112th Avenue SE Alternatives

Technical Memorandum

OCTOBER 2011

PREPARED FOR

Sound Transit

PREPARED BY

CH2MHILL

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Acronyms and Abbreviations

EIS	Environmental Impact Statement
FTA	Federal Transit Authority
I-405	Interstate 405
I-90	Interstate 90
LOS	level of service
mph	miles per hour
OCS	overhead catenary system
PCE	perchloroethylene
SCC	Federal Transit Authority Standard Cost Categories
TPSS	traction power substation

Executive Summary

On July 28, 2011, the Sound Transit Board of Directors selected the final East Link Light Rail project to be built. The project originates at the International District Station in Seattle, travels east across Lake Washington and Mercer Island on the Interstate 90 (I-90) freeway, travels through the city of Bellevue, and terminates in downtown Redmond. In South Bellevue, the project route travels on the east side of Bellevue Way SE and 112th Avenue SE toward downtown Bellevue, then crosses to the west side of 112th Avenue SE and includes an East Main Station. Sound Transit has prepared this technical memorandum to evaluate design options on 112th Avenue at the request of the City of Bellevue. Specifically, Section 4 of the Term Sheet signed August 9 and 10, 2011, between the City and Sound Transit stipulates the following:

"4) City Requested Modifications to the Project

Sound Transit agrees to evaluate for potential inclusion in the Project's scope the following City requested modifications, and to conduct further engineering, environmental and other federal reviews, and outreach as appropriate:

a. *Grade-separate the alignment along 112th Avenue so as to eliminate traffic conflicts and to reduce noise from gated crossings and/or bells.*

b. *Review further the optimal location to cross from the east to the west-side of 112th.*

c. *Move the SE 8th Station to the East Main Street Design Option location described in the final EIS. Noise walls planned by Sound Transit in this area should be designed so as to mitigate noise from trains entering and exiting the station.*

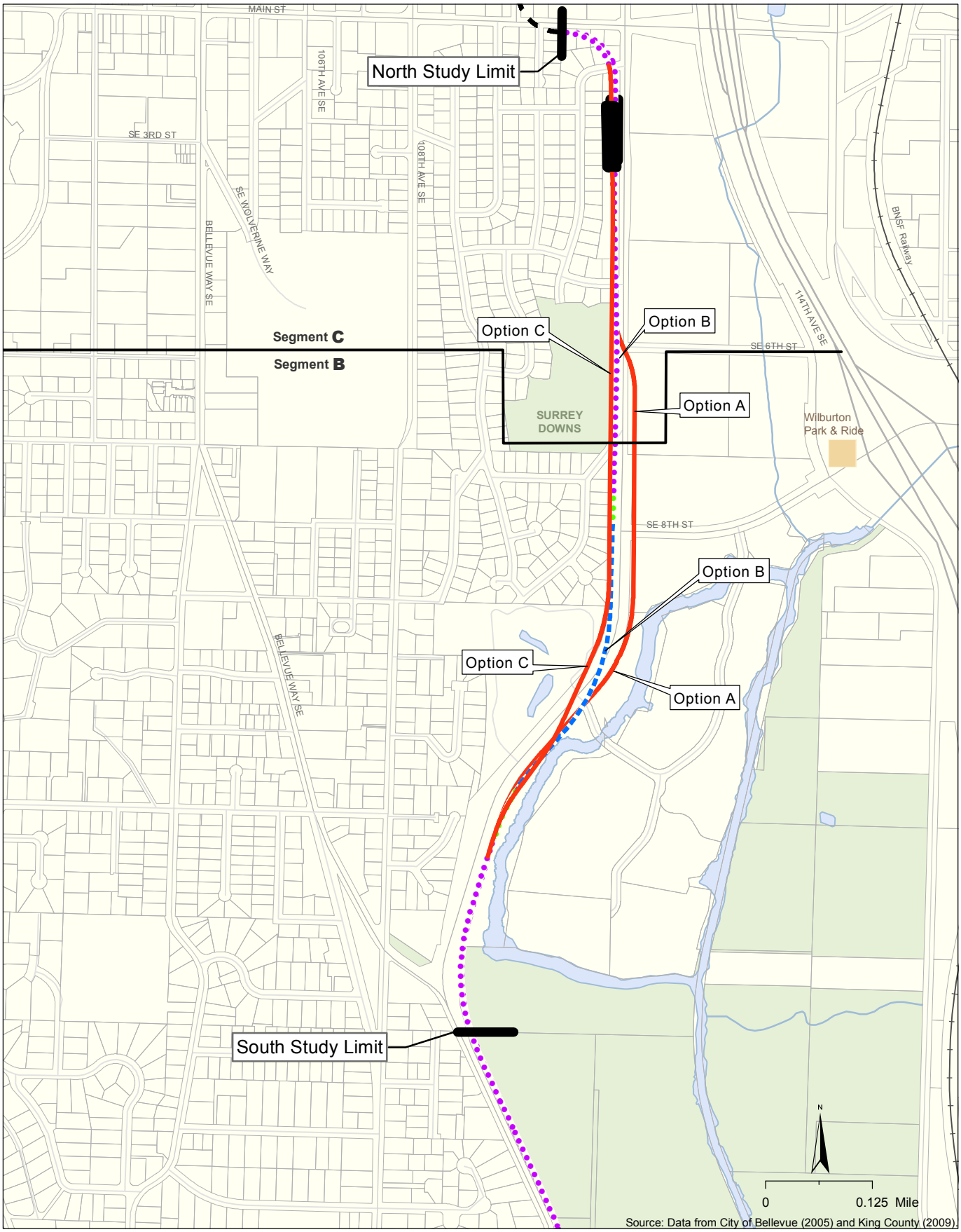
d. *Between Surrey Downs Park and Main Street provide additional landscaping between the light rail alignment and the sidewalk on 112th.*

e. *Change access to enhance Surrey Downs Park for neighborhood use."*

The purpose of this technical memorandum is to assist Sound Transit and the City of Bellevue in identifying a preferred option along 112th Avenue SE for further consideration. This study compares two design options to the design presented in the Final Environmental Impact Statement (EIS) for the B2M/C9T with East Main station selected by the Sound Transit Board. Option B was developed to provide full grade separation (no surface crossings with streets), which could eliminate all gates and bells associated with street crossings and all potential traffic conflicts. Subsequently, Option C was developed following early concerns expressed of the possible visual effects of the elevated flyover of 112th Avenue SE in Option B.

ES.1 Study Limits and Description of Options

The study limits for the three options are from, but not including, the Winters House north to the south portal of the Downtown Bellevue Tunnel at Main Street. Each option includes an East Main Station. Exhibit 1 presents a graphic representation of the three options and the study limits.



At-Grade Route
Elevated Route
Retained-Cut Route
Retained-Fill Route
Tunnel Route
Proposed Station

Option A: Final EIS Alternative B2M-C9T – At-Grade to West Side at SE 6th Street (Preliminary Engineering Alternative)
Option B: Flyover To Trench
Option C: At-Grade to At-Grade at SE 15th Street

Exhibit 1
B2M-C9T Options Study Limits
East Link Project

ES.2 Option A: Final EIS Alternative B2M-C9T with East Main Station: At-Grade to West Side at SE 6th Street

For all options the track is located within a lidded retained cut between the Winters House and Bellevue Way SE. For Option A, from the Winters House, the route proceeds north along the east edge of Bellevue Way SE and slowly rises to at-grade. The track continues on the east side of 112th Avenue SE with gated crossings at the east leg of SE 15th Street and SE 8th Street. Then the alignment crosses at-grade from the east side to the west side at the SE 6th Street intersection. It continues at-grade along the west side of 112th Avenue SE to Main Street, closing neighborhood access at SE 4th Street and SE 1st Place, but provides realigned access to SE 4th Street via SE 6th Street. Option A continues northward to the East Main Station located on the west side of 112th Avenue SE, south of Main Street. The alignment curves west to the south side of Main Street and connects to the C9T tunnel alignment at the south portal. Exhibit 2 provides a plan view of the Option A route within the study limits. Cross-sections identified on the plan view may be found in Appendix B along with route visual simulations, and additional features and characteristics of the Option A alignment are be found in Appendix A.

ES.3 Option B: Flyover to Trench

For Option B, from the retained cut trench at Winters House, the alignment slowly rises along the east side of the wye intersection of Bellevue Way and 112th Avenue SE, matches at-grade, and then transitions into an elevated structure south of the SE 15th Street intersection. The elevated guideway crosses from the east to the west side of 112th Avenue SE at SE 15th Street and remains elevated to the SE 8th Street intersection. The alignment then transitions to retained fill and then to a retained-cut trench along the west side of 112th Avenue SE in front of Surrey Downs Park. A lidded structure over the trench guideway at SE 4th Street provides continued neighborhood access. Option B removes the existing park access from 112th Avenue SE, but access road modifications can be made from SE 4th Street to connect to the park's parking lot. The alignment rises slightly to the retained-cut East Main Station located on the west side of 112th Avenue SE, south of Main Street. The route then curves west to the south side of Main Street and connects to the C9T tunnel alignment at the south portal. Exhibit 3 provides a plan view of the Option B route within the study limits. Appendix C provides cross-sections identified on the plan view along with route visual simulations, and Appendix A includes additional features and characteristics of the Option B alignment.

ES.4 Option C: At-Grade to At-Grade at SE 15th Street

For Option C, from the retained cut trench at the Winters House, the alignment slowly rises along the east side of the wye intersection of Bellevue Way and 112th Avenue SE, continuing along the east side of 112th Avenue SE. The alignment matches at-grade north of the wye intersection and crosses through a modified and gated SE 15th Street intersection. Then the alignment continues north along the west side of 112th Avenue SE and has a retained-cut wall on the west side of the guideway along the Surrey Downs neighborhood. Similar to Option A, although at slightly different track elevations, the at-grade guideway closes neighborhood access at SE 4th Street and SE 1st Place and realigns SE 4th Street to the SE 6th Street and 112th Avenue SE signalized intersection. In Option C, the rail crossing at the realigned SE 4th Street will be gated. Option C continues northward to the East Main Station located on the west side of 112th Avenue SE, south of Main Street. The route then curves west to the south side of Main Street and connects to the C9T tunnel alignment at the south portal. Exhibit 4 provides a plan view of the Option C route within the study limits. Cross-sections identified on the plan view may be found in Appendix D along with route visual simulations, andadditional features and characteristics of the Option C alignment are be found in Appendix A.

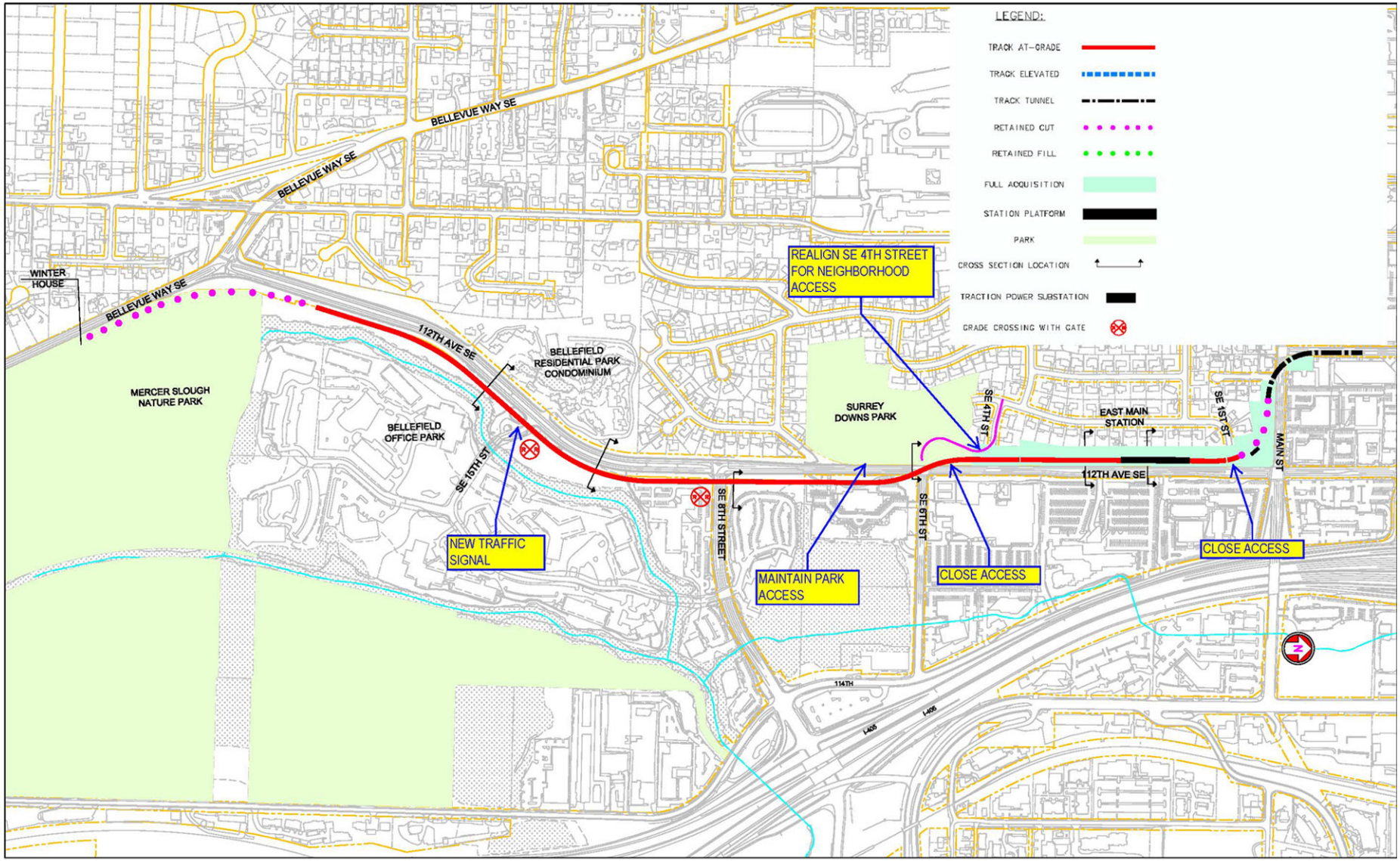


Exhibit 2
Option A: Final EIS Alternative B2M-C9T–At-Grade to West Side at SE 6th Street (Preliminary Engineering Alternative)

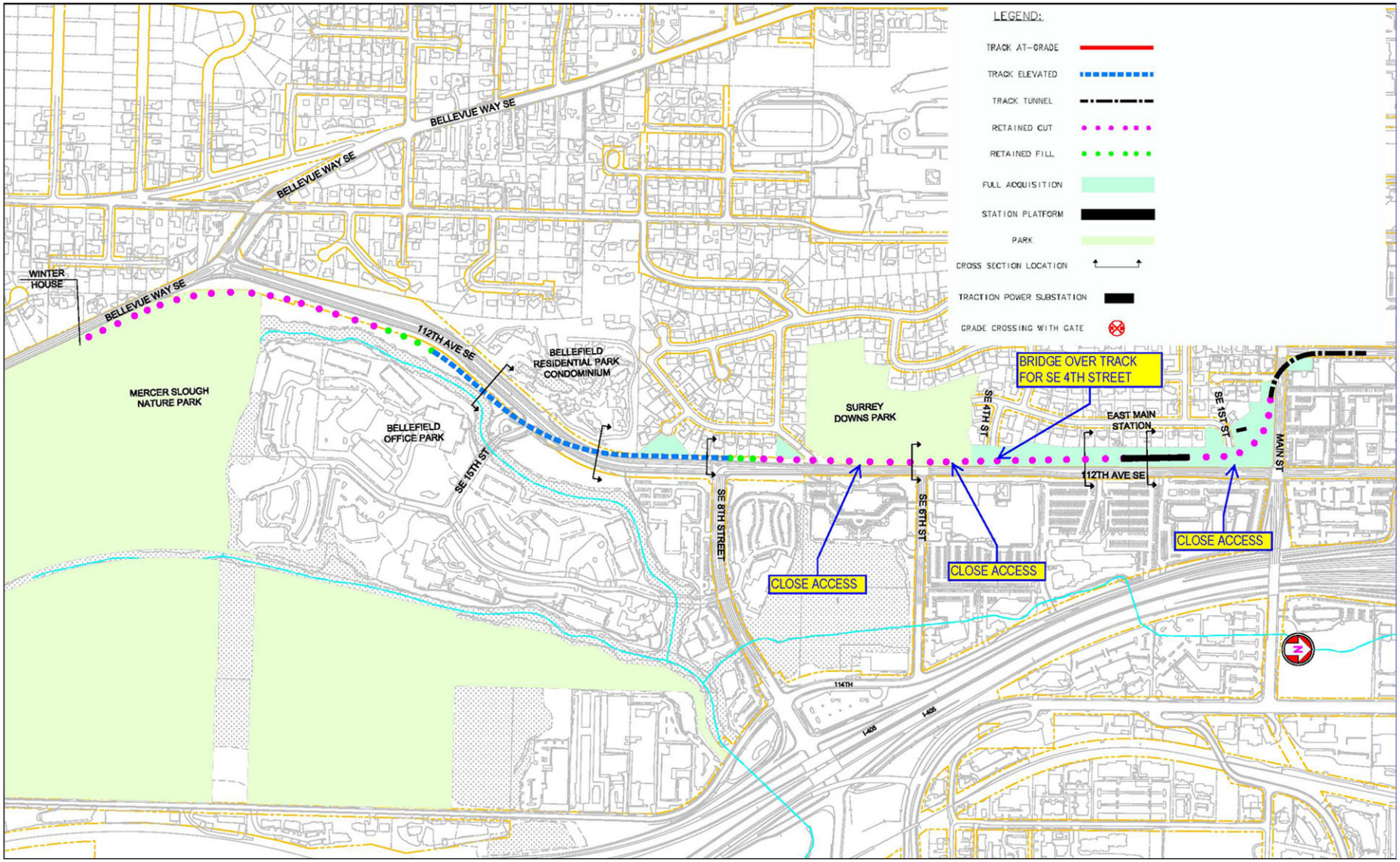


Exhibit 3
Option B: Flyover to Trench

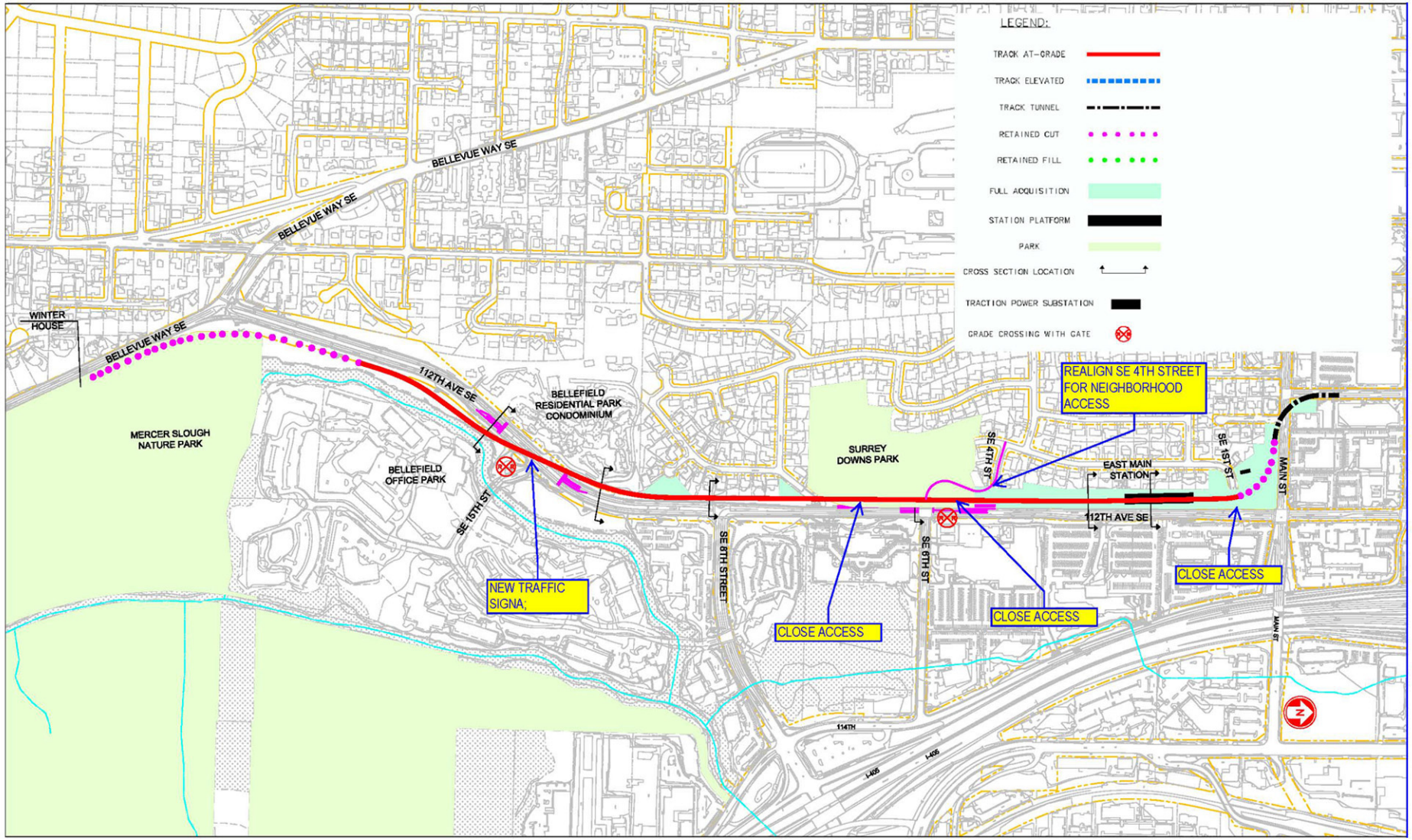


Exhibit 4
Option C: At-Grade to At-Grade at SE 15th Street

Key engineering design considerations used to develop alternative route options A, B, and C along 112th Avenue SE from the wye intersection at Bellevue Way to Main Street included soil conditions, roadway reconstruction, number of grade crossings and crossing locations, operating speed of light rail trains, and construction schedule. Brief descriptions of these considerations are provided in Appendix A.

Quantitative traffic, environmental, and cost comparisons among the three design options are summarized in Tables ES-1and ES-2. For the purpose of this technical memorandum, costs are reported as the difference between the preliminary engineering cost estimate for B2M/C9T with the SE 8th Station and Options B and C. The preliminary engineering cost estimate is similar, but not identical to Option A since it includes a station at SE 8th rather than at East Main location.

TABLE ES-1
Cost Impact Comparison Table (figures shown in millions of 2010$)

Baseline B2M-C9T (Preliminary Engineering Alternative)	Option B: Flyover to Trench	Option C: At-Grade to At-Grade at SE 15th Street
Baseline	$15 to $20 increase	$25 to $30 decrease
Note: The baseline is the preliminary engineering cost estimate, which is similar, but not identical to, Option A since it includes a station at SE 8th Street rather than at East Main location. Therefore, the cost increase would be higher when compared to Option A, and the cost decrease would be lower when compared to Option A.		

ES.5 Conclusions

Out of the three options, Option B would have the fastest travel time since it is fully grade separated and, therefore, would attract the greatest ridership and have the smoothest light rail operation. Although none of the options would result in failing intersections during operation, Option A would result in more traffic congestion during construction than the other two options. Option A would also result in the greatest number of at-grade crossings along 112th Avenue and the greatest number of modifications to 112th Avenue side streets.

Option A would have the least number of full and partial acquisitions and displacements, while Options B and C would result in the same total amount of full and partial acquisitions and displacements. Project elements, such as the elevated profile, the straddlebents and the walls supporting the retained-cut portion of Option B would affect the visual experience along 112th Avenue for travelers and adjacent residents. Options B and C would both result in greater numbers of noise and vibration impacts since they are closer to homes along 112th Avenue SE than Option A, with Option C having the most. All noise impacts for all options could be mitigated; however, under Option C, one to three vibration impacts could still remain after mitigation. The cost estimates in this memo include allowances for the noise and vibration mitigation. Option C would also result in the greatest amount of permanent park impact at Surrey Downs Park. Options B and C offer reduced construction risk related to poor soil conditions compared to Option A since B and C alternatives shift from the east side to the west side near SE 15th Street. However, the retained cut portion in Option B will introduce new risk. Relative to the route studied in the preliminary engineering work on B2M/C9T (which is similar to Option A but with the station at SE 8th rather than at Main Street), Option B is higher cost, and Option C results in cost savings.

ES.6 Next Steps

The City of Bellevue and Sound Transit are scheduled to execute a binding Memorandum of Understanding (MOU) by October 27, 2011. The City and Sound Transit are expected to identify a preferred option for the 112th design in that MOU. If the preferred option is other than Option A (which is included in the Final EIS) additional environmental review might be needed and, if so, will be performed prior to the Sound Transit Board of Directors decision on the option.

TABLE ES-2
112th Avenue SE Environmental and Traffic Comparison Table

Resource	Option A: FEIS Alternative B2M-C9T with East Main Station	Option B: Flyover to Trench	Option C: At-Grade to At-Grade at SE 15th Street
Projectwide Ridership[a]	51,000	51,500	51,000
Segment B and C daily boardings[b]	12,500	13,000	12,500
Segment B and C travel time[b]	11 minutes	10 minutes	11 minutes
Traffic impacts to 112th Avenue SE during construction	Temporary traffic detours, lane closures, and increased congestion would occur on 112th Avenue SE and SE 15th and SE 8th Streets. SE 6th Street would require temporary lane closures due to at-grade light rail train construction.	Temporary traffic detours, lane closures, and increased congestion would occur on 112th Avenue SE and SE 15th Street, but less than Option A due to available construction staging on west side of 112th Avenue SE and not impacting SE 6th or 8th Streets. SE 4th Street would be temporarily closed.	Temporary traffic detours, lane closures, and increased congestion would occur on 112th Avenue SE and SE 15th Street, but less than Option A due to available construction staging on west side of 112th Avenue SE and not impacting SE 8th or east leg of SE 6th Streets. The west leg of SE 6th Street (realigned SE 4th Street) would be temporarily closed.
At-grade crossings along 112th Avenue SE	2 to 3 crossings (SE 8th, SE 15th Streets if open, and SE 6th Street)	0 crossings	2 crossings (SE 15th Street and SE 6th Street)
112th Avenue SE traffic operations: number of failing intersections	0	0	0
Modifications to 112th Avenue SE side streets or driveways (closed and/or converted to right-in/right-out)	2 to 3 (option to close SE 15th Street, SE 1st Street, and Lincoln Plaza maintenance driveway)	2 (SE 1st Street and Surrey Downs Park access)	2 (SE 1st Street and Surrey Downs Park access)
Acquisitions	Full: 11; partial: 11	Full: 16; partial: 12	Full: 16; partial: 13
Displacements	Residential: 46; business: 5	Residential: 51; business: 5	Residential: 51; business: 5
Visual	Project elements would not alter visual experience	Elevated profile and straddlebent over 112th Avenue; Elements influencing the visual experience include high retaining wall for retained cut adjacent to Surrey Downs Park	Similar as Option A, although noise wall at Bellefield Residential Park may be higher.
Noise impacts (before mitigation)	Moderate: 40; severe: 2	Moderate: 41; severe: 8	Moderate: 57; severe: 7
Noise impacts (after mitigation)	All impacts could be mitigated with sound walls, insulation, and special trackwork	All impacts could be mitigated with sound walls, insulation and special trackwork	All impacts could be mitigated with sound walls, insulation and special trackwork. Sound insulation might be considered instead of sound walls at Bellefield Residential Park
Vibration	Vibration: 1; after mitigation: 0; groundborne noise: 0	Vibration: 8; after mitigation: 0; groundborne noise: 0	Vibration: 11; after mitigation: 1 to 3; groundborne noise: 0
Parkland (acres of permanent impact to Surrey Downs Park)	0.5; loss of access from park's north end and access from 112th Avenue SE on south end of park would remain	0.6; loss of access from south end and new north access from SE 4th Street	1.4; loss of access from south end, and new north access from realignment of SE 6th Street entrance

[a] Projectwide ridership is reported for the East Link corridor (Segments A through E).
[b] Travel time and daily boardings are reported for the full length of Segments B and C.

Section 1

Traffic and Environmental Impact Comparisons

The following assessment in this section only concerns the identified study limits in this report unless noted otherwise. Table 1 summarizes the quantitative comparison among the three design options and a more qualitative discussion about each resource and potential mitigation measures follows. Environmental and cost impacts are presented in two parts, Segment B and Segment C, for each option. By separating Segments B and C, alternative alignments may be considered by mixing and matching one segment for the other between Options B and C. The dividing line between Segments B and C is approximately at the south end of Surry Downs Park as illustrated in Exhibit 1.

1.1 Transportation

For all options, travel time and daily boardings are reported for the entire length of Segments B and C. Projectwide ridership is reported for the overall East Link corridor (Segments A through E).

For Option A, the travel time would be approximately 11 minutes, with 5 minutes in Segment B and 6 minutes in Segment C. Approximately 4,500 daily boardings are forecasted in Segment B and 8,000 daily boardings are forecasted in Segment C in year 2030. The projectwide ridership with this option would be 51,000. Year 2030 intersection level of service (LOS) along 112th Avenue SE would continue to meet LOS standards as in the No-Build condition. Gated crossings would be installed at SE 15th and SE 8th in Segment B. SE 1st Street in Segment C and a Lincoln Plaza maintenance driveway in Segment B would be closed and an option to close SE 15th Street access to Bellefield Office Park exists. Some of the pedestrian crossings at SE 8th and SE 6th Streets would be longer than today with the light rail train crossing at SE 8th Street and the crossing of 112th Avenue SE at SE 6th Street. Temporary impacts during construction would result in temporary traffic detours, lane closures, and increased congestion along 112th Avenue SE. SE 15th, SE 8th, and SE 6th Streets in Segment B would be temporarily closed (partial and/or full) due to at-grade light rail train construction.

For Option B, travel times would be slightly shorter compared with Option A and take approximately 10 minutes, with 4 minutes in Segment B and 6 minutes in Segment C. Daily boardings would be approximately 4,500 in Segment B and 8,500 in Segment C, for a total increase of 500 compared to Option A, due to the faster travel time. The projectwide ridership would also increase by 500 to 51,500. While intersection LOS would continue to meet LOS standards similar to Option A; vehicle delays along 112th Avenue SE would improve with no at-grade crossings. The at-grade crossings at SE 15th, SE 8th, and SE 6th Streets in Segment B would no longer occur under this option. The northbound right-turn pocket included in Option A at 112th Avenue SE and SE 8th Street for safety and vehicle queue storage would not be required as the option is fully elevated. SE 15th Street would not be closed, but SE 1st Street and the south entrance to Surrey Downs Park in Segment C would be closed. Access to Surrey Downs Park would be from SE 4th Street. The pedestrian crossings at SE 8th and SE 6th Streets would be similar to today but access to Surrey Downs Park from 112th Avenue SE would be only via SE 4th Street. During construction, traffic impacts would be less than with Option A due to available construction staging area on the west side of 112th Avenue SE and not impacting SE 8th and SE 6th Streets. The east leg of SE 15th Street in Segment B would be temporarily closed due to construction of the elevated profile in this area, and SE 4th Street in Segment C would be temporarily closed (partial and/or full) with construction of the retained cut profile in this area.

TABLE 1
Summary of Transportation and Environmental Impacts for 112th Avenue SE Options

Resource	Option A: FEIS Alternative B2M-C9T with East Main Station			Option B: Flyover to Trench			Option C: At-Grade to At-Grade at SE 15th Street		
	Segment B Study Area	**Segment C Study Area**	**Total**	**Segment B Study Area**	**Segment C Study Area**	**Total**	**Segment B Study Area**	**Segment C Study Area**	**Total**
Projectwide Ridership [a]	51,000			51,500			51,000		
Segment B and C daily boardings [b]	4,500	8,000	12,500	4,500	8,500	13,000	4,500	8,000	12,500
Segment B and C travel time [b]	5 minutes	6 minutes	11 minutes	6 minutes	4 minutes	10 minutes	5 minutes	6 minutes	11 minutes
Traffic impacts to 112th Avenue SE during construction	Temporary traffic detours, lane closures, and increased congestion would occur on 112th Avenue SE and SE 15th and SE 8th Streets.	SE 6th Street would require temporary lane closures due to at-grade light rail train construction.	Temporary traffic detours, lane closures, and increased congestion would occur.	Temporary traffic detours, lane closures, and increased congestion would occur but less than Option A due to available construction staging on west side of 112th Avenue SE and not impacting SE 6th or 8th Streets.	SE 4th Street would be temporarily closed.	Temporary traffic detours, lane closures, and increased congestion would occur.	Temporary traffic detours, lane closures, and increased congestion would occur on 112th Avenue SE and SE 15th Street, but less than Option A due to available construction staging on west side of 112th Avenue SE and not impacting SE 8th or east leg of SE 6th Streets.	The west leg of SE 6th Street (realigned SE 4th Street) would be temporarily closed.	Temporary traffic detours, lane closures, and increased congestion would occur.
At-grade crossings along 112th Avenue SE	1 to 2 crossings	1 crossing	2 to 3 crossings	0 crossings	0 crossings	0 crossings	1 crossing	1 crossing	2 crossings
Failing intersections	0	0	0	0	0	0	0	0	0
Modifications to 112th Avenue SE side streets or driveways	0 to 1 (option to close SE 15th Street)	2 (SE 1st Street and Lincoln Plaza maintenance driveway)	2 to 3 (option to close SE 15th and SE 1st Street and Lincoln Plaza maintenance driveway)	0	2 (SE 1st Street and Surrey Downs Park access)	2 (SE 1st Street and Surrey Downs Park access)	0	2 (SE 1st Street and Surrey Downs Park access)	2 (SE 1st Street and Surrey Downs Park access)

TABLE 1
Summary of Transportation and Environmental Impacts for 112th Avenue SE Options

Resource	Option A: FEIS Alternative B2M-C9T with East Main Station			Option B: Flyover to Trench			Option C: At-Grade to At-Grade at SE 15th Street		
	Segment B Study Area	Segment C Study Area	Total	Segment B Study Area	Segment C Study Area	Total	Segment B Study Area	Segment C Study Area	Total
Acquisitions	Full: 0; partial: 8	Full: 11; partial: 3	Full: 11; partial: 11	Full: 3; partial: 11	Full: 13; partial: 1	Full: 16; partial: 12	Full: 3; partial: 11	Full: 13; partial: 2	Full: 16; partial: 13
Displacements	Residential: 0; business: 0	Residential: 46; business: 5	Residential: 46; business: 5	Residential: 3; business: 0	Residential: 48; business: 5	Residential: 51; business: 5	Residential: 3 ; business: 0	Residential: 48; business: 5	Residential: 51; business: 5
Visual	Project elements would not alter visual experience.	Project elements would not alter visual experience.	Project elements would not alter visual experience.	Elevated profile and straddlebent over 112th Avenue SE would occur.	Elements influencing the visual experience include high retaining wall for retained cut adjacent to Surrey Downs Park.	Elevated profile and straddlebent over 112th Avenue SE would occur; elements influencing visual experience include high retaining wall for retained cut adjacent to Surrey Downs Park.	Impacts similar as Option A, although noise wall at Bellefield Residential Park might be higher.	Impacts would be same as Option A.	Impacts would be similar to Option A, although noise wall at Bellefield Residential Park might be higher.
Noise impacts before mitigation (after mitigation)	Moderate: 23 (0); severe: 2 (0)	Moderate: 17 (0); severe: 0 (0)	Moderate: 40 (0); severe: 2 (0)	Moderate: 30 (0); severe: 8 (0)	Moderate: 11 (0); severe: 0 (0)	Moderate: 41 (0); severe: 8 (0)	Moderate: 42 (0); severe: 7 (0)	Moderate: 15 (0); severe: 0 (0)	Moderate: 57 (0); severe: 7 (0)
Vibration and groundborne noise impacts (after mitigation)	Vibration: 0 (0); groundborne noise: 0	Vibration: 1 (0); groundborne noise: 0	Vibration: 1 (0); groundborne noise: 0	Vibration: 7 (0); groundborne noise: 0	Vibration: 1 (0); groundborne noise: 0	Vibration: 8 (0); groundborne noise: 0	Vibration: 9 (1 to 3); groundborne noise: 0	Vibration: 2 (0); groundborne noise: 0	Vibration: 11 (1 to 3); groundborne noise: 0
Surrey Downs Park Impacts in acres	None	0.5	0.5	None	0.6	0.6	None	1.4	1.4

[a] Projectwide ridership is reported for the East Link corridor (Segments A through E).
[b] Travel time and daily boardings are reported for the full length of Segments B and C.

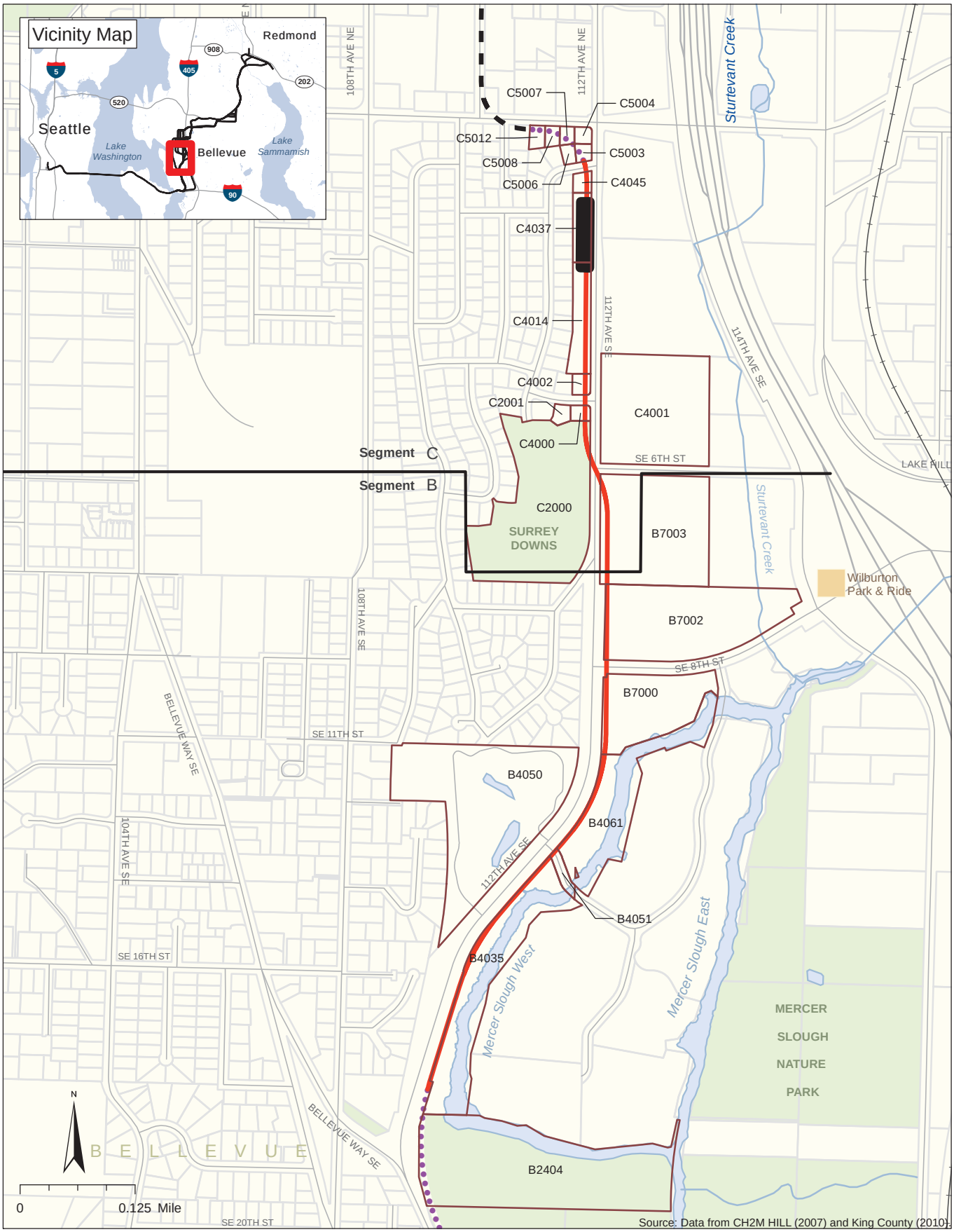
For Option C, travel time, daily boardings, and projectwide ridership would be similar to Option A. Two signalized, gated, at-grade crossings would be installed: one at SE 15th Street in Segment B and the other on the west leg the new realigned SE 4th/SE 6th Street in Segment C. The at-grade crossings on the east leg of SE 8th Street and across 112th Avenue SE at SE 6th Streets with Option A would no longer occur under this variation. Intersection LOS would continue to meet LOS standards similar to Option A. Similar to Option B, the northbound right-turn pocket included in Option A at 112th Avenue SE and SE 8th Street for safety and vehicle queue storage would not be required. SE 15th Street would not be closed, but SE 1st Street and the south entrance to Surrey Downs Park would be closed. Access to Surrey Downs Park would be via SE 6th Street (the realigned SE 4th Street). The pedestrian crossings at SE 8th Street would be similar to today, but pedestrians crossing at SE 6th Street would be longer than today with west side light rail train crossing; access to Surrey Downs Park from 112th Avenue SE would be only via SE 6th Street. During construction, traffic impacts would be less than with Option A due to available construction staging area on the west side of 112th Avenue SE and not impacting SE 8th Street and the east leg of SE 6th Street. SE 15th Street in Segment B and the west leg of SE 6th Street (the realigned SE 4th Street) in Segment C would be temporarily closed (partial and/or full) with the at-grade profile construction in these areas. Access to Bellefield Residential Park would be maintained on 112th Avenue SE.

1.2 Property Acquisitions

Option A: FEIS Alternative B2M-C9T with East Main Station would affect 22 properties (see Exhibit 5), with 8 partial acquisitions and no full acquisitions in the Segment B study area, and 3 partial acquisitions and 11 full acquisitions in the Segment C study area. There would be no displacements in the Segment B study areas and 46 residential displacements and 5 business displacements in the Segment C study area.

Option B: Flyover to Trench would affect 28 parcels (see Exhibit 6), with 11 partial acquisitions and 3 full acquisitions in the Segment B study area, and 1 partial acquisition and 13 full acquisitions in the Segment C study area. There would be 3 residential displacements and no business displacements in the Segment B study areas and 48 residential displacements and 5 business displacements in the Segment C study area. This is 7 more affected parcels than Option A, including 5 additional full acquisitions and 1 additional partial acquisitions. This option would have 5 additional residential displacements and no additional business displacements. Most of the additional acquisitions, including three displacements, would be single-family residences between Surrey Downs Park and the Bellefield Residential Park in Segment B. Additional displacements would also occur on the inside of the curve from 112th Avenue SE to Main Street in Segment C, where the alignment shifts slightly to the west when compared with B2M-C9T because additional sight-distance is needed on this curve. Some properties on the east side of 112th Avenue SE that would be partial acquisitions under Option A would not be affected by Option B.

Option C: At-Grade to At-Grade at SE 15th Street would affect 29 parcels (see Exhibit 7), with 11 partial acquisitions and 3 full acquisitions in the Segment B study area, and 2 partial acquisitions and 13 full acquisitions in the Segment C study area. There would be 3 residential displacements and no business displacements in the Segment B study areas and 48 residential displacements and 5 business displacements in the Segment C study area. This is 7 more affected parcels than Option A, including 5 additional full acquisitions and 2 additional partial acquisitions. This option would have 5 additional residential displacements and no additional business displacements. Most of the additional acquisitions, including three displacements, would be single-family residences between Surrey Downs Park and the Bellefield Residential Park in Segment B. Additional displacements would also occur on the inside of the curve from 112th Avenue SE to Main Street in Segment C, where the alignment shifts slightly to the west when compared with B2M-C9T because additional sight-distance is needed on this curve. Option C would also require partial acquisition of a property north of Surrey Downs Park that the Option B would not require. Some of the properties on the east side of 112th Avenue SE that would be partial acquisitions under Option A would not be affected by Option C.



B1119 Map ID & Affected Parcel Boundary

Proposed Station

At-Grade Route

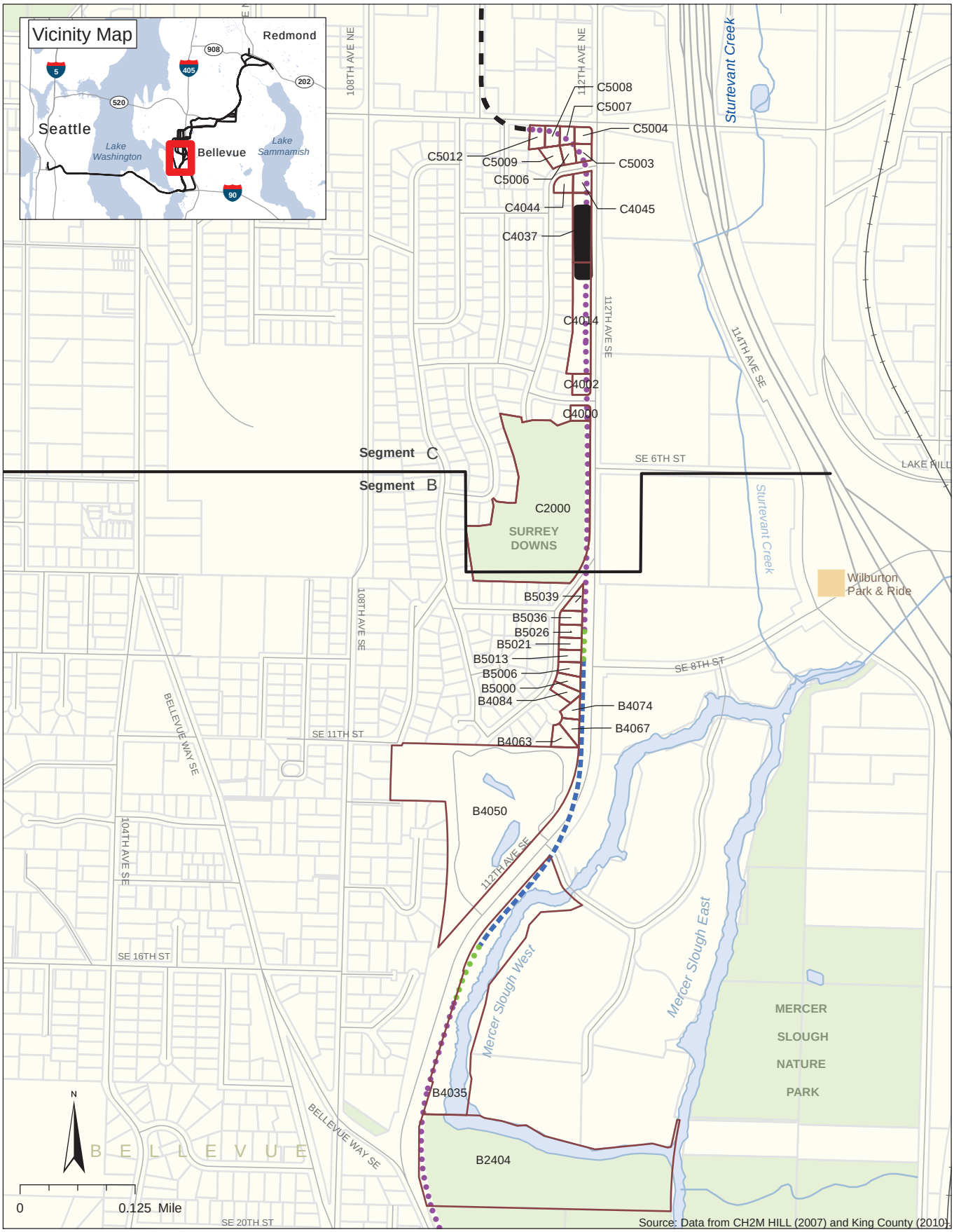
Elevated Route

Retained-Cut Route

Retained-Fill Route

Tunnel Route

Exhibit 5
Affected Parcels
Option A: Final EIS Alternative B2M-C9T – At-Grade to West Side at SE 6th Street
East Link Project



B1119 Map ID & Affected Parcel Boundary

Proposed Station

At-Grade Route

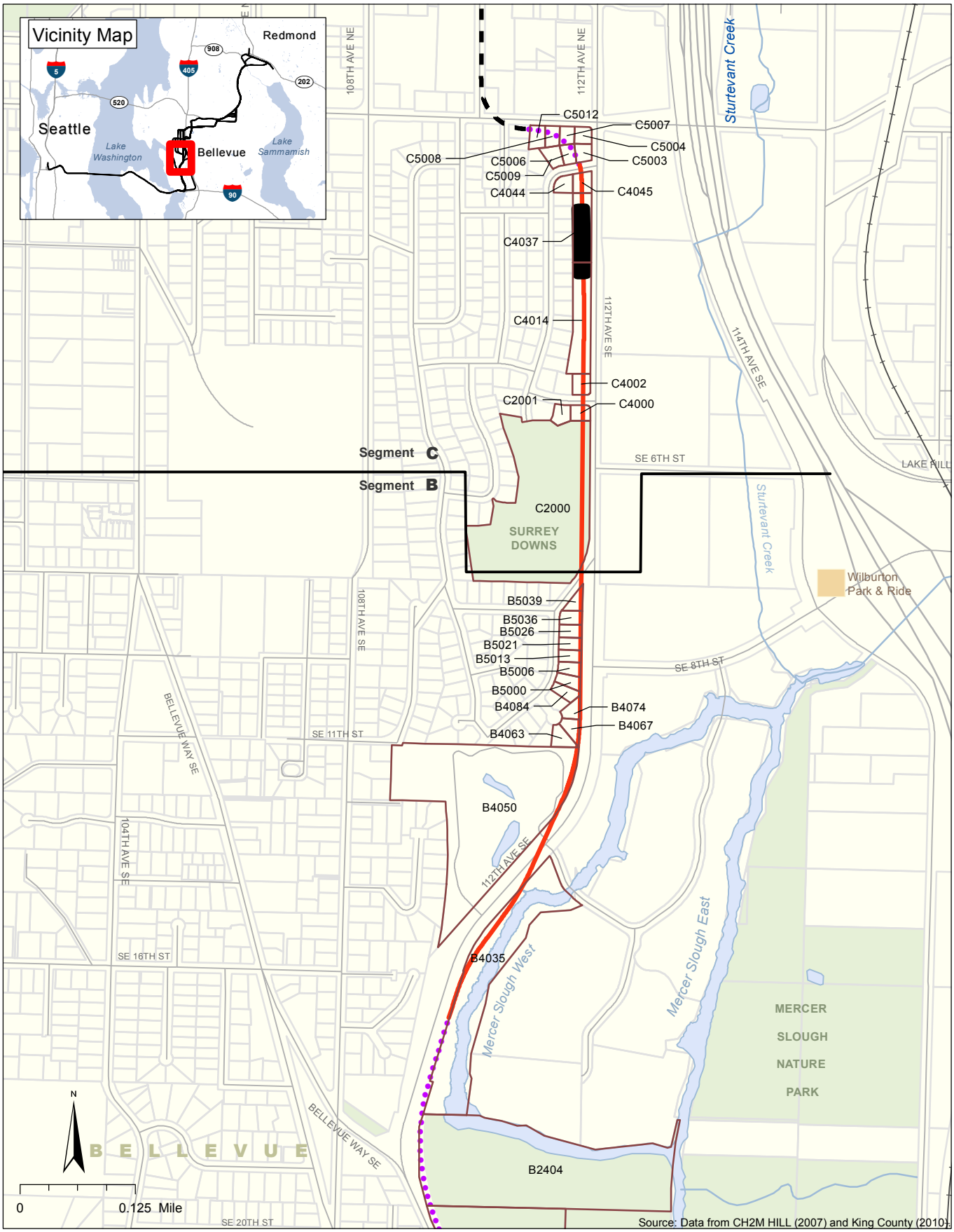
Elevated Route

Retained-Cut Route

Retained-Fill Route

Tunnel Route

Exhibit 6
Affected Parcels
Option B: Flyover To Trench
East Link Project



B1119 Map ID & Affected Parcel Boundary

Proposed Station

At-Grade Route

Elevated Route

Retained-Cut Route

Retained-Fill Route

Tunnel Route

Exhibit 7
Affected Parcels
Option C: At-Grade to At-Grade at SE 15th Street
East Link Project

1.3 Visual

Three-dimensional visual simulations and engineering cross-sections have been prepared for Option A and are found in Appendix B. Under Option A: FEIS Alternative B2M-C9T, the area between the trackway/retaining wall and the Mercer Slough water trail would be replanted with native and noninvasive vegetation. People boating along this portion of the Mercer Slough water trail might have upward views of the catenaries and east face of the retaining wall, as they currently have upward views of the adjacent Bellefield Office Park, which is a midrise complex of office buildings, parking lots, and driveways that dominates views along this portion of the trail.

Option A would also remove some of the landscaped median between SE 15th and SE 8th Streets. The remaining portions of the medians and adjacent vegetation would continue to contribute to the boulevard like character of 112th Avenue SE. The presence of the light rail and the removed vegetation would be noticeable along this part of 112th Avenue SE affecting both the travelers along 112thAvenue SE and residents in the Bellefield Residential Park.

In the Segment C, travelers along 112thAvenue SE would experience a visual change where the light rail tracks would replace landscaping along 112th Avenue SE and on the north portion of the Surrey Downs Park. Park users would not likely experience much change from within the park. Moving north, the guideway would replace a row of residences with the light rail tracks, landscaping the bluff west of the tracks as well as the area between the tracks and the sidewalk, thereby creating more vegetated areas than currently exist today.

Three-dimensional visual simulations and engineering cross-sections have been prepared for Option B and are found in Appendix C. For Option B: Flyover to Trench, the elevated and retained fill portions would be more visible than the retained-cut and at-grade portions of Option A routes when viewed from 112th Avenue SE, residences to the west, and from the Mercer Slough Water Trail in the Segment B study area. As with the Option A, the slope between the guideway and the Mercer Slough Water Trail would be replanted with native and noninvasive vegetation.

Option B would be most visible from 112th Avenue SE and nearby residences where it would pass over and above 112th Avenue SE for approximately 550 feet. A support column would be required in the existing landscaped median in the center of 112th Avenue SE as one column of a straddlebent (which is a structure made of two column piers with a beam on top to straddle over the roadway to support the elevated light rail guideway) and the second column would be located on the west side of 112th Avenue SE. The elevated structure would be highly noticeable from adjacent residences and travelers along 112th Avenue SE. Option B: Flyover to Trench would remove a few residences along the west side of 112th Avenue SE south of Surrey Downs Park. The remaining property would either return to a reconfigured residential lot or be landscaped compatible with the residential area.

Within the Segment C study area, the primary difference between Option B and Option A would be that Option B would pass through the entire eastern edge of Surrey Downs Park in a retained cut. This would affect views to travelers along 112th Avenue SE. As depicted in the visualizations (Appendix C, Overhead View, View Area 4.0) for this option, the retaining wall, wall support beams, and fence on top of the walls that are adjacent to the park would change the appearance of the portion of 112th Avenue SE near Surrey Downs Park. The visual effect of this wall could be mitigated by measures such as street trees and wall treatments to soften the bulk and massiveness of the wall.

North of Surrey Downs Park, Option B would transition to a more shallow retained cut profile west of 112th Avenue SE. Option B would also remove residences, but it would not require a retaining wall as tall as that next to Surrey Downs Park. Just as in Option A, removing residences would provide an opportunity to extend a "green" strip of landscaping on either side of the alignment, both along the bluff up to the next row of residences and adjacent to 112th Avenue SE providing a broader landscaped area for travelers entering or leaving Downtown Bellevue.

Three-dimensional visual simulations and engineering cross-sections have been prepared for Option C and can be found in Appendix D. Within the Segment B study area, Option C would cross 112th Avenue SE to the west side farther south than Option A. As with Option B, it would require the removal of a few residences along the west side of 112th Avenue SE and south of Surrey Downs Park and vegetation near residences that would be replanted following construction. These changes would be noticeable from adjacent residents and travelers along 112th Avenue SE.

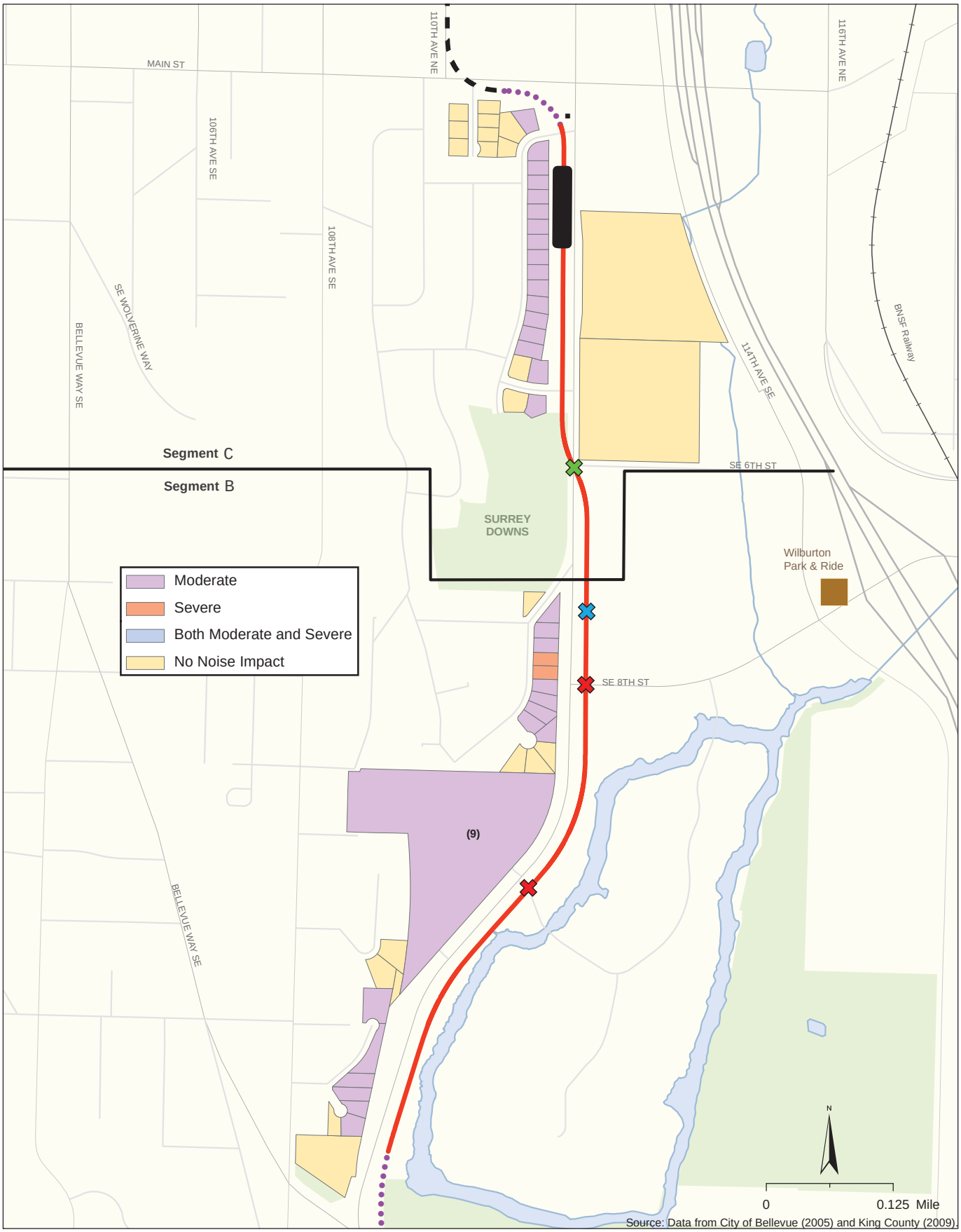
Option C would pass along more of the west side of 112th Avenue SE than Option A proposes. Unlike Option A, it would travel through the entire eastern edge of Surrey Downs Park, (and be located slightly farther west into the park than either Option A or B). The realigned SE 4th Street to SE 6th Street west of the guideway would include a retaining wall, but the bulk and scale would be less than the light rail guideway retaining wall under Option B at Surrey Downs Park. Option C is the same as Options A and B north of the park, in that it would replace the residences with light rail tracks and landscaping. Like Option A, the light rail tracks would remain at-grade with 112th Avenue SE.

1.4 Noise

Under Option A: FEIS Alternative B2M/C9T with East Main Station, there is predicted to be 23 moderate and 2 severe noise impacts in the Segment B study area, and 17 moderate and no severe noise impacts in the Segment C study area (see Exhibit 8). Of these, 33 are single-family residences and 9 are multi-family units, located at the Bellefield Residential Park. The severe noise impacts would be caused by the crossover north of SE 8th Street in Segment B. Bells from the train and on the gates at the SE 15th and SE 8th Street crossings and from the train at the East Main Station also contribute to the noise impacts.

Noise impacts could be mitigated with sound walls approximately 6 to 8 feet tall along the west side of the trackway from just north of the intersection of Bellevue Way and 112th Avenue SE to Surrey Downs Park, with openings for traffic access at SE 15th and SE 8th Streets. North of Surrey Downs Park, mitigation would also include sound walls approximately 6 to 10 feet tall from near SE 6th Street to the tunnel portal (depending on the height of the retaining wall north of SE 4th Street). Building sound insulation would be used for areas where sound walls are not entirely effective or where openings are required for traffic and pedestrians at SE 15th Street and SE 8th Street (see Exhibit 9). Crossover noise would be mitigated with special trackwork. Two moderate impacts at SE 4th Street that were identified in the Final EIS have been removed because they were caused by gates for a pedestrian crossing that is no longer assumed at this location.

For the Option B: Flyover to Trench, there would be 30 moderate and 8 severe noise impacts in the Segment B study area, and 11 moderate and no severe noise impacts in the Segment C study area (see Exhibit 10). There would be additional moderate impacts to ten units at the Bellefield Residential Park compared to Option A due to the noise from the closer alignment and elevated structure. Two additional moderate impacts to single-family residences would also occur to the south and north of the Bellefield Residential Park for the same reason. Under Option B, eight of the ten single-family residences along 111th Place SE in Segment B would change from moderate to severe impacts when compared to Option A. The higher noise levels along 111th Place SE are due to the added noise from the elevated structure and close proximity to the residences. Five residences that had moderate impacts under Option A would be displaced by Option B and, therefore, have no impacts. Six properties south and north of SE 4th Street in Segment C that have moderate impacts under Option A would also have no impacts because of the deep retained-cut profile at this location. There are no at-grade street crossing bells from the train or gates for Option B.



At-Grade Route
Elevated Route
Retained-Cut Route
Retained-Fill Route
Tunnel Route
Proposed Station

Crossover Location
Gated Crossing
Shared Crossing*
(*Crossing at signalized, traffic controlled intersection without light rail gates)

Exhibit 8
Noise Impacts
Option A: Final EIS Alternative B2M-C9T – At-Grade to West Side at SE 6th Street
East Link Project

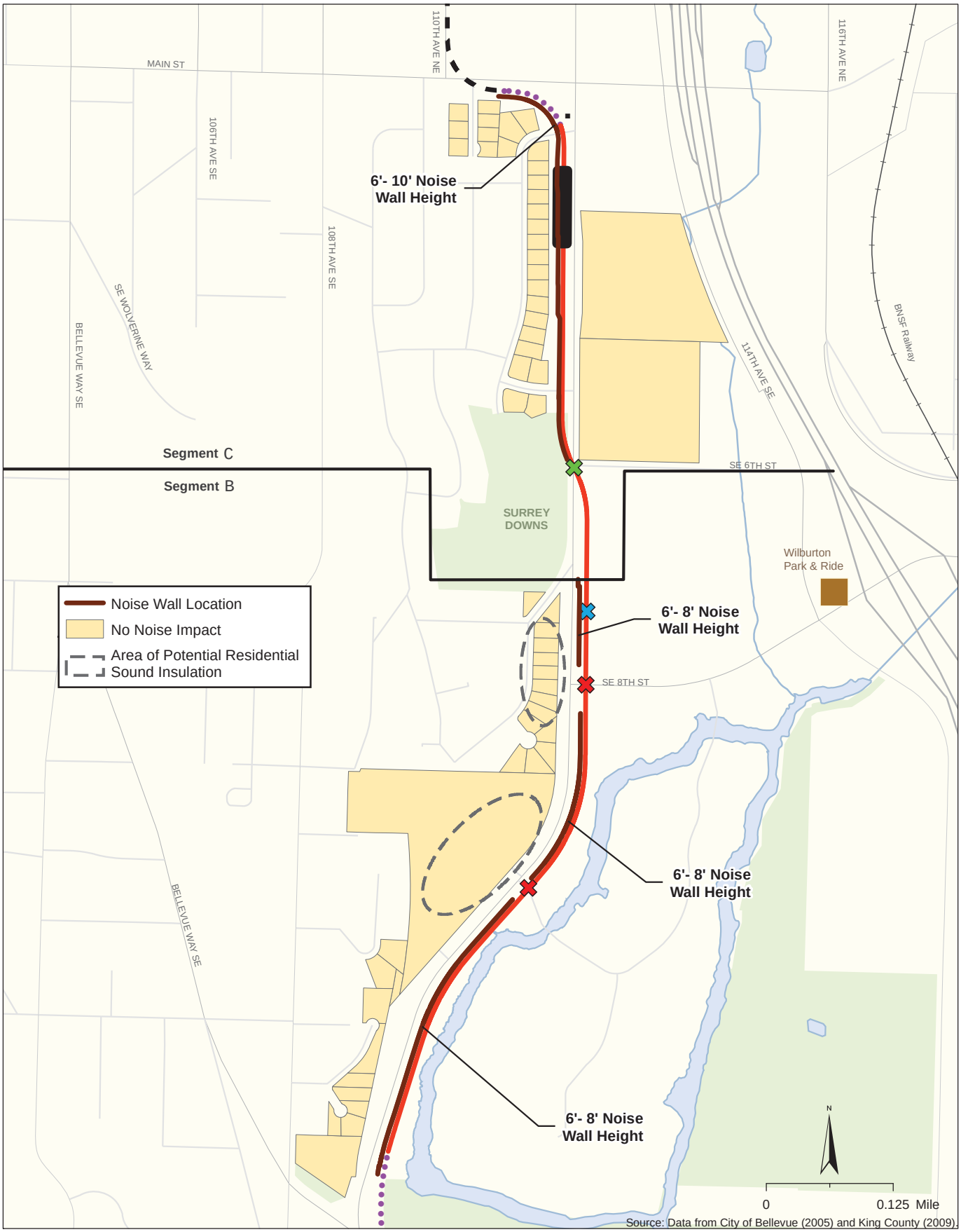
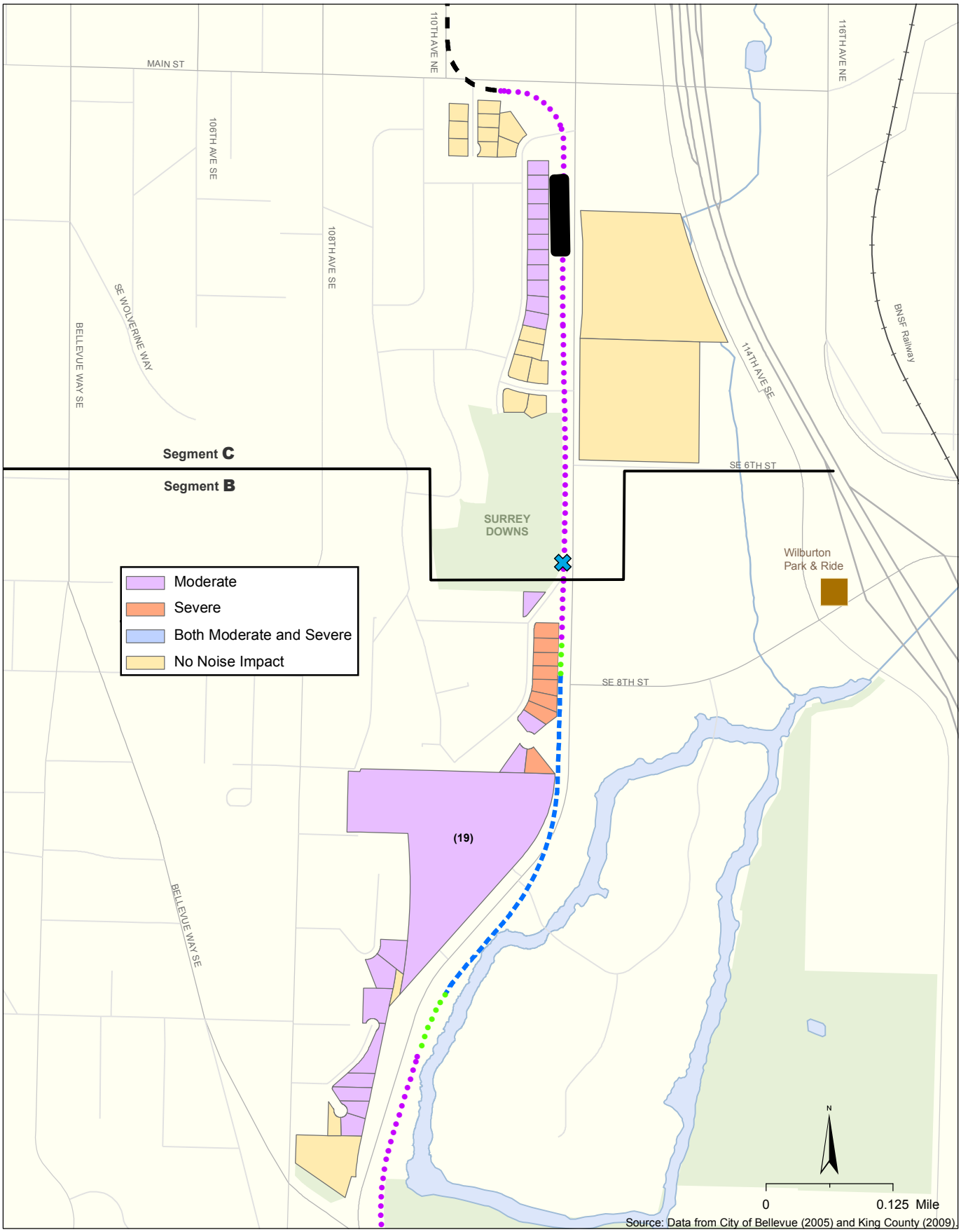


Exhibit 9
Noise Mitigation
Option A: Final EIS Alternative B2M-C9T – At-Grade to West Side at SE 6th Street
East Link Project



At-Grade Route
Elevated Route
Retained-Cut Route
Retained-Fill Route
Tunnel Route
Proposed Station

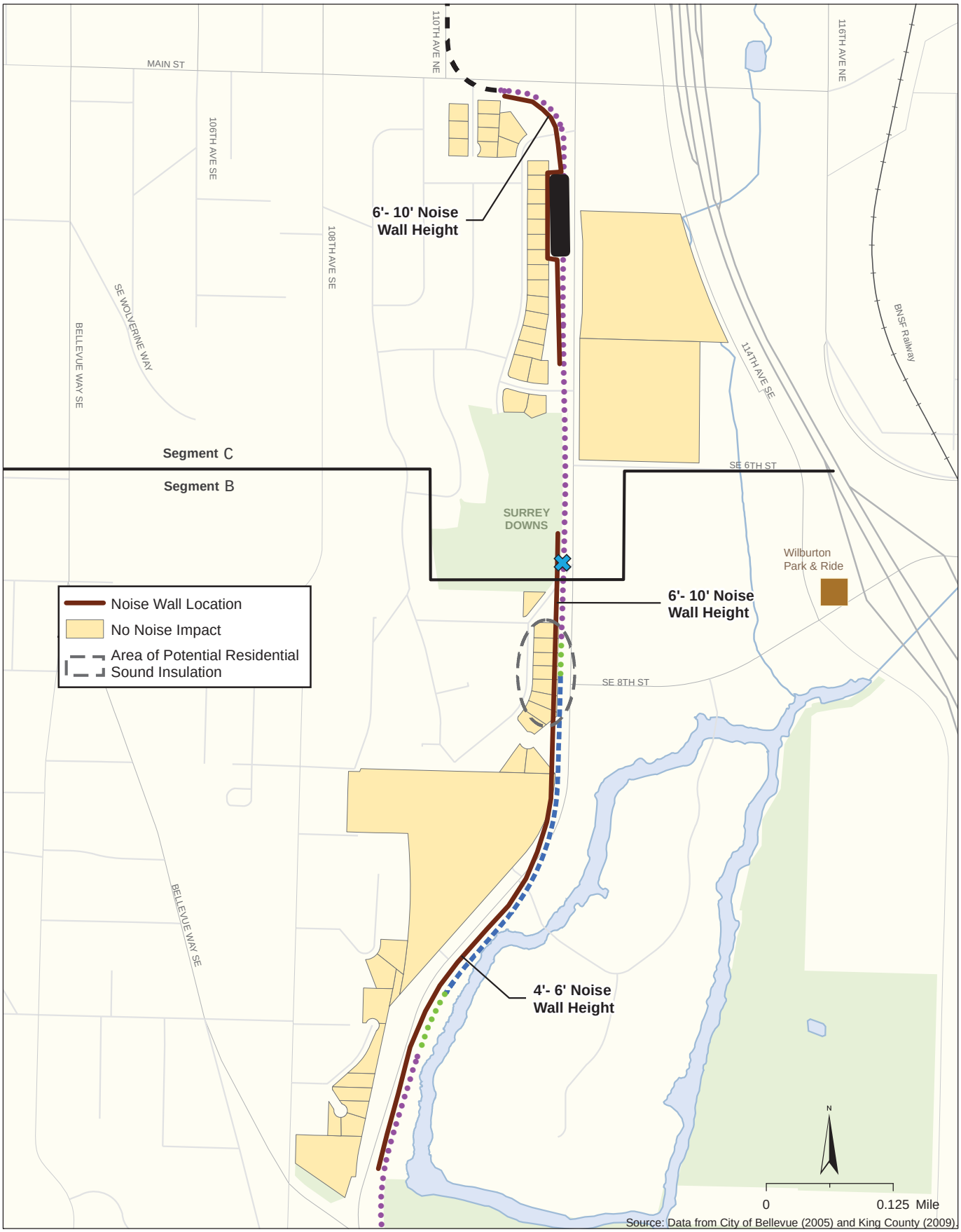
Crossover Location
Gated Crossing
Shared Crossing*
(*Crossing at signalized, traffic controlled intersection without light rail gates)

Exhibit 10
Noise Impacts
Option B: Flyover To Trench
East Link Project

To mitigate impacts from Option B, a sound wall approximately 4 to 6 feet tall would be installed along the west side of the elevated guideway from just north of the intersection of Bellevue Way and 112th Avenue SE to the retained fill transition near SE 8th Street. A 6 to 10 foot sound wall would be installed near the tracks on the retained fill section, continuing to the retained cut area near Surrey Downs Park. Some residences along the west side of 112th Avenue SE that currently shield other homes further west from traffic noise would be removed. No traffic noise impacts are predicted to occur from removal of the shielding based on recent noise measurements in this area. A sound wall approximately 6 to 10 feet tall (depending on the height of the retaining wall north of SE 4th Street) would also be required from just north of SE 4th Street to the East Main Station, continuing to the tunnel portal. The proposed sound walls, would mitigate all impacts, with the potential exception of some houses along 111th Place south of Surrey Downs Park. These houses are higher than the train and therefore may require sound insulation, although taller sound walls may eliminate the need for sound insulation (see Exhibit 11). Crossover noise would be mitigated with special trackwork.

For Option C: At Grade to At Grade at 15th , there would be 42 moderate and 7 severe noise impacts in the Segment B study area, and 15 moderate and no severe noise impacts in the Segment C study area (see Exhibit 12). There would be an additional 16 moderate and 6 severe impacts to units at the Bellefield Residential Park compared with Option A. All six severe impacts are located near the at-grade crossing at SE 15th Street and are due to the combined noise from the light rail trains, train-mounted bells, and gated-crossing bells. Noise impacts along 111th Place SE in Segment B would be moderate because the crossover is relocated compared to Option A; however, one additional severe impact would occur because of the proximity to the light rail tracks. Some residences along the west side of 112th Avenue SE that currently shield other homes further west from traffic noise would be removed. No traffic noise impacts are predicted to occur from this removal.

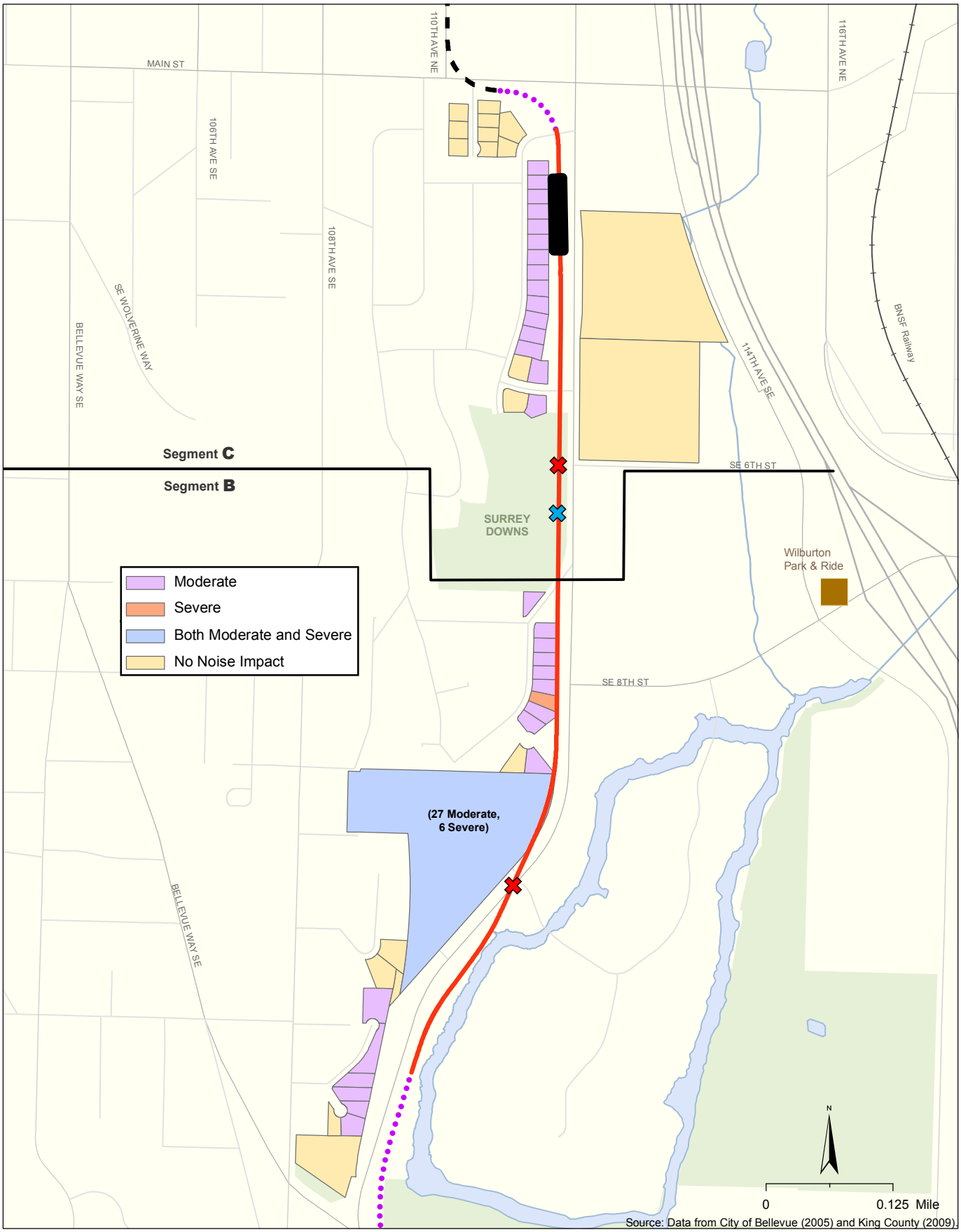
To mitigate impacts from Option C, a sound wall approximately 6 to 8 feet tall could be installed close to the tracks along the west side of the guideway from just north of the intersection of Bellevue Way and 112th Avenue SE to just south of the at-grade crossing at SE 15th Street. A second sound wall ranging in height between 8 and 12 feet tall would be located along the west side of 112th Avenue SE, beginning just north of the southern entrance to the Bellefield Residential Park, and continuing to the northern entrance to the Bellefield Residential Park. This sound wall would include a short extension along the west side of Bellefield Park Drive into Bellefield Residential Park to minimize noise exposure into the residential community. A third wall between 6 and 10 feet tall would begin just north of the at-grade crossing, on the west side of 112th Avenue SE, continuing through the East Main Station, and ending at the tunnel portal. Because of the opening in the sound wall at the Bellefield Residential Park for vehicle access, train bells at the crossing, and the at-grade gate crossing bells, there are several severe impacts near the opening. By wrapping the sound wall along the entrance road to the Bellefield Residential Park and overlapping with the northern sound wall, as described above, all severe impacts at lower floors could be fully mitigated. However, there is a potential for building sound insulation at some upper floor units depending on the height of the sound walls and location of the bells for the gates at the Bellefield Park Drive. Building sound insulation could be considered at the Bellefield Residential Park as an alternative to sound walls depending on height and aesthetic requirements (see Exhibit 13). Crossover noise would be mitigated with special trackwork. Also, some houses along 111th Place south of Surrey Downs Park are higher than the train and may require sound insulation although a taller sound wall may eliminate the need for sound insulation.



At-Grade Route
Elevated Route
Retained-Cut Route
Retained-Fill Route
Tunnel Route
Proposed Station

Crossover Location
Gated Crossing
Shared Crossing*
(*Crossing at signalized, traffic controlled intersection without light rail gates)

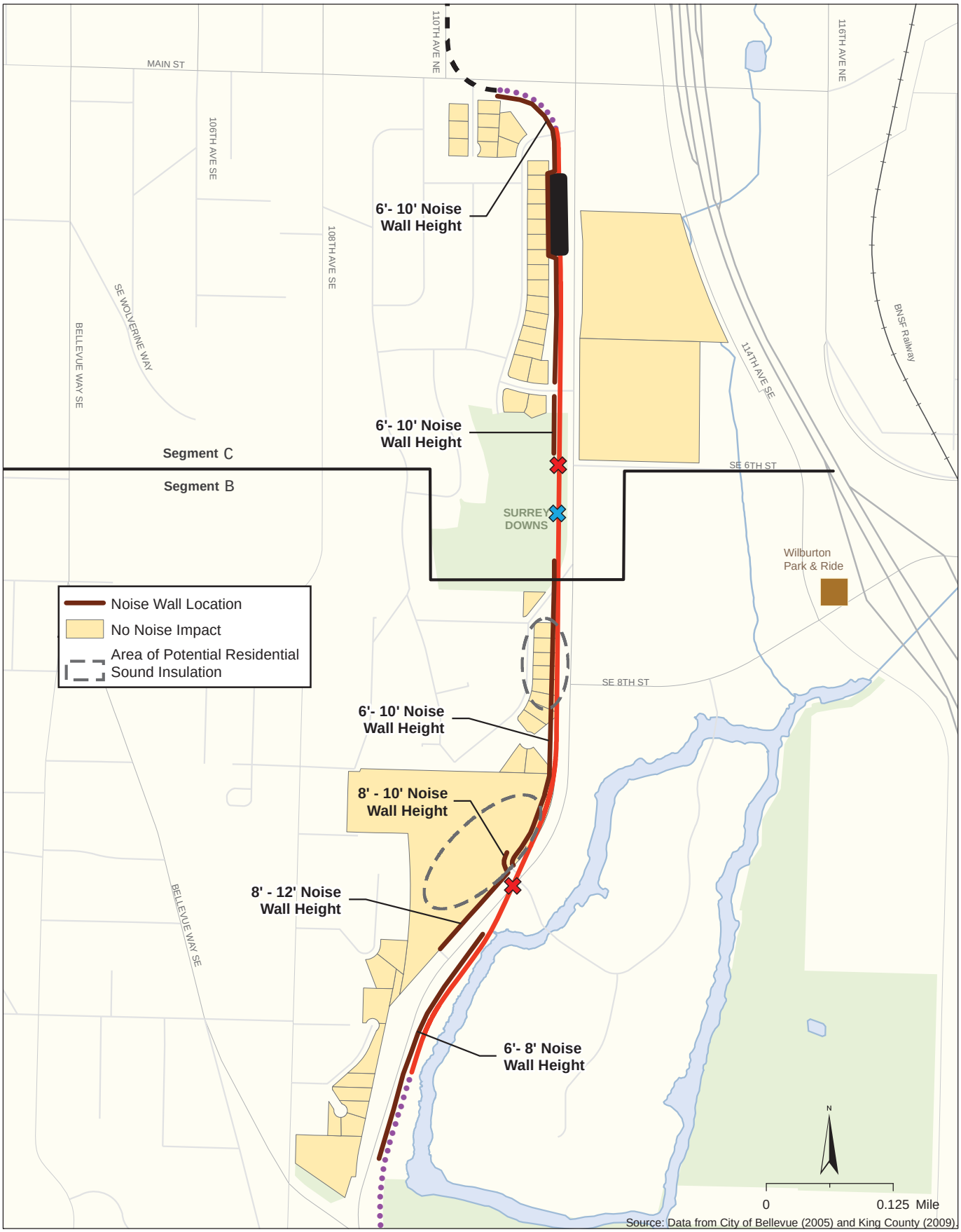
Exhibit 11
Noise Mitigation
Option B: Flyover To Trench
East Link Project



At-Grade Route
Elevated Route
Retained-Cut Route
Retained-Fill Route
Tunnel Route
Proposed Station

Crossover Location
Gated Crossing
Shared Crossing*
(*Crossing at signalized, traffic controlled intersection without light rail gates)

Exhibit 12
Noise Impacts
Option C: At-Grade to At-Grade at SE 15th Street
East Link Project



At-Grade Route
Elevated Route
Retained-Cut Route
Retained-Fill Route
Tunnel Route
Proposed Station

Crossover Location
Gated Crossing
Shared Crossing*
(*Crossing at signalized, traffic controlled intersection without light rail gates)

Exhibit 13
Noise Mitigation
Option C: At-Grade to At-Grade at SE 15th Street
East Link Project

1.5 Vibration

Option A: FEIS Alternative B2M/C9T with East Main Station would have no potential vibration impacts in the Segment B study area and 1 potential vibration impact in the Segment C study area at a single-family residence (see Exhibit 14) near the tunnel portal at E Main Street. The potential impact would occur on 110th Place SE in Segment C and is due to the proximity of the alignment to the foundation of the buildings and the speed of the trains. This impact could be mitigated.

With Option B: Flyover to Trench, there would be potential vibration impacts at 7 single-family residences in the Segment B study area, and 1 single-family residence in Segment C (see Exhibit 15). This is 7 more than Option A. In addition, the King County District Court within Surrey Downs Park would potentially be impacted if not removed prior to project construction, as called for in the Surrey Downs Park Master Plan. The potential for vibration impacts in both segments is due to the closer proximity of the proposed alignment to the building foundation of sensitive receptors compared to Option A and the speed of the trains. All impacts could be effectively mitigated with ballast mats or resilient rail fasteners. The proposed double-crossover approximately 400 feet south of SE 6th Street would not cause vibration impacts on sensitive receivers.

With Option C: At Grade to At Grade at 15th, there would be 9 potential vibration impacts in the Segment B study area, including one residential unit in Bellefield Residential Park and eight residences on 111th Place SE. In the Segment C study area, there would be two potential vibration (see Exhibit 16). This would be 10 more vibration impacts than Option A. The potential for vibration impacts in both segments is due to the closer proximity of the proposed alignment to the building foundations of sensitive receptors when compared to both Options A and B, as well as the speed of the trains. Most impacts could be effectively mitigated with ballast mats or resilient rail fasteners. However, due to the close proximity of some of the buildings, one to three of the potential vibration impacts on 111th Place SE may not be entirely mitigated with these standard design measures. At these three locations, mitigated vibration from the light rail vehicles may be perceptible inside the buildings, but vibration levels would be significantly lower than the thresholds for potential structural damage. The proposed double-crossover approximately 200 feet south of SE 6th Street would not cause vibration impacts. There would be no groundborne noise impacts from Option A, B or C.

1.6 Parkland

The only difference in park impacts between these options would occur at Surrey Downs Park in the Segment C study area. All options under consideration would require an update to the Surrey Downs Master Plan. Option A would modify a portion of the park plan, whereas the City of Bellevue requested that Option B and C change the park orientation from a community park to primarily a neighborhood park function.

Option A: FEIS Alternative B2M-C9T would result in 0.5 acre of permanent and 0.5 acre of temporary impacts at Surrey Downs Park. Option A would close the northern vehicular access to Surrey Downs Park (see Exhibit 17). There would be no impacts on Surrey Downs Park south of SE 6th Street, since Option A would remain on the east side of 112th Avenue SE. The southern vehicular access into the park would remain. Option A would eliminate one of the two new planned pedestrian access points at the north end of the park and remove a portion of the parking from the north end that serves the court building primarily. Option A would also realign SE 4th Street, which would result in permanent use of Surrey Downs Park property for the roadway, separating a 0.5-acre area from the remainder of the park. This area would continue to be part of the park, however, and would provide a visual buffer from 112th Avenue SE.

Realignment of SE 4th Street would remove the north parking lot, which would reduce existing parking by approximately one-half. Consistent with all options under consideration, properties located on the west of 112th Avenue SE between Main Street and Surrey Downs Park would be acquired.

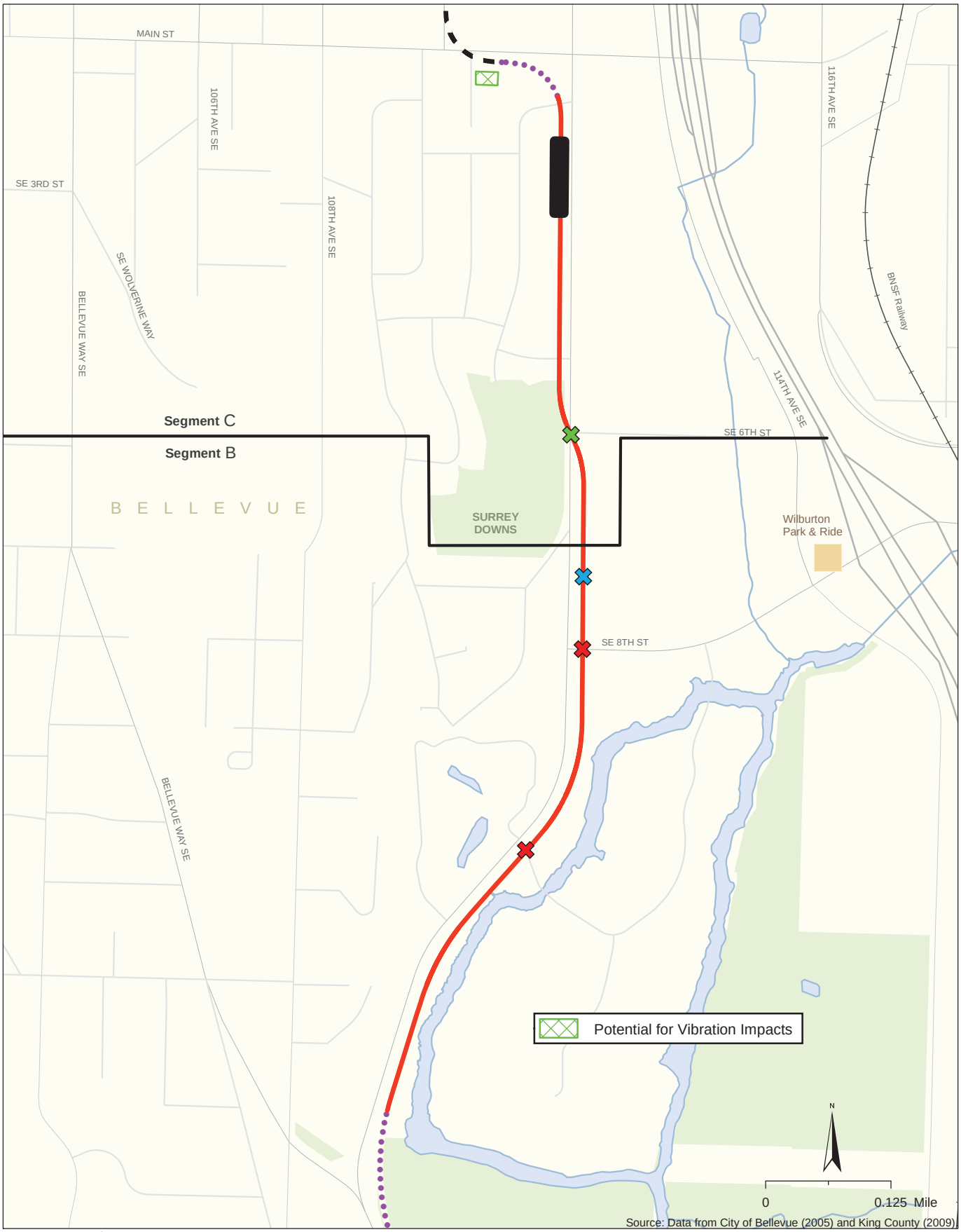


Exhibit 14
Vibration Impacts
Option A: Final EIS Alternative B2M-C9T – At-Grade to West Side at SE 6th Street
East Link Project

At-Grade Route
Elevated Route
Retained-Cut Route
Retained-Fill Route
Tunnel Route
Proposed Station
Crossover Location
Gated Crossing
Shared Crossing

Exhibit 15
Vibration Impacts
Option B: Flyover To Trench
East Link Project

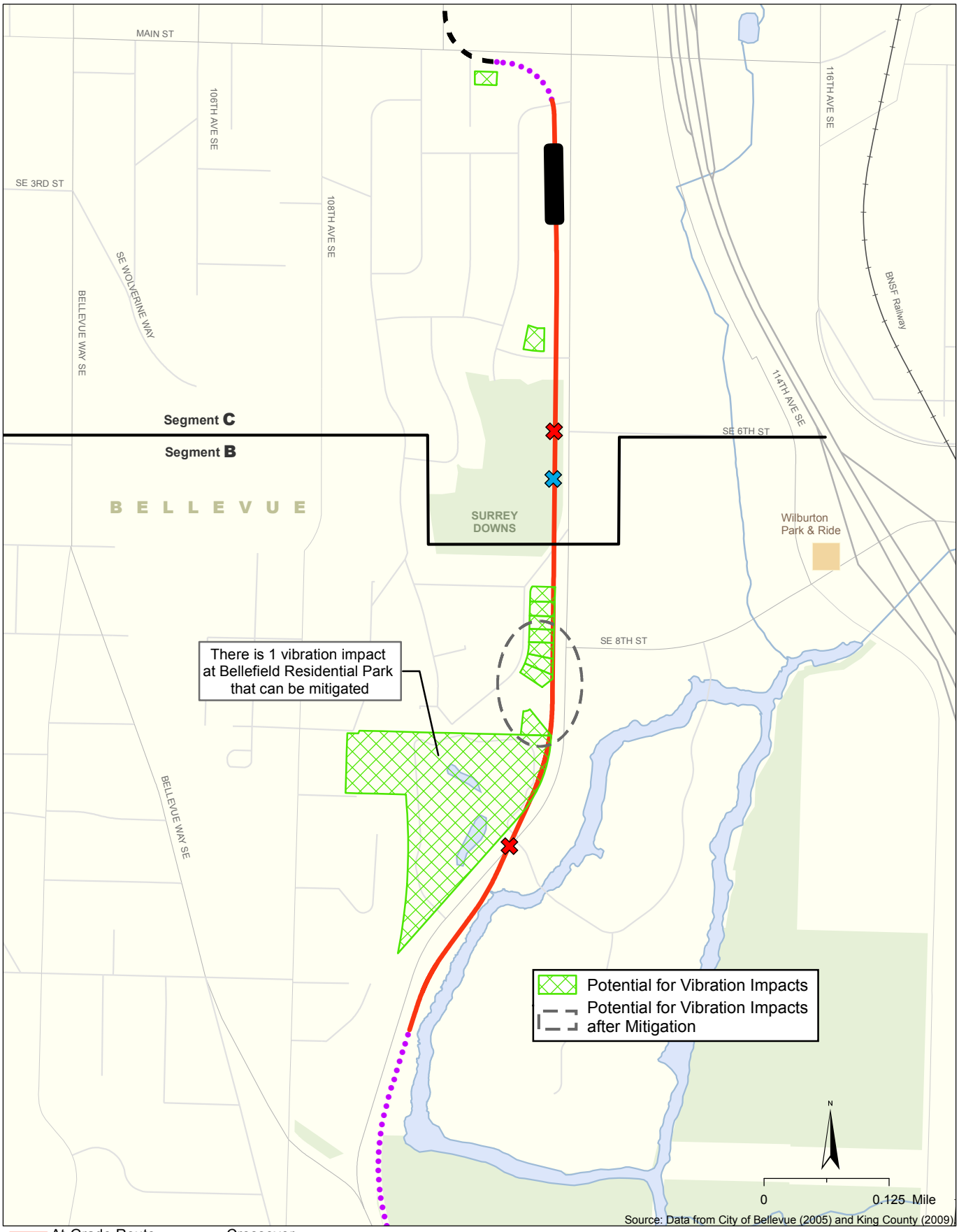
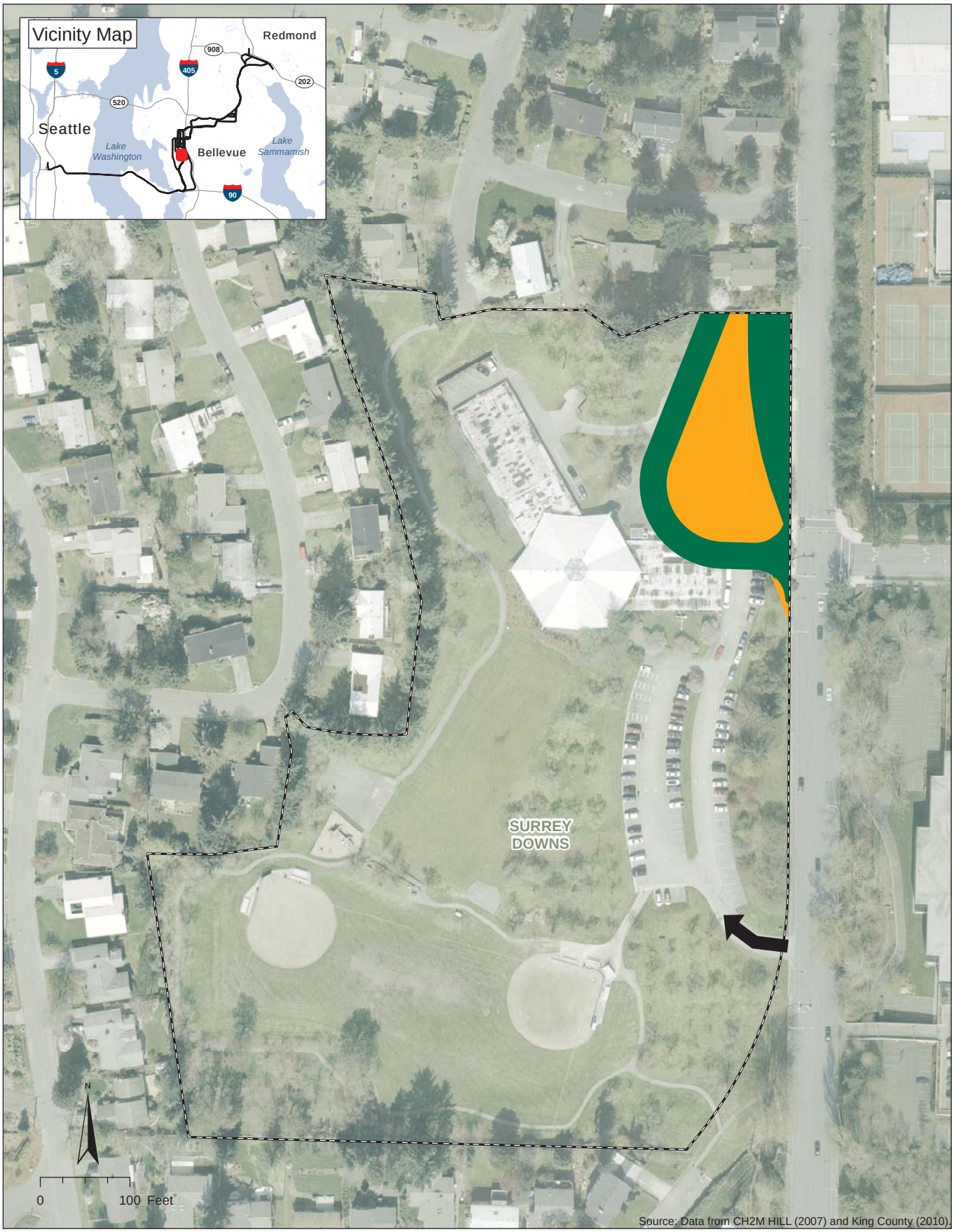


Exhibit 16
Vibration Impacts
Option C: At-Grade to At-Grade at SE 15th Street
East Link Project



Existing Park Boundary
Permanent Impact
Temporary Impact
Post-Construction Access to Surrey Downs Park

Exhibit 17
Park Impacts
Option A: Final EIS Alternative B2M-C9T – At-Grade to West Side at SE 6th Street
East Link Project

Once the project is built and operational, a substantial amount of the acquired area will be available and could be developed into an open space linear park, which would provide new passive open space. Option B: Flyover to Trench would result in 0.9 acre of temporary impacts and 0.6 acre of permanent impacts at Surrey Downs Park (See Exhibit 18). Permanent impacts would be slightly greater than impacts under the Option A and temporary construction impacts would be greater because a retained cut would be constructed along the entire length of the park, resulting in visual changes as viewed from 112th Avenue SE.

Option B: Flyover to Trench would remove both the northern and southern vehicle and planned pedestrian access points to the park and provide a new entrance off of SE 4th Street, as shown in Exhibit 18. Approximately the same number of parking stalls would remain as with Option A, but would be split between the north and south parking lots.

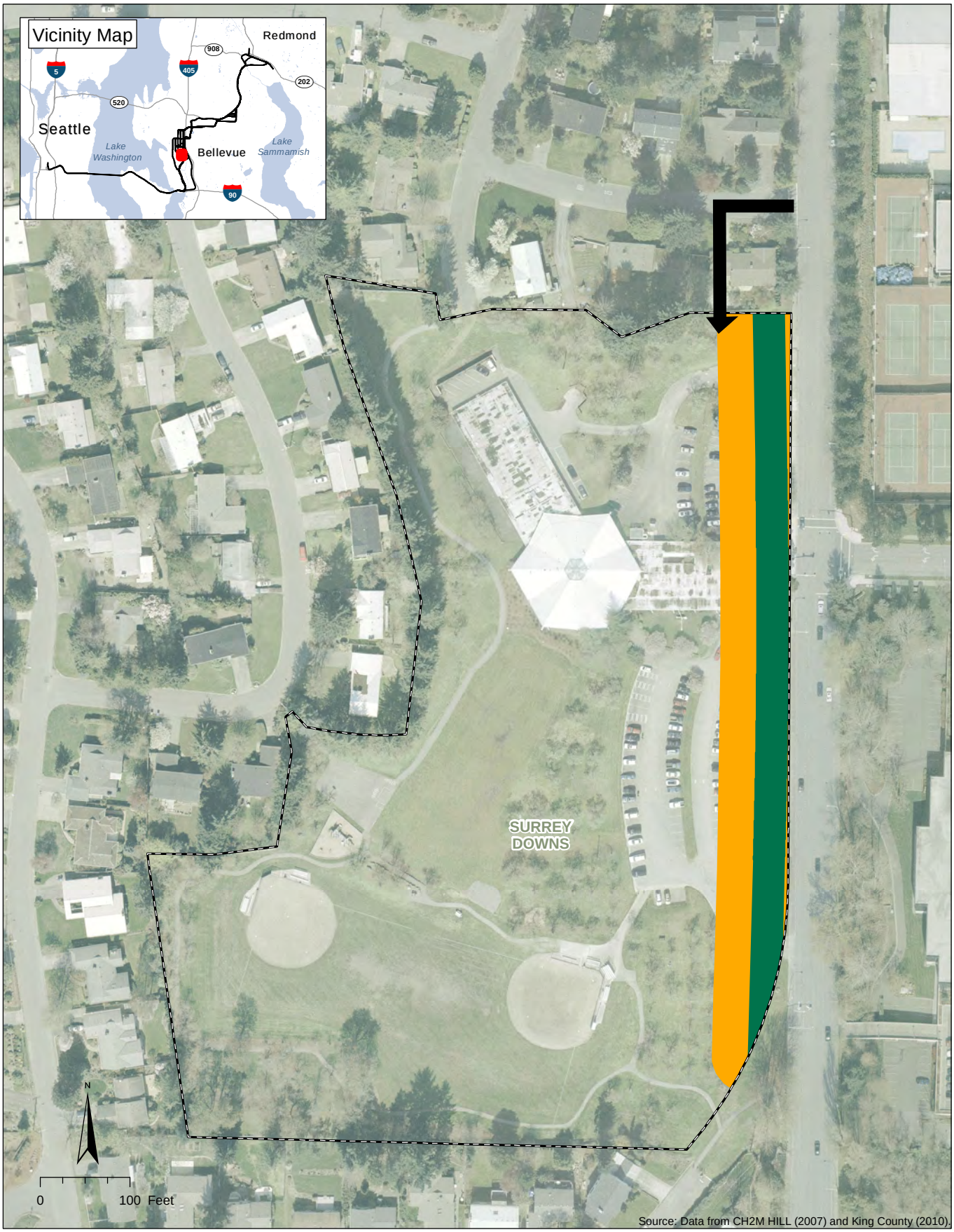
Consistent with all options under consideration, properties located on the west of 112th Avenue SE between Main Street and Surrey Downs Park would be acquired. Once the project is built and operational, a substantial amount of the acquired area will be available and could be developed into an open space linear park, which would provide new passive open space. This new linear park would replace the impacted areas in Surrey Downs Park, which is primarily passive open space.

Option C: At-Grade to At-Grade at SE 15th Street would result in 0.6 acre of temporary impacts and 1.4 acre of permanent impacts at Surrey Downs Park, which is greater than the other options under consideration (see Exhibit 19). The area affected would accommodate the guideway as well as the intersection improvements at 112th Avenue SE and SE 6th Street. Temporary impacts would be slightly greater than Option A and less than Option B.

Option C would remove both the northern and southern vehicle and planned pedestrian access points to the park, the existing north parking lot and part of the south parking lot, resulting in a slightly greater parking impact than Options A and B. A new access to the south portion of the parking lot would be provided off the realigned SE 4th Street entrance to SE 6th Street, as shown in Exhibit 19. Similar to Option A, realigning SE 4th Street would result in permanent use of Surrey Downs Park property for the roadway, separating a portion of the park from the remainder of the park. This area would continue to be part of the park, however, and would provide a visual buffer from 112th Avenue SE.

As with the other two options under consideration, properties located on the west of 112th Avenue SE between Main Street and Surrey Downs Park would be acquired as part of Option C, which would provide new passive open space.

The configuration and accessibility of replacement land for Surrey Downs Park along 112th Avenue SE between Main Street and the Park would vary depending on the option. For example, the tracks for Option A are located closer to 112th Avenue SE than the tracks for Options B and C and therefore, Option A would include more contiguous replacement land on the west side of the alignment. Options B and C would split the replacement land more evenly, thereby resulting in more landscaping between the trackway and 112th Avenue SE.



Existing Park Boundary
Permanent Impact
Temporary Impact
Post-Construction Access to Surrey Downs Park

Exhibit 18
Park Impacts
Option B: Flyover To Trench
East Link Project

Existing Park Boundary
Permanent Impact
Temporary Impact
Post-Construction Access to Surrey Downs Park

Exhibit 19
Park Impacts
Option C: At-Grade to At-Grade at SE 15th Street
East Link Project

Section 2

Cost Estimate Comparisons

For the purpose of this technical memorandum, costs for Options B and C are reported as the difference between the preliminary engineering cost estimate for B2M/C9T with the SE 8th station. The preliminary engineering cost estimate is similar—but not identical to—Option A since it includes a station at SE 8th rather than at East Main location. Sound Transit calculated capital costs in 2010 dollars. Estimated capital costs include construction, right-of-way, construction cost mark-ups for general conditions, overhead, profit and sales tax, a design allowance, and allocated contingency.1

Given the design level for these project alternatives, and the associated uncertainties regarding the project scope, engineering data, mitigation requirements, schedule, and project delivery methods, these are considered to be preliminary design cost estimates. They represent approximately 10 percent overall design completion. These cost estimates have been prepared to guide project budgeting evaluation from the information available at the time they were prepared. The final project costs will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other variable factors. As a result, the final project costs will vary from those presented. Because of these factors, funding needs must be carefully reviewed before making specific financial decisions or establishing final budgets.

Table 2, Cost Impact Comparison Table, compares the Preliminary Engineering Alternative with Options B, and C.

TABLE 2
Cost Impact Comparison Table (figures shown in millions of 2010 dollars)

B2M-C9T (Preliminary Engineering Alternative)	**Option B: Flyover to Trench**		**Option C: At-Grade to At-Grade at SE 15th Street**	
Baseline	**Segment B**	**Segment C**	**Segment B**	**Segment C**
	$10 to $15 decrease	**$25 to $35 increase**	**$30 to $40 decrease**	**$5 to $10 increase**
	from baseline	from baseline	from baseline	from baseline
Note: The Baseline is the Preliminary Engineering Cost Estimate, which is similar, but not identical to Option A since it includes a station at SE 8th rather than at East Main Location. Therefore, the cost increase would be higher when compared to Option A, and the cost decrease would be lower when compared to Option A.				