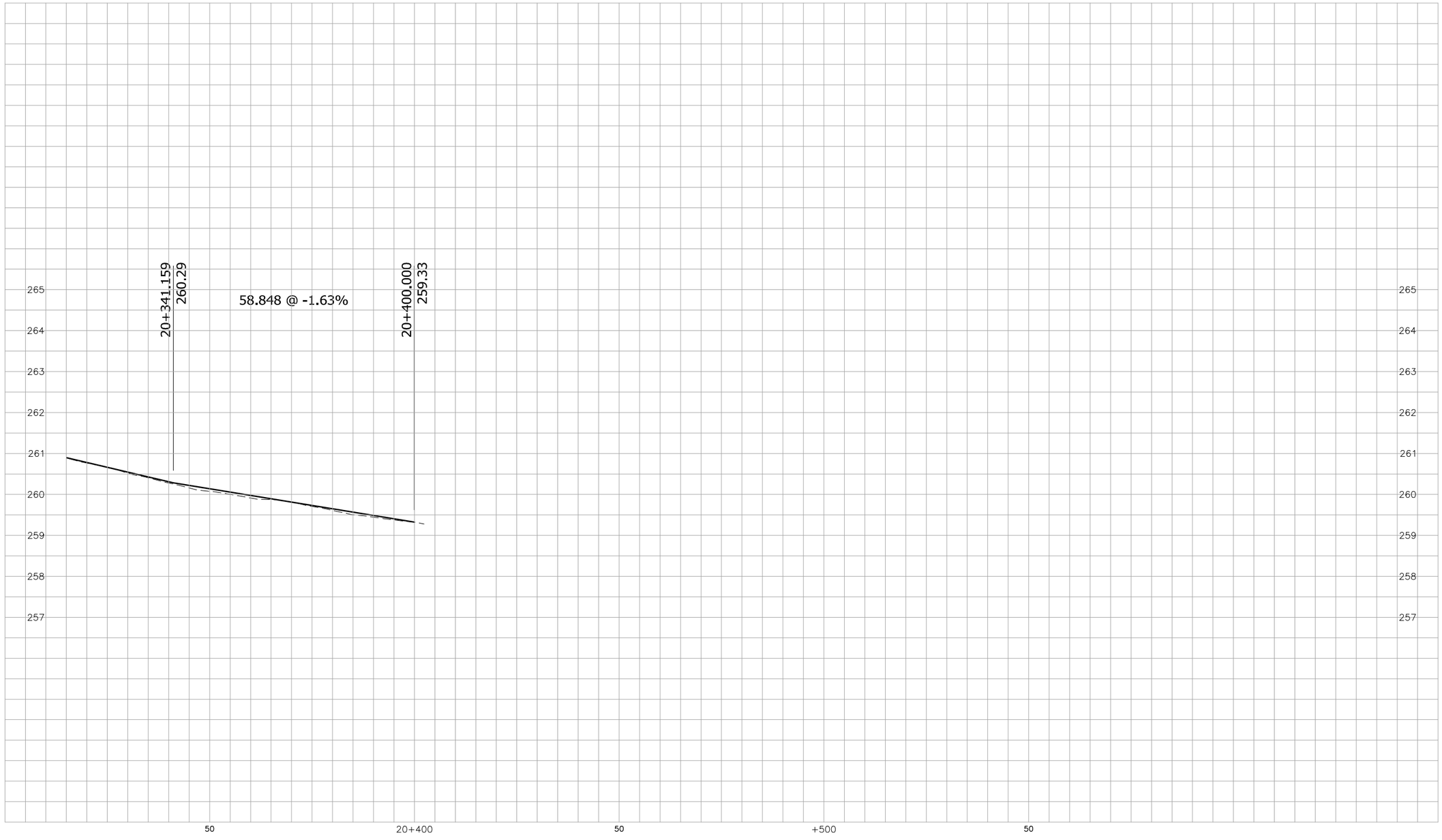
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

PROFILE
HIGHWAY 410 INTERCHANGE
S-E RAMP

SHEET
PROF12

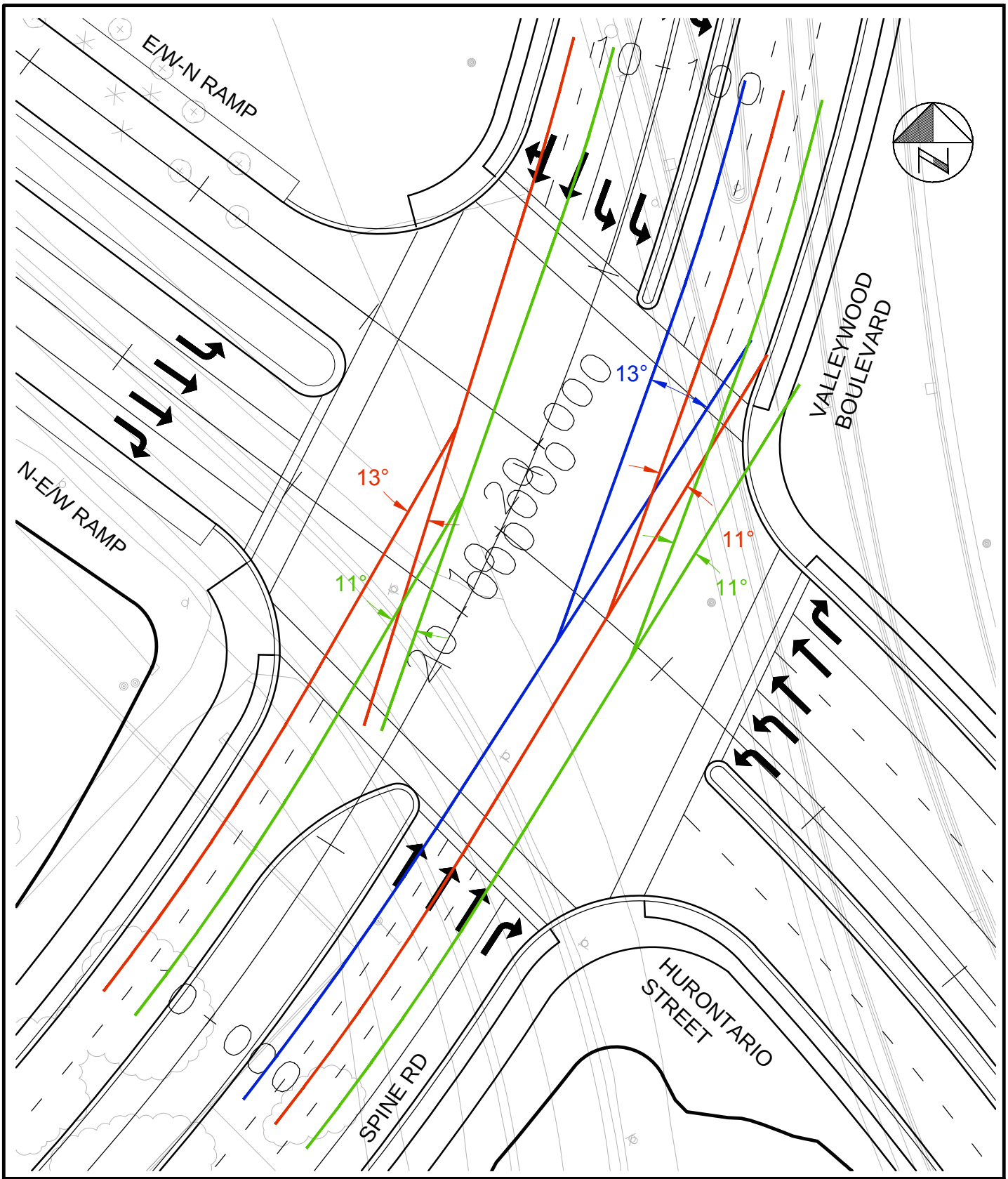


SCALES

5m 0 10m
Horizontal

0.5m 0 1m
Vertical

Appendix B:
Illustrations of Identified Safety Issues



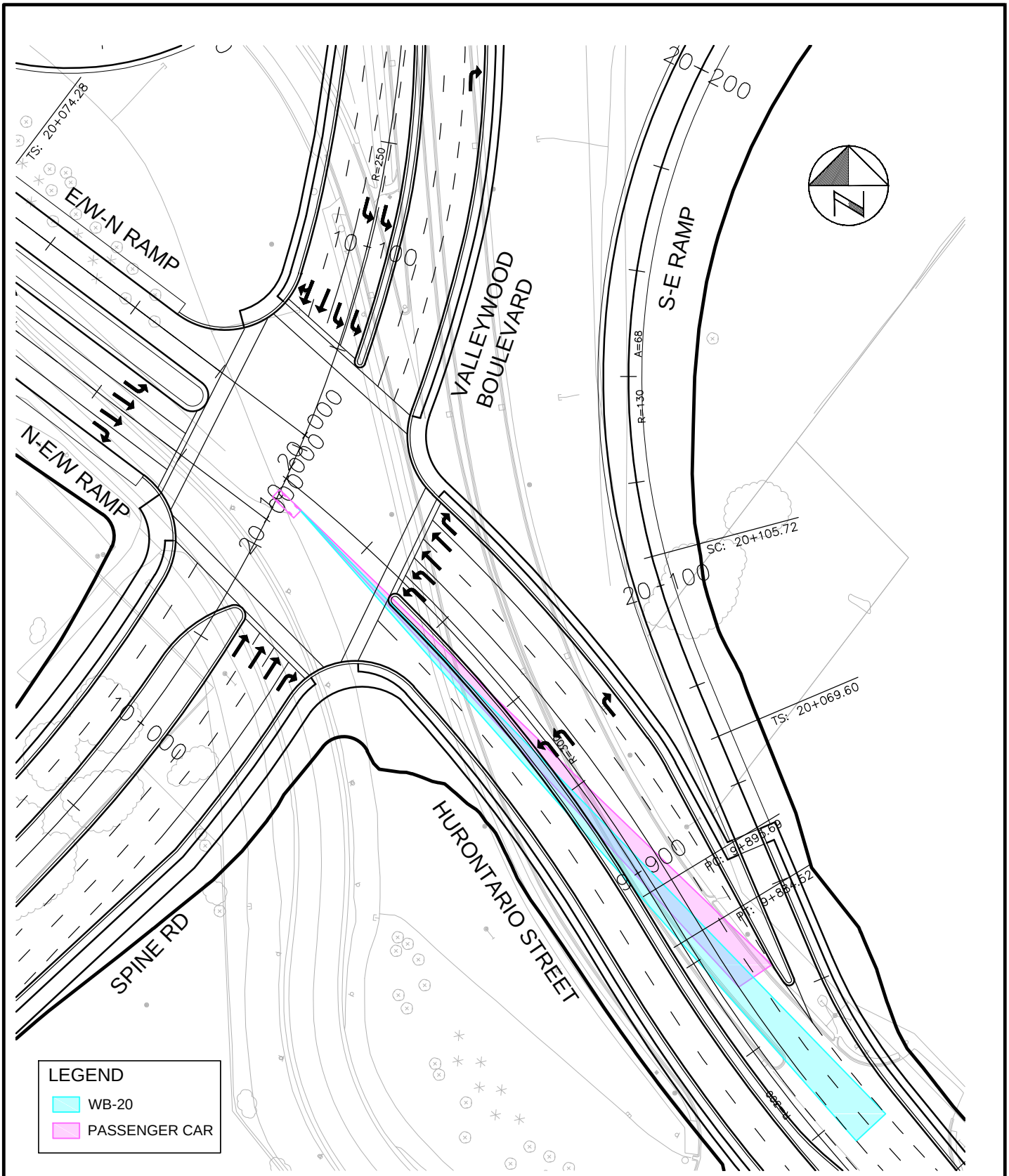
HWY 410 INTERCHANGE
CLASS ENIRONMENTAL ASSESSMENT

TOWN OF CALEDON

FIGURE B-1 EASTBOUND/WESTBOUND
NATURAL TRAVEL PATH OVERLAP

wood.

Project No.	TPB166090
Date	DEC 2018
Scale	1:500
Drawing No.	B-1



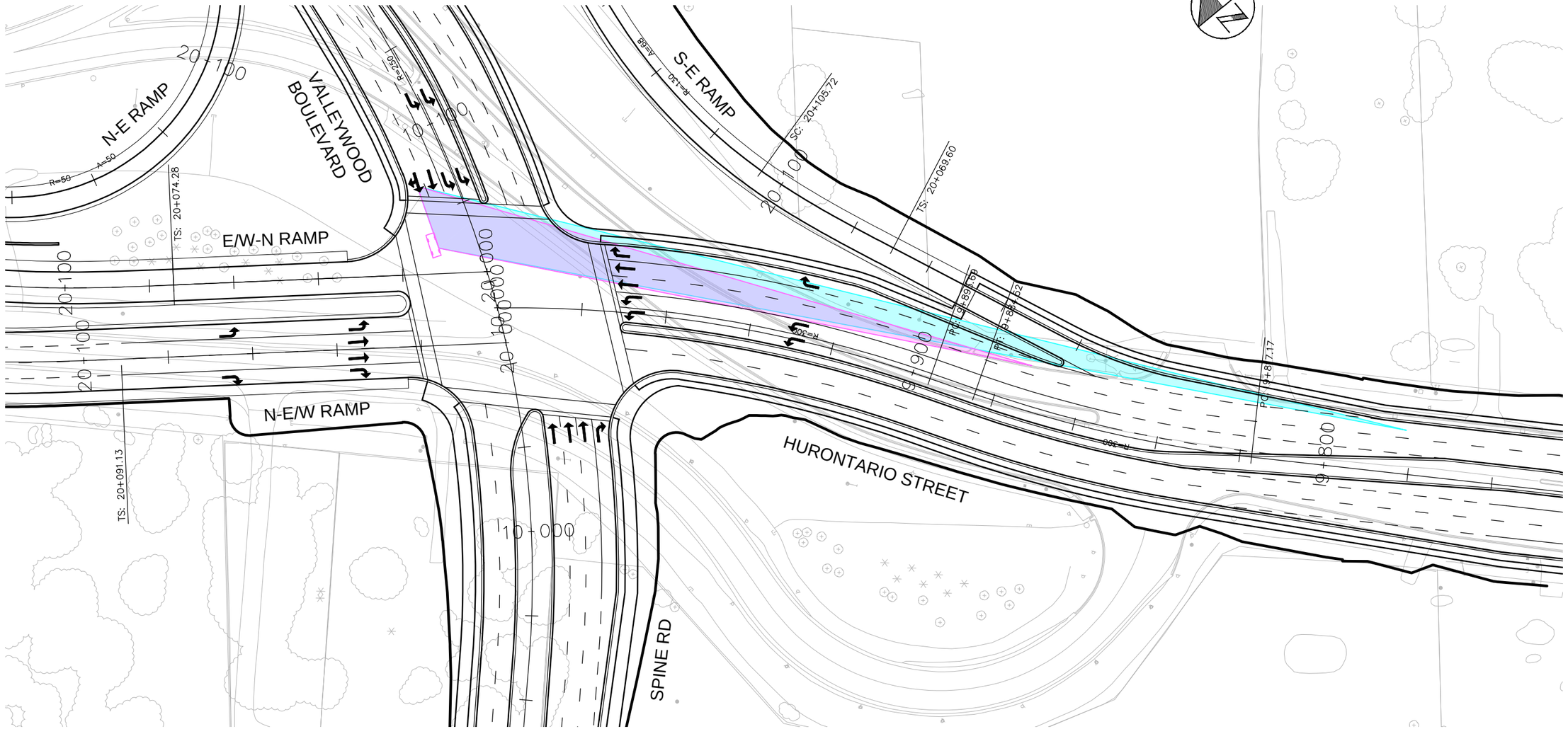
HWY 410 INTERCHANGE
CLASS ENIRONMENTAL ASSESSMENT

TOWN OF CALEDON

FIGURE B-2 SOUTHBOUND LEFT
INTERSECTION SIGHT DISTANCE

wood.

Project No.	TPB166090
Date	DEC 2018
Scale	1:1000
Drawing No.	B-2



LEGEND

- WB-20
- PASSENGER CAR

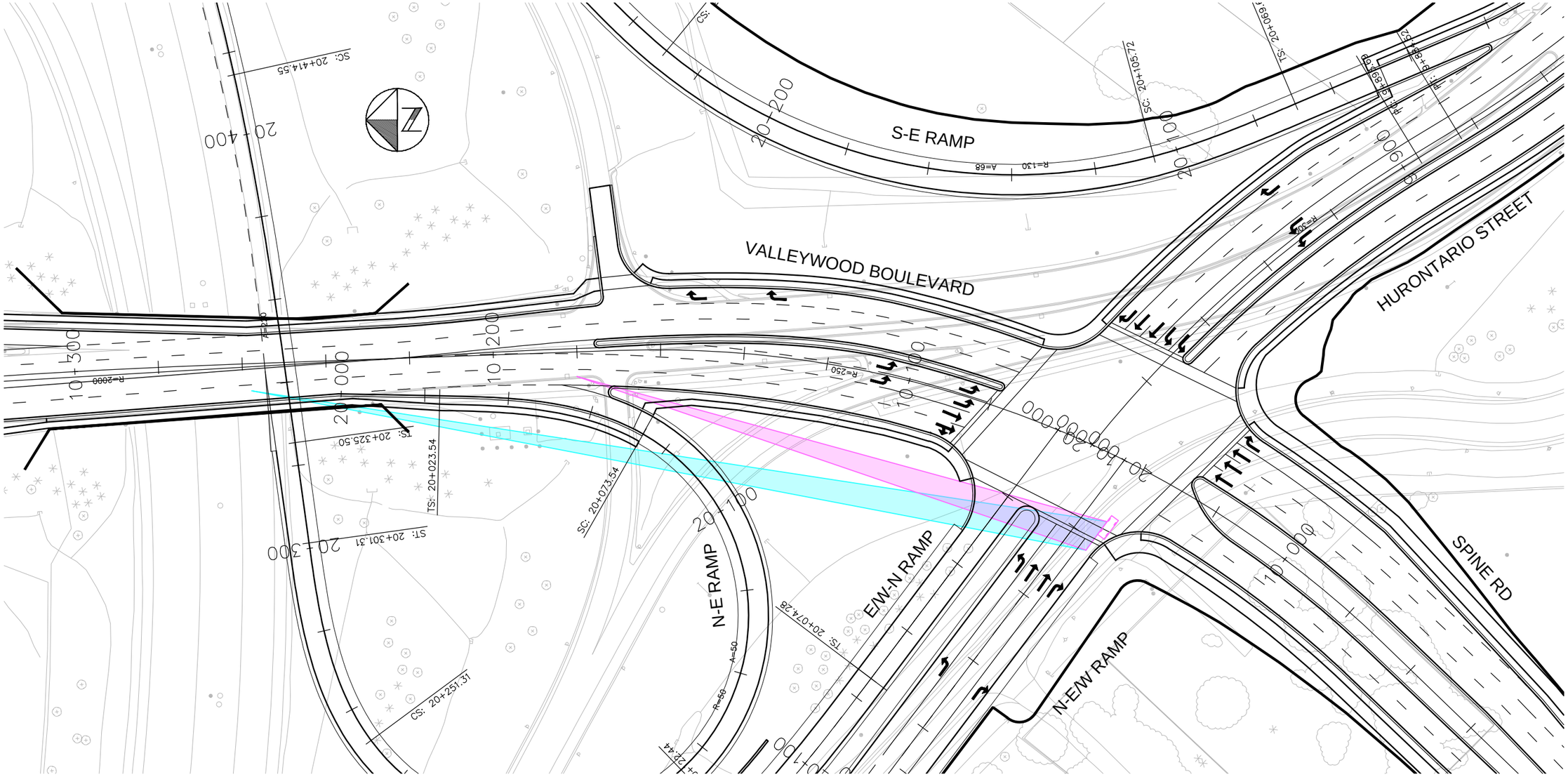
HWY 410 INTERCHANGE
CLASS ENIRONMENTAL ASSESSMENT

TOWN OF CALEDON

FIGURE B-3 WESTBOUND RIGHT DEPARTURE SIGHT DISTANCE

wood.

Project No.	TPB166090
Date	DEC 2018
Scale	1:1000
Drawing No.	B-3



LEGEND

- WB-20
- PASSENGER CAR

HWY 410 INTERCHANGE
CLASS ENIRONMENTAL ASSESSMENT

TOWN OF CALEDON

FIGURE B-3 WESTBOUND RIGHT DEPARTURE SIGHT DISTANCE

wood.

Project No.	TPB166090
Date	DEC 2018
Scale	1:1000
Drawing No.	B-3