MEMORANDUM

To:	Nathan Nguyen, City of Santa Cruz
From:	Frederik Venter, PE, Blake Silkwood, PE, Kimley-Horn and Associates, Inc.
Date:	November 3rd, 2021
Subject:	Site Ingress/Egress Evaluation and Conceptual Engineering Drawings 831 Water Street

This memorandum presents Kimley-Horn's Site Ingress/Egress Evaluation and Conceptual Engineering evaluation of the proposed redevelopment at 831 Water Street (Project) in the City of Santa Cruz (City).

Project Understanding

The proposed Project is located at the northwest corner of Water Street and North Branciforte Avenue. The Project includes two 5-story mixed-use buildings housing 145 apartment units and 3,057 square foot of ground floor retail. The existing land uses at the project site include a convenience store, retail and self-service car wash and will be replaced with the proposed Project.

Conceptual Engineering Evaluation

To aid the City of Santa Cruz, Kimley-Horn evaluated the proposed development plans for the following engineering criteria:

1. General Plan Roadway Buildout
2. Right-of-Way Impacts
3. Sight Distance Evaluation
4. Fire Access

Kimley-Horn based the Site Ingress/Egress Evaluation and Conceptual Engineering on the development application documents provided by the City with a submission date of September 9th, 2021. This was supplemented by a high-quality aerial photograph. Work was not based on CADD files nor a topographic survey.

General Plan Roadway Buildout

Figures 1 and 2 shows the roadway buildout per the City General Plan adjacent to the Project. This plan accommodates the following City planned improvements:

1. Class 2 bike lanes and green bike lane striping along southbound Branciforte Avenue.
2. Dedicated right turn lane on southbound Branciforte Avenue to turn to westbound Water Street.
3. A traffic signal modification to accommodate the updated sidewalk location and signal visibility requirements per MUTCD Standards. This will involve placing a traffic signal with mast arm for

the westbound Water Street approach and a traffic signal for the southbound Branciforte Avenue approach. This traffic signal modification assumes the existing traffic signal control equipment can remain in place.

4. Class 2 buffered Bike Lanes along westbound Water Street.

Note that this conceptual engineering assumes that the existing Santa Cruz METRO stop along Water Street remains in place, and no bus stop improvements are implemented.

Right-of-Way Impacts

Figure 3 shows the Right-of-Way impacts associated with the City General Plan roadway buildout. To accommodate the General Plan roadway buildout, a dedication of approximately 765 square feet will be required along the Branciforte Avenue frontage.

Sight Distance Evaluation

Figures 4 and 5 show the proposed driveway locations and a stopping sight distance analysis. Kimley Horn evaluated stopping sight distance, basic site circulation, and traffic operations for personal vehicles and delivery vehicles.

To evaluate stopping sight distance, the 2018 American Association of State Highway and Transportation Officials (AASHTO) methodology was utilized. The sight distance required for the geometric and physical conditions, as well as driver behavior and operating speeds are directly related to the resultant distances traversed during perception-reaction time and braking.

Stopping sight distance is defined as the sum of reaction distance and braking distance to come to a complete stop. The reaction distance is based upon the driver reaction time while the braking distance is dependent upon the vehicle speed, roadway grades and the coefficient of friction between the tires and roadway as the vehicle decelerates to a complete stop. This sight distance analysis indicates the minimum visibility that is required for an approaching vehicle on the roadway to stop safely if a vehicle from the Project enters the approaching road or an object is in the roadway. This sight distance evaluation is based on the AASHTO standard criteria of a 3.5 foot driver eye height and 2.0 foot object height.

The analysis used a design speed of 35 mph as a safety factor, as both streets have posted speeds of 30 mph based on the City's most recent Engineering and Traffic Survey. While Branciforte Avenue is on a flat grade, Water Street has a downgrade of approximately 6% and will require accommodation in the sight distance calculation. The AASHTO standard setback for sight distance is typically 14.5 feet from the edge of the major road traveled way and AASHTO also states that the distance from the front of a passenger vehicle to the driver is nearly always eight (8) feet. Based on the Project layout, the intersection sight distance was measured from an 8-foot setback from the roadway traveled way. This assumes that a vehicle has stopped at the back of sidewalk, confirmed that no crossing pedestrians are present, pulled forward and stopped before the bike lane. The vehicle then completes the turn if there is a sufficient gap in traffic.

Based on the existing roadway geometry and design speeds, sight distance for the proposed driveway along Branciforte Avenue meets the AASHTO minimum requirement of 250 feet. However, this will require removal of on-street parking and the landscape strip to be properly maintained with low height vegetation from the Project driveway to Belvedere Terrace, as shown on Figure 4.

For Water Street, a design speed of 35 mph was used for the assessment of vertical and horizontal sight distance due to findings from the City's most recent Engineering and Traffic Survey. The proposed driveway along Water Street meets the AASHTO minimum requirement of 271 feet at 6% downgrade. The vertical sight distance sight distance view line is met by just clearing the existing roadway crest curve as shown on Figure 5. Adequate sight distance was also verified in the field at a design speed of 35 mph. The 85th percentile speed along Water Street is 27 mph, and the posted speed limit is 30 mph. At these 85th percentile speeds, the stopping sight distance is reduced to 215 feet and the vertical sight distance requirement continues to be met.

Fire Access

Figure 6 shows the fire access for the property. Per discussion with the City, the Fire Department has indicated they would stage fire trucks along Water Street to respond to a fire at the Project site. The Fire Department also noted that there is an existing fire access route on the southern edge of the property to egress from 175 and 179 Belvedere Terrace. To maintain this fire egress, the existing driveway on Water Street should be converted to a rolled curb and an access control system installed to prohibit other vehicular access. This access point will be directly adjacent to the proposed signal pole with mast arm on Water Street. An AutoTURN analysis was performed for fire egress, with the results shown on Figure 6.

Findings and Recommendations

Findings:

1. Developers' plans do not account for the proposed southbound exclusive right turn lane along Branciforte Avenue. Relocation of traffic signal and storm drain facilities is required.
2. Sight distance along Branciforte Avenue meets the AASHTO minimum requirement of 250 feet. However, this will require the removal of on-street parking and landscape strip to be maintained with low height vegetation from the Project driveway to Belvedere Terrace.
3. Sight distance along Water Street is met based on AASHTO requirements.
4. The fire egress point on Water Street is sufficient based on AutoTURN analysis. The existing driveway on Water Street should be converted to a rolled curb and an access control system installed to prohibit other vehicular access.

Recommendations:

1. The Applicant to revise the site plan to include the southbound right turn lane along Branciforte Avenue per the City General Plan. Revision shall include relocation of traffic signal equipment and catch basin.
2. A neighborhood permit parking program excluding 831 Water residents be established to help provide adequate parking for residents and offset the parking removal on Branciforte Avenue.
3. The applicant to remove the channelizers for the protected bike lane along the Water Street project frontage. The striped buffered bike lane median can remain.

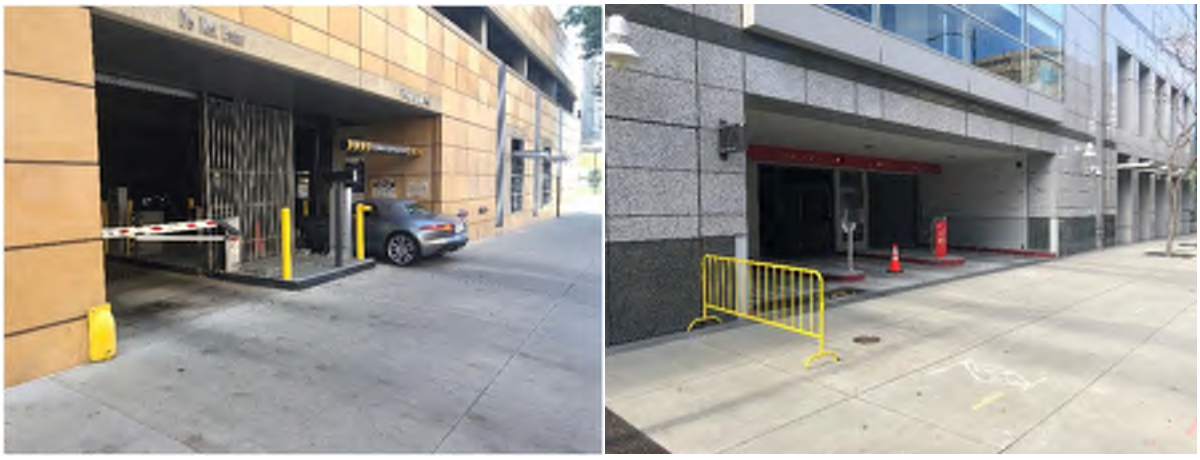
4. The Applicant to work with the City Engineer to install warning signs along Water Street due to the retaining wall screening vehicles entering and exiting the driveway. Examples of MUTCD-compliant signage are shown below.

W1-10(Lt)

SW4-1(CA)

W7-5

5. The Applicant to install an electronically actuated warning device that will emit light and sound when vehicles exit the driveway on Water Street due to the limited vertical sight distance. The device should be placed high on the retaining wall so bikes and vehicles traveling westbound receive warning well before the slope in the roadway. In addition, the Applicant to install a rapid open-close gate system to minimize vehicle queueing on Water Street as they enter the garage. Example precedent images are shown below.



Sample Precedent Images – "Car Coming" Signs and Rapid Open-Close Gates

Additional Studies:

The following studies may be required after finalization of the site plan to address the issues identified in this memo:

1. Traffic Impact Study (TIS): A TIS may be required to address Level of Service (LOS) and queuing at Water Street / Branciforte Avenue intersection. A parking study is also recommended to ensure sufficient parking is provided within the site as per City's parking requirements.

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FIGURE 1

General Plan Roadway Buildout with Fire Truck

831 WATER STREET

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FIGURE 2

General Plan Roadway Buildout with SU-30 Truck

831 WATER STREET

NORTH

GRAPHIC SCALE IN FEET
0 20 40 80

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FIGURE 3
Right-Of-Way Impacts
831 WATER STREET

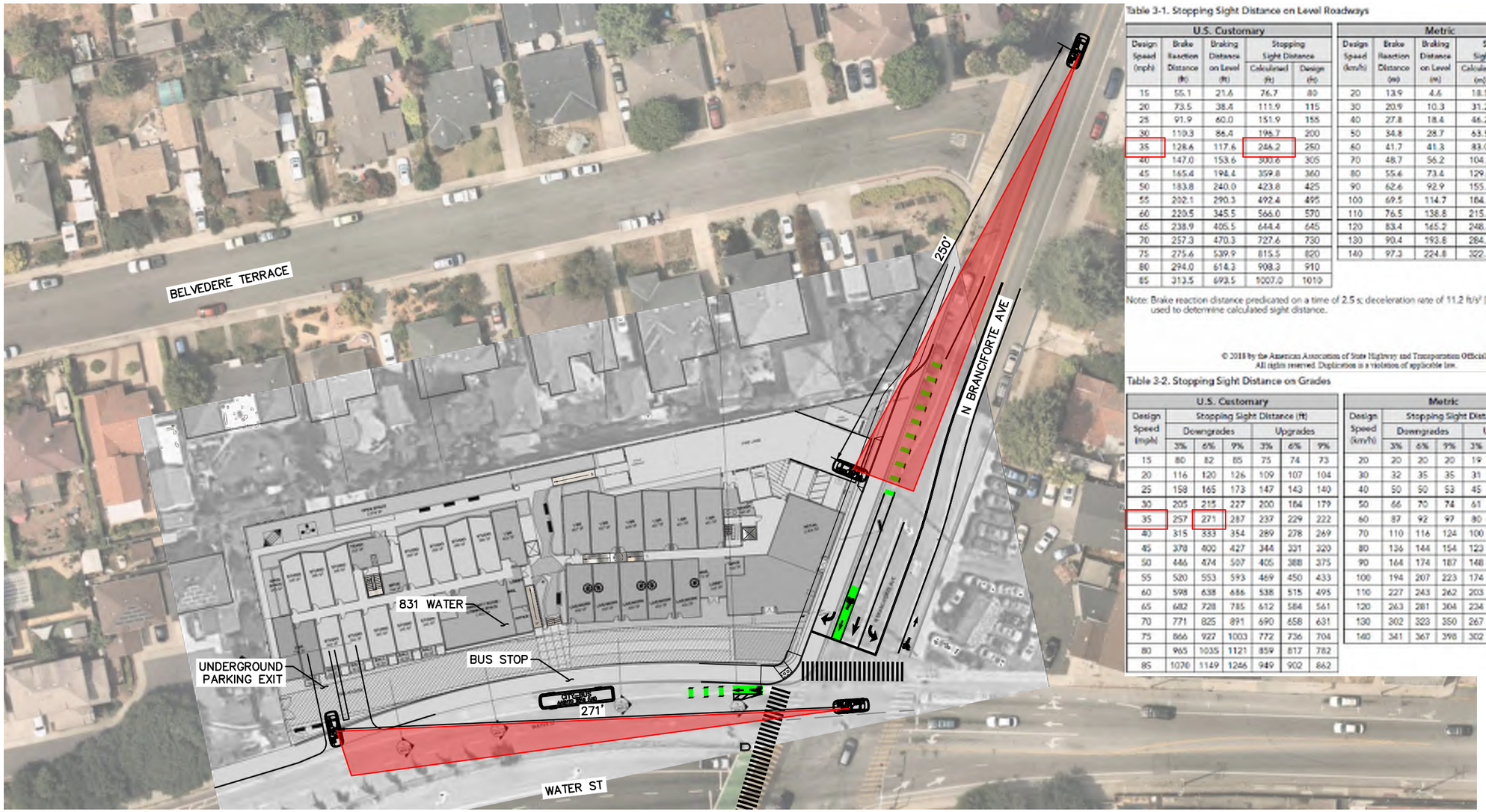

Table 3-1. Stopping Sight Distance on Level Roadways

U.S. Customary					Metric				
Design Speed (mph)	Brake Reaction Distance (ft)	Braking Distance on Level (ft)	Stopping Sight Distance Calculated (ft)	Stopping Sight Distance Design (ft)	Design Speed (km/h)	Brake Reaction Distance (m)	Braking Distance on Level (m)	Stopping Sight Distance Calculated (m)	Stopping Sight Distance Design (m)
15	55.1	21.6	76.7	80	20	13.9	4.6	18.5	20
20	73.5	38.4	111.9	115	30	20.9	10.3	31.2	35
25	91.9	60.0	151.9	155	40	27.8	18.4	46.2	50
30	110.3	86.4	196.7	200	50	34.8	28.7	63.5	65
35	128.6	117.6	246.2	250	60	41.7	41.3	83.0	85
40	147.0	153.6	300.6	305	70	48.7	56.2	104.9	105
45	165.4	194.4	359.8	360	80	55.6	73.4	129.0	130
50	183.8	240.0	423.8	425	90	62.6	92.9	155.5	160
55	202.1	290.3	492.4	495	100	69.5	114.7	184.2	185
60	220.5	345.5	566.0	570	110	76.5	138.8	215.3	220
65	238.9	405.5	644.4	645	120	83.4	165.2	248.6	250
70	257.3	470.3	727.6	730	130	90.4	193.8	284.2	285
75	275.6	539.9	815.5	820	140	97.3	224.8	322.1	325
80	294.0	614.3	908.3	910					
85	313.5	693.5	1007.0	1010					

Note: Brake reaction distance predicated on a time of 2.5 s; deceleration rate of 11.2 ft/s² [3.4 m/s²] used to determine calculated sight distance.

Table 3-2. Stopping Sight Distance on Grades

U.S. Customary							Metric						
Design Speed (mph)	Stopping Sight Distance (ft)						Design Speed (km/h)	Stopping Sight Distance (m)					
	Downgrades			Upgrades				Downgrades			Upgrades		
	3%	6%	9%	3%	6%	9%		3%	6%	9%	3%	6%	9%
15	80	82	85	75	74	73	20	20	20	20	19	18	18
20	116	120	126	109	107	104	30	32	35	35	31	30	29
25	158	165	173	147	143	140	40	50	50	53	45	44	43
30	205	215	227	200	184	179	50	66	70	74	61	59	58
35	257	271	287	237	229	222	60	87	92	97	80	77	75
40	315	333	354	289	278	269	70	110	116	124	100	97	93
45	378	400	427	344	331	320	80	136	144	154	123	118	114
50	446	474	507	405	388	375	90	164	174	187	148	141	136
55	520	553	593	469	450	433	100	194	207	223	174	167	160
60	598	638	686	538	515	495	110	227	243	262	203	194	186
65	682	728	785	612	584	561	120	263	281	304	234	223	214
70	771	825	891	690	658	631	130	302	323	350	267	254	243
75	866	927	1003	772	736	704	140	341	367	398	302	287	276
80	965	1035	1121	859	817	782							
85	1070	1149	1246	949	902	862							

NORTH

GRAPHIC SCALE IN FEET
0 30 60 120

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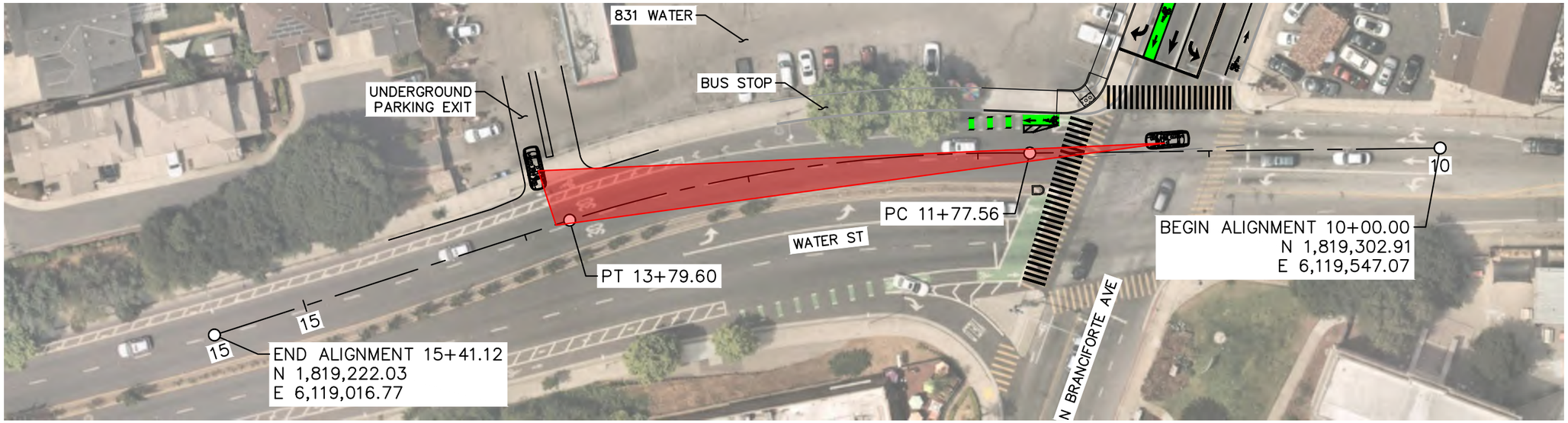
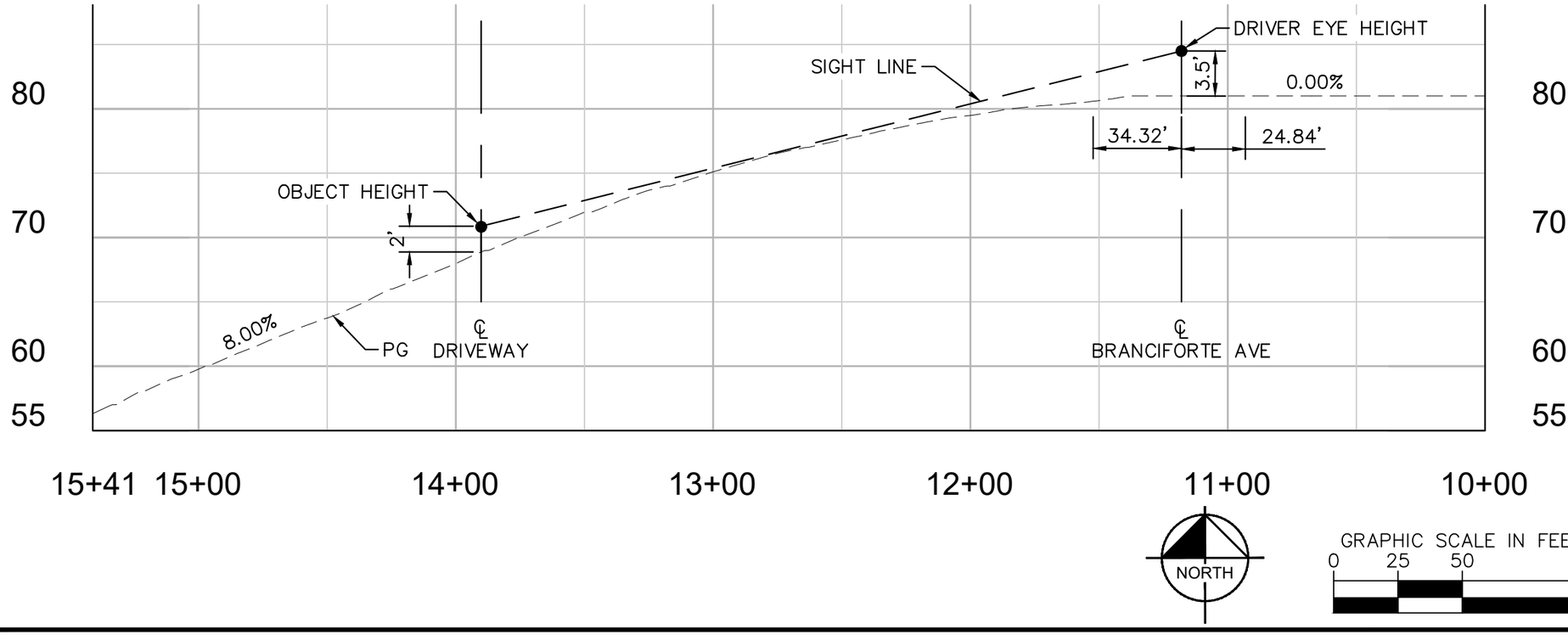
FIGURE 4
STOPPING SIGHT DISTANCE
831 WATER STREET





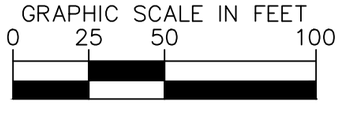


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FIGURE 5

STOPPING SIGHT DISTANCE - CREST VERTICAL CURVE

831 WATER STREET

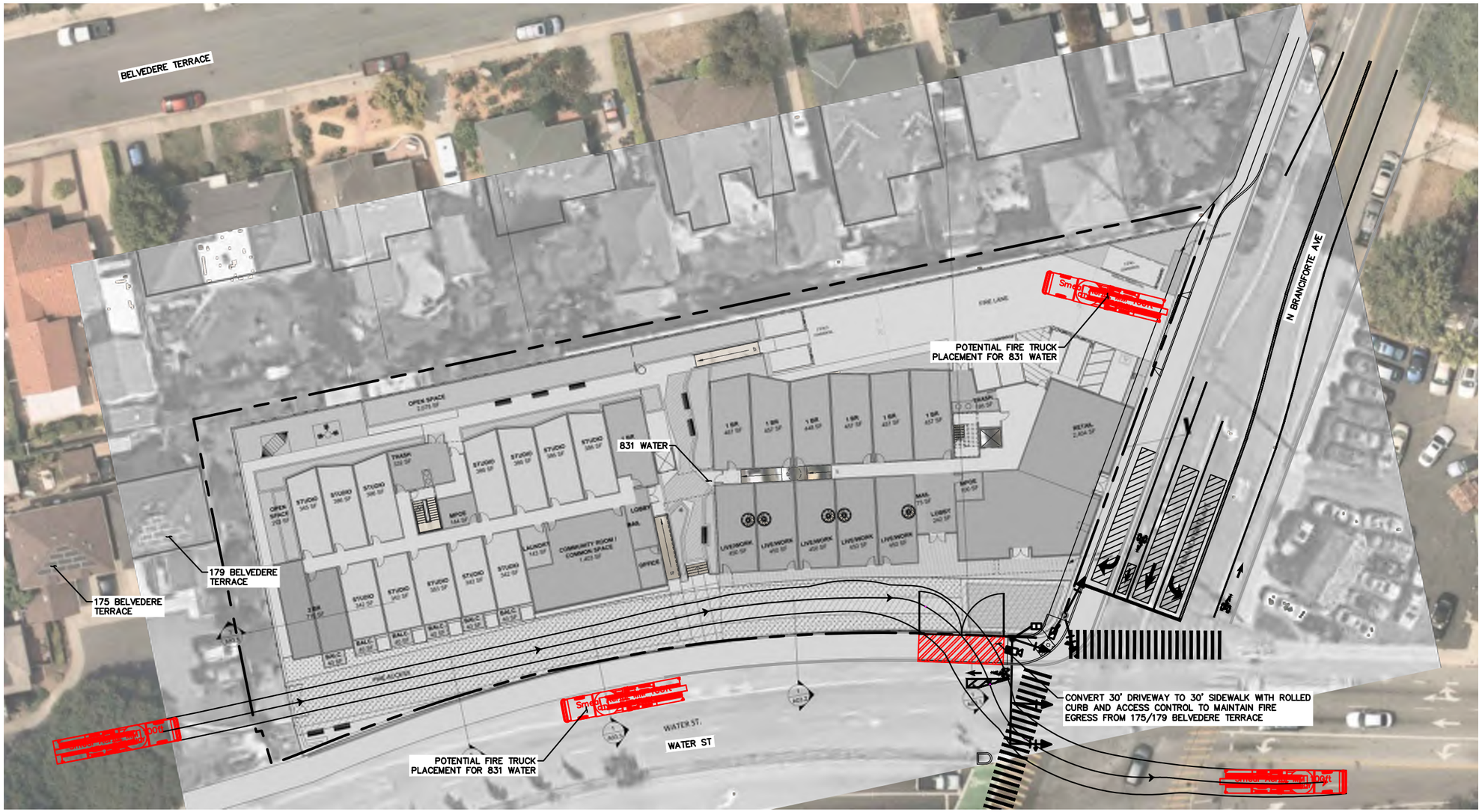

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FIGURE 6
FIRE ACCESS
831 WATER STREET