

Appendix H4

Sensitivity Analysis of School Boundary Changes

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August 18, 2021

TECHNICAL MEMORANDUM

Project: Issaquah School District – HS #4 / ES #17
Subject: Traffic Impact of School Boundary Changes
Date: August 18, 2021
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The Issaquah School District (ISD) proposes to co-locate a new elementary school (serving grades pre-kindergarten through 5) and a new high school (serving grades 9 through 12) on property located west of 228th Avenue SE and north of SE 43rd Way. The site is located within the City of Issaquah, but the site access driveway on 228th Avenue SE and frontage along 228th Avenue SE is within City of Sammamish jurisdiction. The *Transportation Technical Report (TTR), REVISED for High School #4 / Elementary School #17*¹ presented the transportation impacts of the project to a broad study area and to all modes of transportation.

The TTR was based on expected school enrollment boundaries at the time of analysis. The City of Sammamish has expressed concern about the potential for increased impacts to the 228th Avenue SE corridor north of the site if the enrollment boundaries were to change in the future. Enrollment areas are set by a public process—a community-based Boundary Review Committee recommends enrollment areas to the Superintendent who then finalized the recommendation. In February 2021, the Boundary Review Committee recommended its boundary for Elementary School #17 that differed from the preliminary boundary evaluated in the TTR. The assumed and expected new boundaries are described further in Section 1 below.

To assist with evaluating potential impacts of the revised elementary school enrollment boundary, as well as possible future enrollment boundary changes for the high school, a sensitivity analysis was performed. This memorandum evaluates potential impacts to the most congested intersection that could be affected by boundary changes—at Issaquah-Pine Lake Road / 228th Avenue SE. The analysis determined that changes in the Elementary School #17 enrollment boundary, which have already been approved, would not adversely affect traffic operations compared to those already evaluated in the TTR. Major changes in the enrollment boundary for High School #4 could increase delays at the 228th Avenue SE / Issaquah-Pine Lake Road SE / SE 30th Street intersection during the AM peak hour. However, the intersection is still projected to operate at LOS E even if 100% of the new High School #4 enrollment were to come from areas now assigned to Skyline High School (Skyline). This level of shift is highly unlikely.

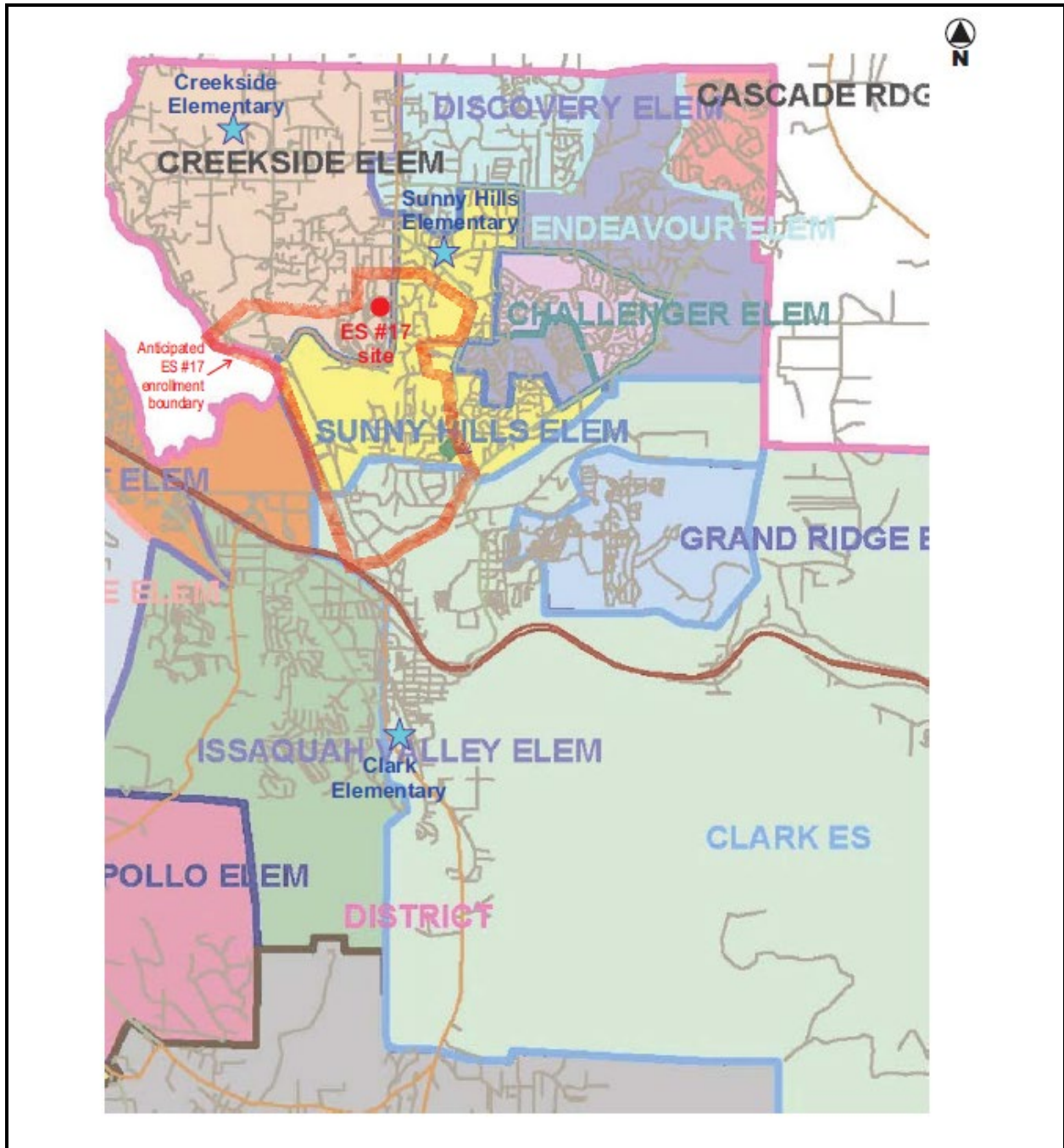
¹ Heffron Transportation, Inc., February 16, 2021.

1. School Enrollment Boundaries

1.1. Enrollment Boundaries Assumed for TTR

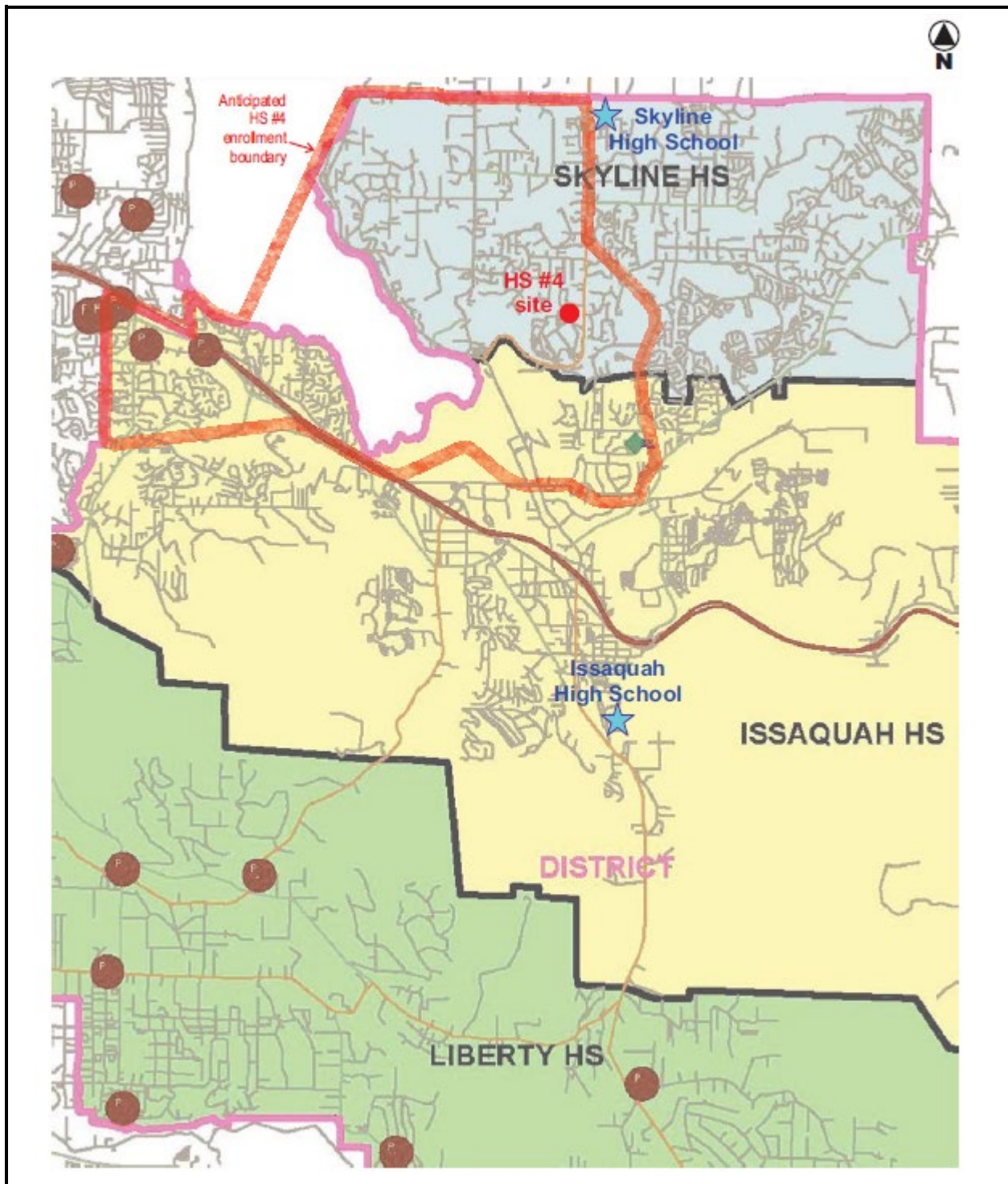
The TTR was performed for preliminary boundaries that ISD based on the best information available at the time. The previously-assumed elementary school enrollment area is shown on Figure 1; and the assumed high school enrollment area is shown on Figure 2.

Figure 1. Assumed Enrollment Area for TTR – Elementary School #17



Source: Issaquah School District, April 2020.

Figure 2. Assumed Enrollment Area for TTR – High School #4

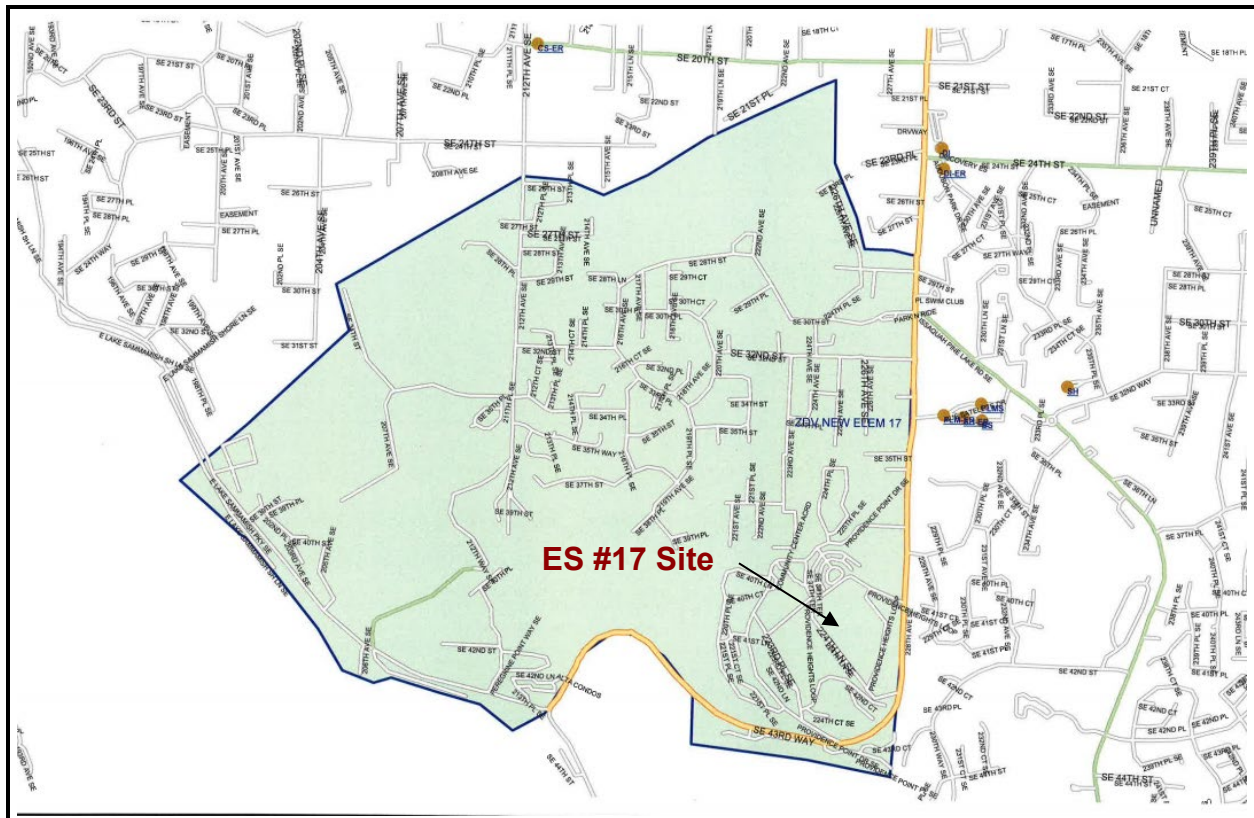


Source: Issaquah School District, April 2020.

1.2. Approved Boundary for Elementary School #17

The enrollment boundary for Elementary School #17 was approved in March 2021. This new boundary, shown in Figure 3, captures an area further north and west than had been previously assumed. It also acknowledged that the number of students who come from within this area is estimated to be 335 students, far below the 744-student capacity assumed for the TTR analysis. As student growth continues in the school district, the boundary could change again or the school could be operated as a magnet-type school that attracts from the full district.

Figure 3. Approved Enrollment Area for Elementary School #17



Source: Issaquah School District, Attendance Maps, from https://www.issaquah.wednet.edu/docs/default-source/maps/br2021/elem17-plms-sky.pdf?sfvrsn=e524d317_4, dated February 2, 2021; accessed July 2021.

2. Traffic Effect of Enrollment Boundary Changes

2.1. School Trips

The TTR determined the number of trips that each school would generate during the AM, Afternoon and PM peak hours of the local street system. TTR Table 7 provided a summary of the cumulative trips. It is reprinted below for convenience. As shown, elementary school traffic is a fraction of the high school trips, and represents about 15% of the site's traffic during the AM peak hour, 29% during the Afternoon peak hour and 31% during the PM peak hour. It is also noted that elementary school employees and staff make up some of each peak hour's trips, and those trip patterns would not be affected by boundary changes.

TTR Table 7. Cumulative Trips Generation for Analysis Peak Hours

Analysis Period	High School #4 Trip Generation			Elementary #17 Trip Generation			Total Trip Generation for Both Schools		
	Inbound	Outbound	Total	Inbound	Outbound	Total	Inbound	Outbound	Total
AM Peak Hour (7:15 to 8:15 AM)									
Trips	767	345	1,112	133	59	192	900	404	1,304
Peak Hour Factor ^a	0.58	0.56	0.58	0.42	0.31	0.38	0.63	0.63	0.63
Afternoon Peak Hour (3:00 to 4:00 PM)									
Trips	127	489	616	131	115	246	258	604	862
Peak Hour Factor	0.76	0.56	0.59	0.62	0.35	0.60	0.77	0.69	0.75
Commuter PM Peak Hour (4:45 to 5:45 PM)									
Trips	147	181	328	68	80	148	215	261	476
Peak Hour Factor	0.78	0.74	0.76	0.77	0.77	0.77	0.87	0.87	0.87

Source: Transportation Technical Report (TTR, REVISED) for High School #4 / Elementary School #17, Heffron Transportation, Inc., February 16, 2021.

a. $PHF = \text{Peak Hour Factor} = \text{Peak Hour Volume} / (4 \times \text{Peak 15-minute Volume})$

2.2. 228th Avenue SE / Issaquah-Pine Lake Road Intersection Impacts

Enrollment boundary changes could affect traffic patterns and traffic volumes on 228th Avenue SE north of the site. The TTR had considered how student-related trips would change with the two new schools. Since students would attend a different school if the new schools are not constructed, the analysis considered how travel patterns would shift. For example, high school students who live in the Sammamish Highlands would shift from Skyline High School to the new High School #4. Based on the preliminary enrollment area defined and provided by the District, the analysis in the TTR assumed that half (50%) of High School #4's student population would originate in areas west of 228th Avenue SE that are now assigned to Skyline High School; the remaining student trips were assumed to originate in areas now assigned to Issaquah High School.

The most congested intersection on 228th Avenue SE north of the site is at Issaquah-Pine Lake Road SE. The TTR assumed that High School #4 and Elementary #17 would add a combined 363 trips to this intersection during the AM peak hour. However, of those, 336 trips would be diverted from other schools for a net increase of 27 trips.

Effect of Elementary School Boundary Change

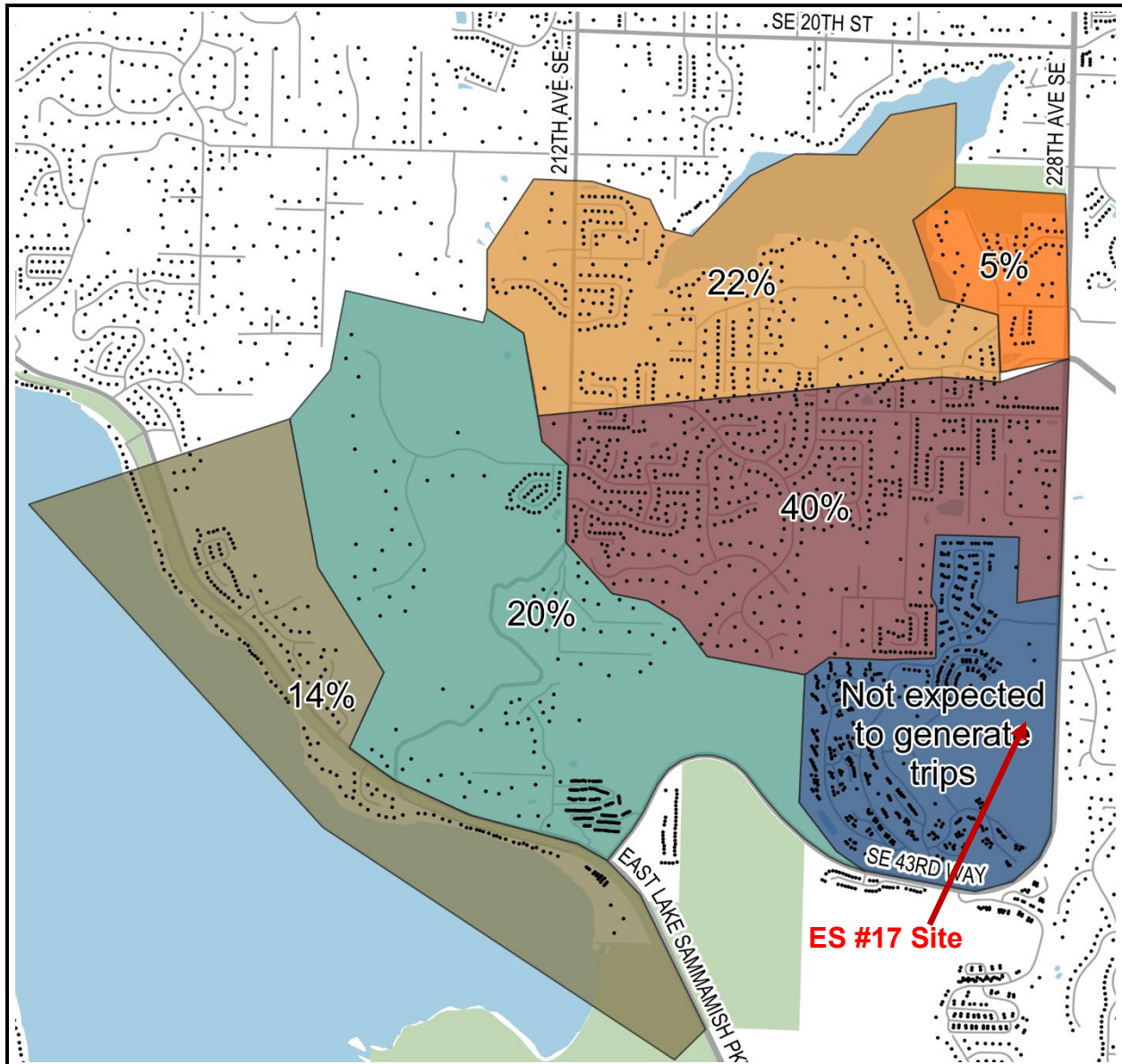
The recently-approved elementary school enrollment boundary could result in the school attracting more trips from north of the site and fewer from south of the site than had previously been assumed. However, the prior boundary captured more neighborhoods located east of 228th Avenue SE, while the approved boundary is entirely located west of 228th Avenue SE. The primary transportation-related effect of the boundary change would be more vehicles making eastbound right turns from SE 30th Street onto 228th Avenue SE (e.g., those driving to school in the morning) and more northbound left turns from 228th Avenue SE (returning home). The enrollment boundary change would reduce westbound left turns and northbound right turns at street intersections on the east side of 228th Avenue SE.

Although the number of students within the approved enrollment area (335) is about 45% of evaluated school capacity, the sensitivity analysis assumed that all 744 students (the proposed full capacity) could come from within that area. Figure 4 shows the approved enrollment area and the household density within that area from King County GIS Open Data. The sub-areas were created by Heffron Transportation



based on routes likely to be used to access the new Elementary #17, according to Google Maps' predictive travel route and travel time mapping resource. No trips were assumed to be generated from the age-restricted residential area within Providence Point. Roughly 30% of school trips (those from the two northern sub-areas) are likely to pass through the 228th Avenue SE / Issaquah-Pine Lake Road SE / SE 30th Street intersection to access the school. The remaining trips are expected to use other routes such as SE 32nd Street for a large portion of the area south of Issaquah-Pine Lake Road SE / SE 30th Street and 212th Way SE for areas south and west of the site.

Figure 4. Approved Elementary #17 Enrollment Area with Trip Distribution Percentages



Source: Author: King County GIS Open Data; Addresses in King County, Accessed: July 19, 2021 <https://gis-kingcounty.opendata.arcgis.com/datasets/kingcounty::addresses-in-king-county-address-point>

The previous TTR analysis had forecast that the 228th Avenue SE / Issaquah-Pine Lake Road SE / SE 30th Street intersection would operate at LOS D in 2024 without the project and LOS E in 2024 with the project during both the morning and afternoon peak hours. This is an acceptable level of service for this intersection. The effects of the boundary adjustment were evaluated using distribution percentages described above to re-assign Elementary School #17 trips. The results are presented in Table 1 and show that the intersection is still forecast to operate acceptably at LOS E during both morning and afternoon peak periods.

Table 1. Level of Service at 228th Ave SE / Issaquah-Pine Lake Rd SE / SE 30th St – Without- and With-Project (TTR Revised and With Recently Approved Enrollment Area)

Analysis Condition	Morning Peak Hour 7:15 to 8:15 A.M.		Afternoon Peak Hour 3:00 to 4:00 P.M.	
	LOS ^a	Delay ^b	LOS	Delay
2024 Without-Project	D	36.1	D	47.3
2024 With-Project – From TTR Revised	E	58.6	E	55.3
2024 With-Project & ES #17 Approved Enrollment Area	E	61.9	E	57.1

Source: *Heffron Transportation, Inc., July 2021.*

a. LOS = Level of service.

b. Delay = Average seconds of delay per vehicle.

Although it is estimated that about 30% of elementary school trips are likely to use the 228th Avenue SE / Issaquah-Pine Lake Road SE / SE 30th Street intersection to access the school, expanded sensitivity analysis was conducted that assumed up to 50% of Elementary School #17 trips would use the 228th Avenue SE / Issaquah-Pine Lake Road SE / SE 30th Street intersection. Even with this worst-case assumption, the intersection is still forecast to operate at LOS E during both morning (average delay of 65.0 seconds per vehicle) and afternoon (average delay of 59.5 seconds per vehicle) peak periods.

Effect of Possible High School Boundary Change

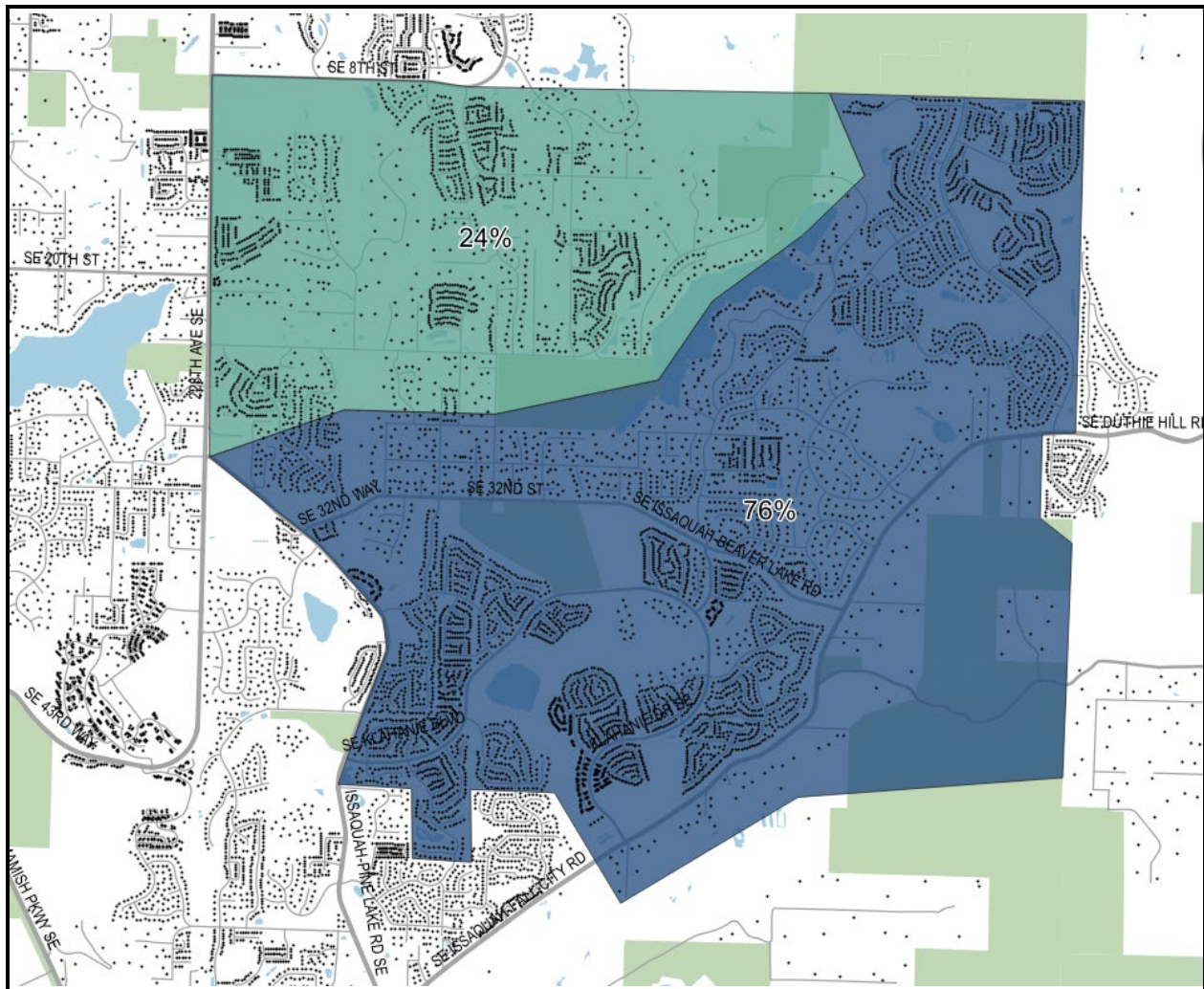
The Boundary Review Board has not yet taken up review of High School #4’s enrollment boundary. However, it is possible that it could also change compared to the one evaluated in the TTR. The potential for change is more limited given that all students who now live north of the site are within Skyline High School’s enrollment area, and as noted previously, the analysis in the TTR already assumed that half (50%) of High School #4’s student population would originate in areas now assigned to Skyline High School. It is unlikely that many more Skyline students would be assigned to the new high school than already assumed, since it would likely require students from the valley be assigned to Skyline to backfill its unused capacity. This situation would draw students past the new High School #4 site to reach Skyline. Regardless, the potential that more of the neighborhoods east of 228th Avenue SE (those currently assigned to Skyline) could be included in the High School #4 enrollment area was tested as a supplemental sensitivity analysis.

The updated Elementary School #17 volumes reflecting its approved enrollment area with 30% using the 228th Avenue SE / Issaquah-Pine Lake Road SE / SE 30th Street intersection combined with the High School #4 with-project volumes used in the TTR analysis were the starting point for the high school boundary sensitivity analysis. As noted above, this reflects a condition where 50% of the High School #4 students would come from student who would otherwise attend Skyline High School. To account for more of the current Skyline enrollment area being assigned to the new high school, specifically areas east of 228th Avenue SE, trips passing through the 228th Avenue SE / Issaquah-Pine Lake Road SE / SE 30th



Street intersection would change directional patterns. Figure 5 shows the area currently assigned to Skyline High School that was tested for potentially being re-assigned to High School #4 and consists of Issaquah School District areas east of 228th Avenue SE and north of Issaquah-Pine Lake Road, SE Issaquah-Fall City Road, and SE Duthie Hill Road.

Figure 5. Skyline High School Enrollment Area Tested for Re-assignment to High School #4 with Trip Distribution Percentages



Source: Author; King County GIS Open Data; Addresses in King County, Accessed: July 19, 2021 <https://gis-kingcounty.opendata.arcgis.com/datasets/kingcounty::addresses-in-king-county-address-point>

The area included for this test together with the household density data from King County’s GIS Open Data, were examined to determine how its residents would access the 228th Avenue SE corridor and the two high school sites—Skyline and the new High School #4. It is estimated that about 25% of student-related trips generated by households located north of about SE 28th Street are estimated to access 228th Avenue SE using SE 24th Street. These trips would be new north-south through trips at the Issaquah-Pine Lake Road SE intersection if those students were re-assigned to High School #4. The remaining 75% of student-related trips from this area (in households south of about SE 28th Street and east of Beaver Lake), would primarily use Issaquah-Pine Lake Road SE to access the 228th Avenue SE corridor. For those trips, a westbound right-turn to Skyline High School would become a westbound left-turn to High School #4.

Likewise, southbound left turns outbound from Skyline High School would become northbound right turns when leaving High School #4. As described in **Appendix F** of the TTR Revised),² an estimated 42% of morning school driveway trips are expected to be linked to existing trips that would occur with or without the school activity. For example, a family member driving a student to school on the way to work is a linked trip. For families residing in the Skyline enrollment area east of 228th Avenue SE, most of those linked trips would involve short out-of-direction trips north to drop off the student before returning to the peak southbound direction on 228th Avenue SE to reach employment destinations. If those students are re-assigned to High School #4, the linked trip would not require out-of-direction travel and would not increase through trips on the corridor (trips would actually decrease on some segments). The re-assignment of AM peak hour trips accounted for the change in both linked trips and those that begin and end within tested enrollment area for High School #4.

For this sensitivity analysis, the proportion of students assigned to the new high school from areas currently assigned to Skyline was increased from 50% to 100% in 10% increments. With those increments, the volumes and directional turn movements through the intersection were adjusted to account for the re-assignments. If 100% of the new high school enrollment were to originate within the current Skyline enrollment area, a total of 517 AM peak hour trips (345 inbound and 172 outbound) could be re-assigned from areas east of 228th Avenue SE through the 228th Avenue SE / Issaquah-Pine Lake Road SE / SE 30th Street intersection. These reflect potential student-related trips; staff trips through the intersection would not be affected by a boundary change.

Figure 6 shows the operational analysis results (levels of service and delay) for the enrollment increments tested, beginning at the without-project level and then showing with-project levels from the 50% assumed in the TTR and ending at 100% originating from the current Skyline enrollment area. As shown, with no changes to the intersection's configuration or capacity, the new High School #4 could have 100 % of its enrollment originating from the current Skyline enrollment area and the intersection would remain operating at LOS E in the morning peak hour. As noted above, this level of shift is highly unlikely since it would require that large portions of the enrollment area that are closer to Skyline High School would have to be re-assigned to within the enrollment area of the new High School #4.

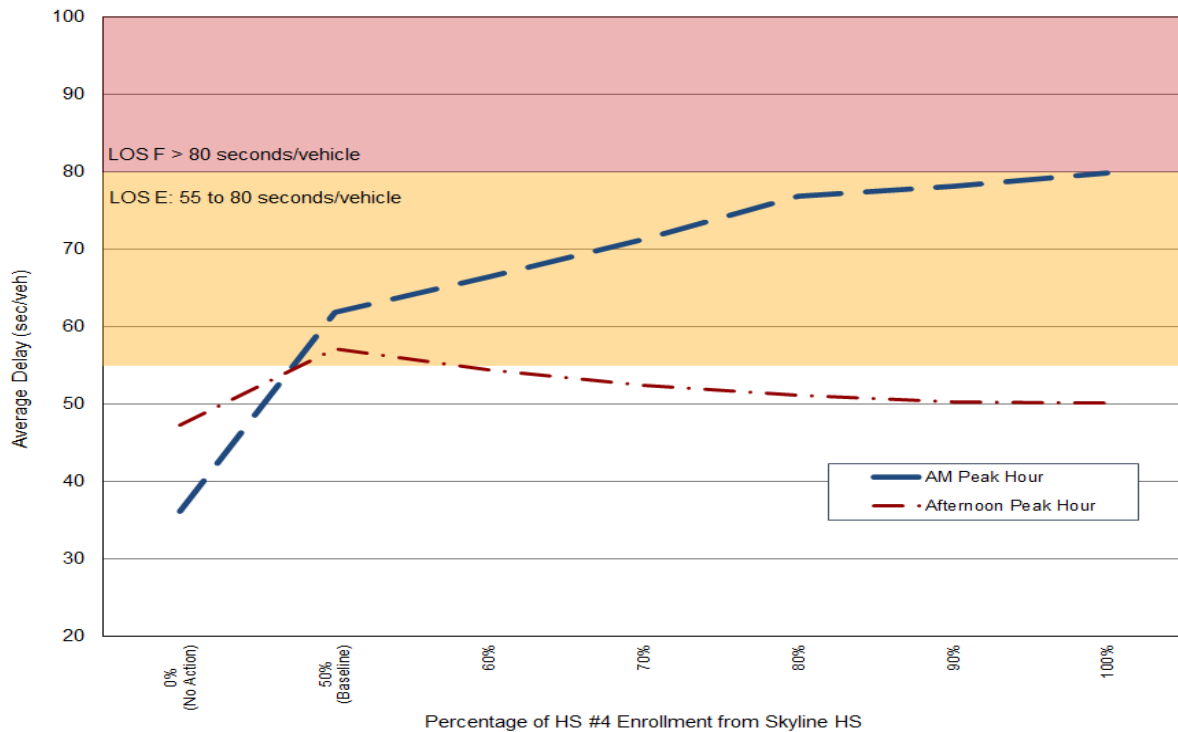
A similar analysis was performed for the afternoon peak hour conditions (results also shown in Figure 6) for which the maximum number of trips that shift travel patterns is estimated at 307 (63 inbound and 244 outbound). That analysis determined that all trips could be shifted to the new High School #4 without causing the subject intersection to fail. In the afternoon peak hour, the shift in enrollment draw area would benefit the intersection, since trips would be removed from high-delay movements (southbound left turn) that conflict with peak direction flows and added to low-delay movements (northbound right turn) that do not conflict with peak flows resulting in slightly reduced levels of overall intersection delay.

The PM peak hour was not examined in detail for this sensitivity analysis, because High School #4 traffic generation is estimated at about half the number of trips estimated for the afternoon peak hour and because the intersection was forecast to operate at a better level of service (LOS D) with less delay (average of 41.0 seconds per vehicle) than predicted for the afternoon peak hour. Therefore, operations are expected to remain at acceptable levels with a shift in PM peak hour trips resulting from the enrollment area changes described.

² *ISD High School #4 / Elementary School #17 – Trip Generation and Distribution – 2nd Update*, Heffron Transportation, Inc., July 31, 2020.



Figure 6. Effect of High School #4 Enrollment Boundary Change on Operations at 228th Ave SE / Issaquah-Pine Lake Rd SE / SE 30th St Intersection



Source: Heffron Transportation, Inc., August 4, 2021

Potential Future 228th Avenue SE Improvements

The City of Sammamish’s future vision for 228th Avenue SE is to widen it to five lanes. Although there is not yet a design, it is assumed that the future five-lane configuration would add a second southbound through lane, and an accompanying receiving lane, to the 228th Avenue SE corridor through the Issaquah-Pine Lake Road SE intersection. Operational analysis of this potential future improvement indicates the intersection would operate at LOS D (average delay of less than 45 seconds per vehicle) in the morning peak hour with 100% of High School #4’s enrollment area entirely within the area now served by Skyline High School.

3. Summary

The analysis determined that changes in the Elementary School #17 enrollment boundary, which have already been approved, would not adversely affect traffic operations compared to those already evaluated in the TTR.

Major changes in the enrollment boundary for High School #4 could increase delays at the 228th Avenue SE / Issaquah-Pine Lake Road SE / SE 30th Street intersection during the AM peak hour. However, the intersection is still projected to operate at LOS E even if 100% of the new High School #4 enrollment were to come from areas now assigned to Skyline High School. This level of shift is highly unlikely. Analysis of the afternoon peak hour conditions determined that all trips could be shifted to the new High School #4 without causing the subject intersection to fail.

MCH/tsm/zdg

