**PROPOSED INTERSTATE 5 HOV LANE IMPROVEMENTS (SR-55 TO SR-57) PROJECT**

# Noise Abatement Decision Report

Noise Study Report, June 2014

OCTA I-5 HOV Lane Project
Orange County, California

12-ORA-5 PM 31.3/34.2
12-0C8900
Project ID No. 12-0000-0085

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June 16, 2014

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# List of Abbreviated Terms and Definitions

| | |
|---|---|
| Benefited residence | A dwelling unit expected to receive a noise reducton of at least 5 dBA from the proposed abatement measure |
| BMP | Best Management Practice |
| Caltrans | California Department of Transportation |
| CEQA | California Environmental Quality Act |
| CFR | Code of Federal Regulations |
| CHP | California Highway Patrol |
| Date of public knowledge | The date that a project is approved—approval of the final environmental documentation (e.g., Record of Decision) is complete |
| dB | A measure of sound pressure level on a logarithmic scale |
| dBA | A-weighted sound pressure level |
| EB | Eastbound |
| ED | Environmental Document |
| FHWA | Federal Highway Administration |
| GP | General Purpose |
| HOV | High Occupancy Vehicle |
| Leq | Equivalent sound level (energy averaged sound level) |
| Leq[h] | A-weighted, energy average sound level during a 1-hour period |
| LOS | Level of Service |
| NAC | Noise abatement criteria |
| NADR | Noise Abatement Decision Report |
| NB | Northbound |
| NSR | Noise study report |
| OCTA | The Orange County Transportation Authority |

| | |
|---|---|
| Planned, designed, and programmed | A noise-sensitive land use is considered planned, designed, and programmed when it has received final development approval (generally the issuance of a building permit) from the local agency with jurisdiction |
| Protocol | Caltrans Traffic Noise Analysis Protocol |
| Reasonable allowance | A single dollar value—a reasonable allowance per benefited residence that embodies five reasonableness factors |
| SB | Southbound |
| SR-22 | State Route 22 |
| SR-55 | State Route 55 |
| SR-57 | State Route 57 |

# 1. Introduction

The Noise Abatement Decision Report (NADR) presents the preliminary noise abatement decision as defined in the California Department of Transportation (Caltrans) Traffic Noise Analysis Protocol (Protocol, 2011). This report has been approved by a California licensed professional civil engineer. The Noise Study Report (NSR) for the Interstate 5 (I-5) High Occupancy Vehicles (HOV) Improvement Project, prepared by AECOM in June 2014, is hereby incorporated by reference.

## 1.1. Noise Abatement Assessment Requirements

Title 23, Code of Federal Regulations (CFR), Part 772 of the Federal Highway Administration (FHWA) standards (23 CFR 772) and the Caltrans Traffic Noise Analysis Protocol (Protocol) require that noise abatement be considered for projects that are predicted to result in traffic noise impacts. A traffic noise impact is considered to occur when future predicted design-year noise levels with the project "approach or exceed" Noise Abatement Criteria (NAC) defined in 23 CFR 772 or when the predicted design-year noise levels with the project substantially increase over existing noise levels. A predicted design-year noise level is considered to "approach" the NAC when it is within 1 dB of the NAC. A substantial increase is defined as being a 12-dB increase above existing conditions.

23 CFR 772 requires that noise abatement measures that are reasonable and feasible and are likely to be incorporated into the project be identified before adoption of the final environmental document.

The Protocol establishes a process for assessing the reasonableness and feasibility of noise abatement. Before publication of the draft environmental document, a *preliminary noise abatement decision* is made. The preliminary noise abatement decision is based on the *feasibility* of evaluated abatement and the *preliminary reasonableness determination.* Noise abatement is considered to be acoustically feasible if it provides noise reduction of at least 5 dBA at receivers subject to noise impacts. Other nonacoustical factors relating to geometric standards (e.g., sight distances), safety, maintenance, and security can also affect feasibility.

The preliminary reasonableness determination is made by calculating an allowance that is considered to be a reasonable amount of money, per benefited residence, to spend on abatement. This *reasonbleness allowance* is then compared to the engineer's cost estimate for the abatement. If the engineer's cost estimate is less than the allowance, the preliminary determination is that the abatement is reasonable. If the cost estimate is higher than the allowance, the preliminary determination is that abatement is not reasonable.

The NADR presents the preliminary noise abatement decision based on acoustical and nonacoustical feasibility factors and the relationship between noise abatement allowances and the engineer's cost estimate. The NADR does not present the final decision regarding noise abatement; rather, it presents key information on abatement to be considered throughout the environmental review process, based on the best available information at the time the draft environmental document (ED) is published. The final overall reasonableness decision will take this information into account, along with other reasonableness factors identified during the environmental review process. These factors may include:

- impacts of abatement construction,
- public and local agency input,
- life cycle of abatement measures,
- views/opinions of impacted residents, and
- social, economic, environmental, legal, and technological factors.

At the end of the public review process for the ED, the final noise abatement decision is made and is indicated in the final ED. The preliminary noise abatement decision will become the final noise abatement decision unless compelling information received during the environmental review process indicates that it should be changed.

## 1.2. Purpose of the Noise Abatement Decision Report

The purpose of the NADR is to:

- summarize the conclusions of the NSR relating to acoustical feasibility and the reasonable allowances for abatement evaluated,
- present the engineer's cost estimate for evaluated abatement,
- present the engineer's evaluation of non-acoustical feasibility issues,
- present the preliminary noise abatement decision, and
- present preliminary information on secondary effects of abatement (impacts on cultural resources, scenic views, hazardous materials, biology, etc.).

The NADR does not address noise barriers or other noise-reducing treatments required as mitigation for significant adverse environmental effects identified under the California

Environmental Quality Act (CEQA). Based on the results of the Noise Study Report, however, no significant noise impacts are anticipated under CEQA.

## 1.3. Project Description

The California Department of Transportation – District 12 (Caltrans), in cooperation with the Orange County Transportation Authority (OCTA), is proposing to improve I-5 between SR-55 HOV viaduct connection and SR-57, within the City of Santa Ana in Orange County. I-5 (SR-55 to SR-57) HOV Lanes Improvement Project (project) proposes the addition of one high occupancy vehicle (HOV) lane in each direction on a 2.9-mile stretch of I-5 through the urban core of Orange County, providing additional HOV capacity and reducing freeway congestion. In addition to the HOV lane improvements, the project proposes the removal of the southbound off-ramp and northbound on-ramp HOV structure at Main Street (referred to as the "Main Street HOV drop structure"). All of the key project improvements are proposed to take place within the existing state right of way; however, where necessary, sound walls outside of the existing state right of way were evaluated. It is necessary to evaluate sound walls outside of existing state right of way where sound walls within state right of way were not feasible. See the NSR for more detail on the sound walls evaluated outside of existing state right of way. The project is primarily funded by OCTA with State Transportation Improvement Program (STIP) and Surface Transportation Program (STP) funds and is proposed to start construction in 2016 and be completed in 2018. Figures 1 and 2 locate the project regionally and locally.

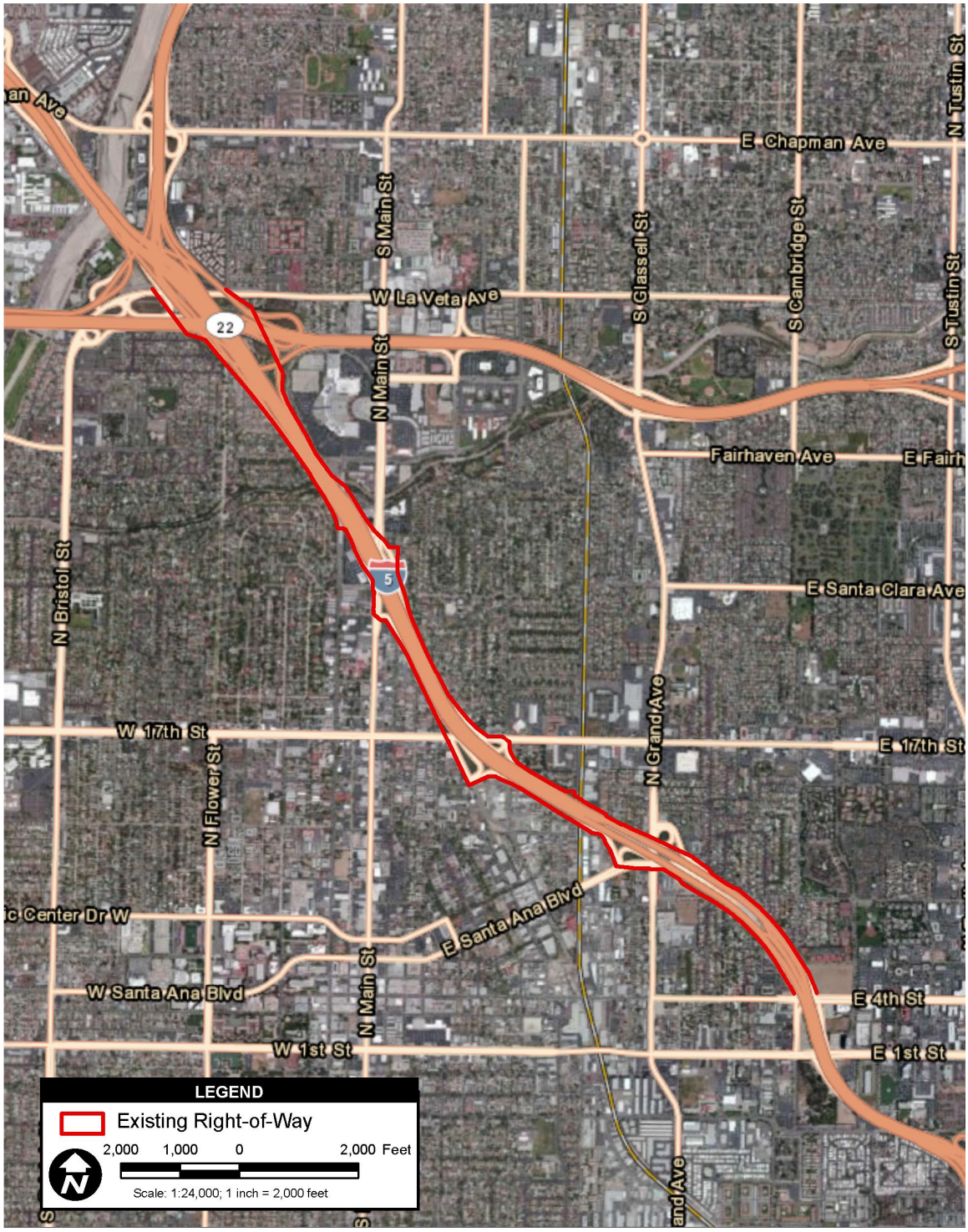
The build condition under consideration is described below. The build condition is Build Alternative 5B, as referenced in Caltrans's previously completed Project Study Report (PSR). Other preceding numbered alternatives have been rejected from further consideration.

## 1.4. Project Purpose and Need

The Orange County Transportation Authority (OCTA) is the project sponsor. Caltrans is the lead agency and provides oversight under CEQA and NEPA under the NEPA authority assigned to Caltrans by the US Department of Transportation (NEPA Assignment MOU), effective October 1, 2012, for Caltrans' participation in the Surface Transportation Project Delivery Program, pursuant to, 23 USC 327, as amended by Moving Ahead for Progress in the 21st Century Act (MAP-21).

**Figure 1. Regional Map**

**Figure 2. Project Study Area Map**



The primary purpose of the proposed project is to improve traffic operations and reduce congestion on I-5 from north of SR-55 HOV viaduct connection to I-5 to south of SR-57. This will improve the safe and efficient local and regional movement of people and goods while minimizing environmental and community impacts. I-5 is the primary freeway route connecting Los Angeles, Orange, and San Diego counties. The project would extend along I-5 for approximately 2.9 miles through the urban core of Orange County. In Orange County, I-5 continues to experience significant traffic congestion, making the proposed project integral to the local community and the region. The proposed project is designed to address congestion and travel delay in the HOV lanes within the project limits.

The traffic congestion results in substantial motorist delay, reduced traffic circulation and level of service (LOS), and increased air pollution from idling vehicles. The proposed improvements would provide additional HOV capacity in both I-5 directions, which would reduce traffic congestion in the HOV and general-purpose lanes within the project limits.

## 1.5. Proposed Build Condition

The build condition would add one new HOV lane (HOV-2) adjacent to the existing HOV lane (HOV-1) in both directions of I-5 between Santa Ana Boulevard/Grand Avenue HOV ramps and SR-57. The concrete barriers that currently separate the HOV-1 lane from the general purpose (GP) lanes in this span of I-5 would be removed. Continuous ingress/egress striping would be provided between the HOV-2 lane and the GP lanes throughout the project limits, except at locations where existing bridge columns are located between the HOV lanes and the GP lanes, including the Lincoln Avenue overcrossing, the North Broadway overcrossing, and the SR-22 separation. All of the key improvements would occur within the existing right of way boundaries.

To accommodate the addition of the HOV-2 lanes, each HOV-1 lane would be moved slightly toward the freeway centerline and the left shoulder would be modified. The existing center median concrete barrier would be relocated at various locations, and existing drainage inlets located along the concrete barriers would be relocated, as necessary. The GP lanes would be shifted slightly toward the outside and the right shoulder would also be modified to accommodate this shift. Shifting the GP lanes to the outside would be accomplished within the paved or landscaped Caltrans right-of-way. In the vicinity of the Lincoln Avenue overcrossing, moving the GP lanes toward the outside would require construction of a new tie-back retaining wall on the northbound and southbound sides of the freeway. Widening in the vicinity of the overcrossing would entail approximately 12 feet of additional pavement width on each side, with an additional 10 feet of reconstruction on existing freeway pavement.

A portion of existing sound wall 23b shown on Figure 3-10 would be reconstructed. The wall is located along the southbound side of the freeway and adjacent to the Santa Ana Boulevard/Grand Avenue exit ramp. Sound wall 23b is a barrier that sits atop the existing retaining wall that runs along the exit ramp. Project improvements would conflict with the structural foundation of the retaining wall underlying SW-23b, requiring reconstruction of both the retaining wall and SW-23b. The retaining wall would be removed and reconstructed in the same location, and SW-23b would be reconstructed to achieve the same top of wall elevations and horizontal extents as existing SW-23b, therefore, the noise modeling for the existing and future conditions show the same wall. The primary change to the wall would be that the wall foundation would be constructed at a lower elevation to accommodate the ramp widening. Approximately 200 linear feet of the wall would require reconstruction.

California Highway Patrol (CHP) median enforcement areas would be constructed adjacent to the HOV lanes in both freeway directions. On the southbound side, the enforcement areas would be constructed between 17th Street and Main Street. On the northbound side, they would be constructed between the Broadway Street overcrossing and the I-5 SB to State Route 22 (SR-22) Eastbound (EB) connector overcrossing.

Storm water treatment best management practices (BMPs) would be constructed where feasible within the project area.

A storm water pump station located along SB I-5, just north of the Lincoln Avenue overcrossing, would be reconstructed, along with its inlet pipe and access staircase, to accommodate the lane configuration and proposed retaining wall.

Slight adjustments would be made to the following entrance/exit ramp areas to accommodate the proposed lane configurations described above:

- Southbound (SB) I-5 Grand Avenue HOV entrance ramp
- SB I-5 to Santa Ana Boulevard/Grand Avenue exit ramp
- 17th Street to SB I-5 entrance ramp
- Northbound (NB) I-5 to 17th Street exit ramp
- Santa Clara Avenue to NB I-5 entrance ramp

Five existing overhead sign structures would be relocated and new sign structures for the modified HOV configurations would be installed.

Another feature of the build condition is removal of the Main Street HOV drop structure located west of the intersection of Main Street and Edgewood Road. Under existing conditions, a concrete structure that crosses over the northbound side of I-5 provides a direct entrance to the northbound HOV lanes and a direct exit from the southbound HOV lanes, with access to and from North Main Street and Edgewood Road. This overcrossing would be demolished and removed and the access to and from the HOV lanes would be eliminated. A new concrete barrier would be installed on the west side of the affected portion of North Main Street, which in turn would be restriped to remove the lanes that currently access this ramp. This also would require a reconfiguration of the signal at the intersection of North Main Street and Edgewood Road. Below the structure, existing concrete barriers and retaining walls that currently separate the ramp lanes from the HOV lanes would be removed and a new retaining wall would be constructed to account for the southbound HOV lanes' higher elevation relative to the northbound HOV lanes.

## 1.6. Affected Land Uses

A field investigation was conducted to identify land uses (i.e., Activity Categories) that could be subject to traffic and construction noise impacts from the proposed project. Both single-family residences and multifamily residences were identified as Activity Category B land uses in the project area. Activity Category C land uses include schools (the Wallace R. Davis Elementary School), parks (e.g., William W. Eldridge Park and Saddleback View Park), and the Discovery Science Center. Activity Category E land uses include several hotels and motels (e.g., Motel 6 and the Red Roof Inn). Existing land uses in the project area are described in further detail below:

- **From SR 57 to Main Street:** Land uses within this segment of the project include a mix of single and multi-family residential developments, commercial facilities, and a science museum. East of I-5 between SR 22 and Main Street, land use is dominated by commercial development but also includes a hotel and the Discovery Science Center. West of I-5 between SR 22 and Main Street, there is a large tract of residential development, which includes a neighborhood park area.

- **From Main Street to Grand Avenue:** Land use east of I-5 between Main Street and Grand Ave is dominated by residential development, but also includes commercial retail facilities near 17$^{th}$ Street and Lincoln Avenue. West of I-5 between Main Street and Lincoln Avenue is a mix of apartment complexes, single family homes, commercial facilities, and a school. Commercial facilities, a baseball field, and some residences exist west of I-5 between Lincoln Avenue and Grand Avenue.

- **From Grand Avenue to 4th Street:** Land use east and west of I-5 between Grand Avenue and 4th Street is dominated by residential land use (both single family homes and apartment complexes with outdoor pool areas), but also includes a few commercial areas, and a playground.

As required by the Protocol, although all developed land uses are evaluated in this analysis, noise abatement is only considered for areas of frequent human use that would benefit from a lowered noise level. In general, an area of frequent human use is an area where people are exposed to traffic noise for an extended period of time on a regular basis. Accordingly, this impact analysis focuses on locations with defined outdoor activity areas, such as residential backyards and common use areas at multifamily residences.

Receivers M-142 and M-145 represent exterior activity areas (playgrounds) at the Wallace R. Davis Elementary School on French Street in Santa Ana. As an exterior activity area/playground, these two receivers have been classified as Land Use Category C, and the exterior Land Use Category C Noise Abatement Criteria of 67 dBA was used as the basis for determining a noise impact at the Wallace R. Davis Elementary School. There are no other schools within the project limits.

The existing land uses within the project area are represented by a total of 202 modeled receivers. Each modeled receiver location was classified according to the Activity Categories listed in the Noise Study Report. Activity Categories for each modeled receiver are also listed in the Noise Study Report. Two receivers (M-042 and M-181) represent satellite/remote parking areas with no other buildings or land uses associated with the receiver, and were classified as non-noise sensitive Activity Category F. For other modeled receivers located within a parking area, Activity Categories were defined according to the overall land use (i.e. an office building or retail facility) of that property. For example, M-055 is located within the parking lot of an office building, and was therefore classified as Activity Category E.

# 2. Results of the Noise Study Report

The NSR for this project was prepared by AECOM on June, 2014.

## 2.1. Noise Impact Locations

Modeling results indicate that predicted traffic noise levels for the 2040 design-year build condition approach or exceed the NAC of 67 dBA $L_{eq(h)}$ for Activity Category B land uses at 45 modeled receptors and six modeled Category C receivers. Build condition noise levels are predicted to exceed the NAC of 72 dBA $L_{eq(h)}$ at five Activity Category E land uses. The receivers where predicted noise levels approach or exceed the NAC are not focused around any specific locations within the project area; they are scattered throughout the corridor on both sides of I-5.

Therefore, traffic noise impacts are predicted to occur at Activity Category B, C, and E land uses within the project area. When compared to the existing noise levels, future traffic noise levels for the 2040 design-year build conditions are generally predicted to stay the same or increase by one to two dB. While the increases in noise levels caused by the proposed project are small and imperceptible, the existing noise levels are high enough that the NAC is already exceeded at many locations. The short-term measurements and long-term monitoring of the existing noise levels support this.

Because traffic noise impacts are predicted to occur, noise abatement must be considered.

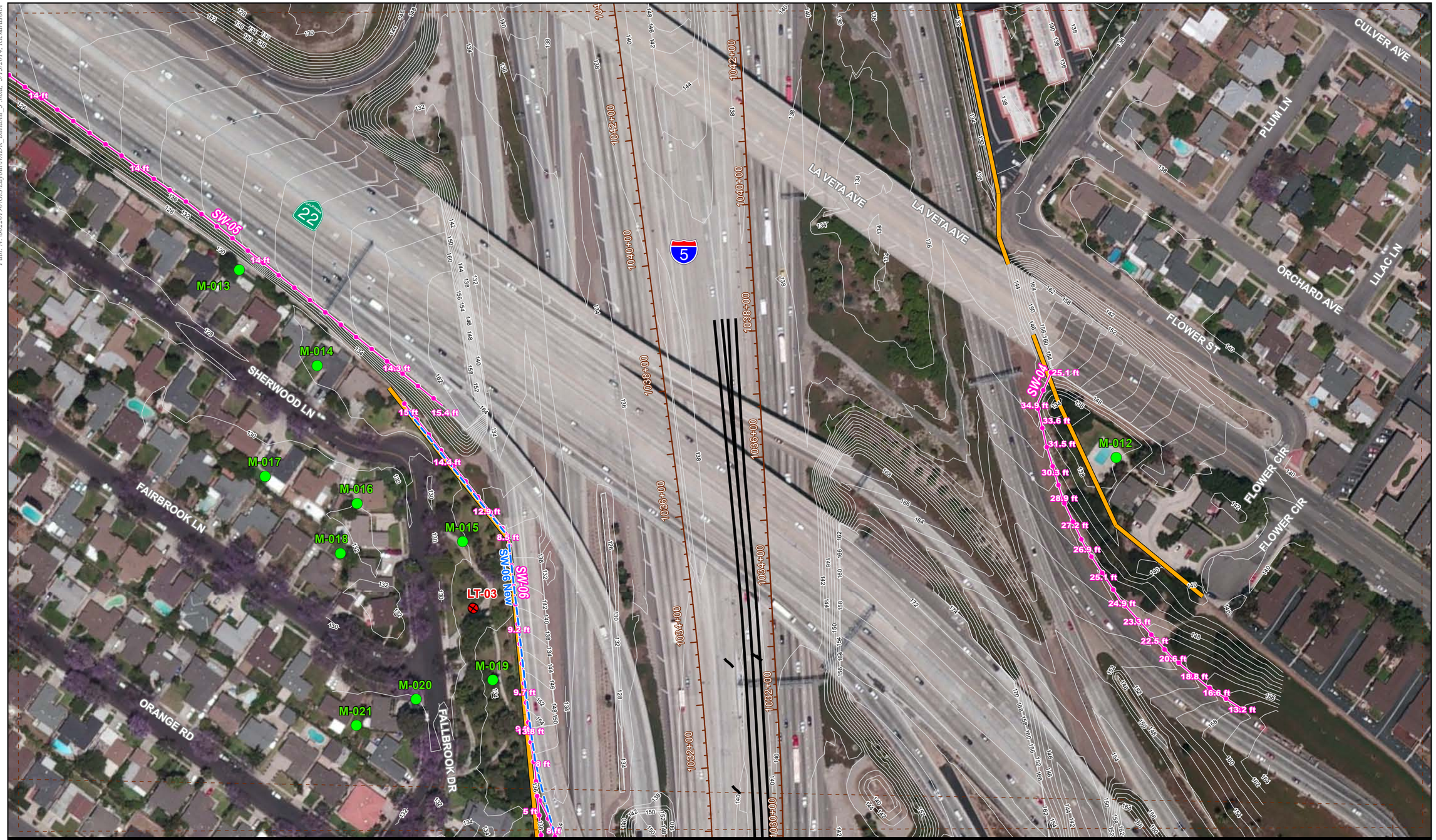
The following receiver locations would be exposed to noise levels that approach or exceed the NAC under Activity Categories B, C, and E under the build condition:

- **Receivers M-015, M-019, M-020**: These receivers represent a park and a single family residence located on the west side of I-5 between Sherwood Lane and Flower Street (Figure 3-1). Currently, there is an existing sound wall 913 feet long varying 8 to 15 feet in height shielding these receivers.
- **Receivers M-041, M-043, M-045, M-047, M-049 through M-053, M-056, M-058, and M-060:** These receivers represent single family homes located on the west side of I-5 between Flower Street and Broadway (Figure 3-3 and Figure 3-4). Currently, there is an existing sound wall varying 9 to 16 feet in height shielding these receivers.
- **Receiver M-042:** This receiver represents a commercial parking lot located on the east side of I-5 near Broadway Road (Figure 3-4). Currently, there is no sound wall shielding this receiver.

- **Receiver M-057:** This receiver represents the Discovery Science Center located on the east side of I-5 near Main Street (Figure 3-5 ). Currently, there is no existing sound wall shielding this receiver.
- **Receiver M-059:** This receiver represents a single-family home located east of I-5 between Edgewood Road and 17th Street (Figure 3-5). Currently, there is an existing sound wall 3,629 feet in length and 15 feet in height shielding this receiver.
- **Receiver M-070:** This receiver represents an office building located west of the I-5 on the corner of Main Street and Santa Clara Avenue (Figure 3-5). Currently, there is no existing sound wall shielding this receiver.
- **Receivers M-077, M-084, M-087, M-090, M-095, M-097, M-099:** These receivers represent single-family homes located east of I-5 located between Edgewood Road and 17th Street (Figure 3-6 and Figure 3-7). Currently, there is an existing sound wall 3,629 feet in length that varies approximately 13 to 16 feet in height shielding these receivers.
- **Receivers M-106, M-108:** These receivers represent a single-family home and two apartment complexes located on the west side of I-5 between Main Street and 17th Street (Figure 3-7). Currently, there is an existing sound 1,887 feet in length that varies approximately 7 to 16 feet in height shielding these receivers.
- **Receiver M-118:** This receiver represents the parking/display area of a car dealership located east of I-5 along 17th Street (Figure 3-8).
- **Receivers M-119, M-121, M-123, M-129, and M-134:** These receivers represent three single-family homes and two apartment complexes located on the northeast side of I-5 between Lincoln Ave and 17th Street (Figure 3-8 and Figure 3-9). Currently, there are two existing sound walls shielding these receivers. Existing SW-19 is 639 feet in length and is approximately 12 feet in height. SW-20 is 1,075 feet long and is approximately 14 feet in height.
- **Receivers M-125, M-128, and M-135:** These receivers represent two apartment complexes and a single-family home located on the west side of I-5 along Penn Way, south of 17th Street (Figure 3-8). Currently, there are no sound walls shielding these receivers.
- **Receivers M-148, M-161:** These receivers represent single-family residences located west of I-5 between Custer Street and Lincoln Ave (Figure 3-9). Currently, there are several privacy walls within the neighborhood, but there is no sound wall along I-5 shielding these receivers.
- **Receivers M-149, M-156, M-159, M-160, and M-163:** These receivers represent single-family homes located on the northeast side of I-5 between Lincoln Avenue and

Grand Avenue (Figure 3-10). Currently, there is an existing sound wall 1,314 feet in length varying 12 to 16 feet in height shielding these receivers.

- **Receiver M-165:** This receiver represents an industrial building located on the west side of the I-5 along Washington Avenue and Fuller Street (Figure 3-10). Currently, there is no existing sound wall shielding this receiver.
- **Receiver M-178:** This receiver represents an office building parking lot located on the west side of the I-5 at the intersection of Santa Ana Boulevard and Grand Avenue (Figure 3-11). Currently, there is no existing sound wall shielding this receiver.
- **Receivers M-179 and M-185:** These receivers represent two sports fields located west of I-5 along Santa Ana Boulevard (Figure 3-11). Currently, there is no sound wall shielding these receivers.
- **Receivers M-186, M-192, and M-193:** These receivers represent single-family homes located on the northeast side of I-5 between Grand Avenue and Park Court Place (Figure 3-12). Currently, there is an existing sound wall that varies approximately 9 feet to 14 feet in height shielding these receivers.
- **Receivers M-189, M-190, M-194, M-198, M-202, M-209:** These receivers represent single-family homes and a park located on the west side of I-5 between Grand Avenue and 4$^{th}$ Street (Figure 3-12 and Figure 3-13). Currently, there is a 2,586-foot long existing sound wall shielding these receivers.




LEGEND

Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
- Build Alternative 5B
- Existing ROW
- Contour Line
- Stations
- Map Extent

**Figure 3-1**
**Noise Measurement, Noise Modeling and Sound Wall Locations**



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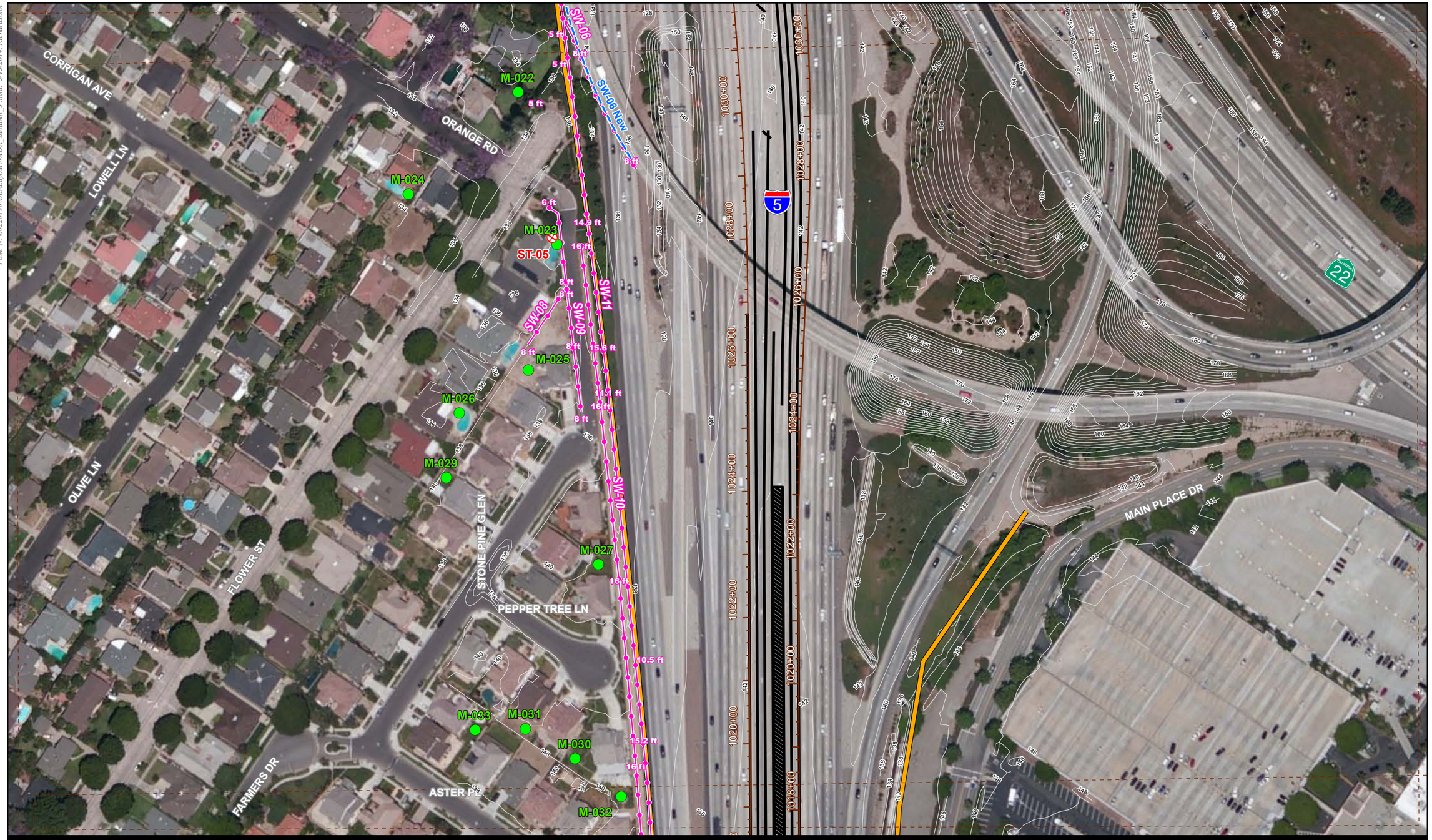


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Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

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- Long Term Measurement Location
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- Modeled Sound Wall
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- Build Alternative 5B
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- Contour Line
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- Map Extent

**Figure 3-2**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

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Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
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**Figure 3-3**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

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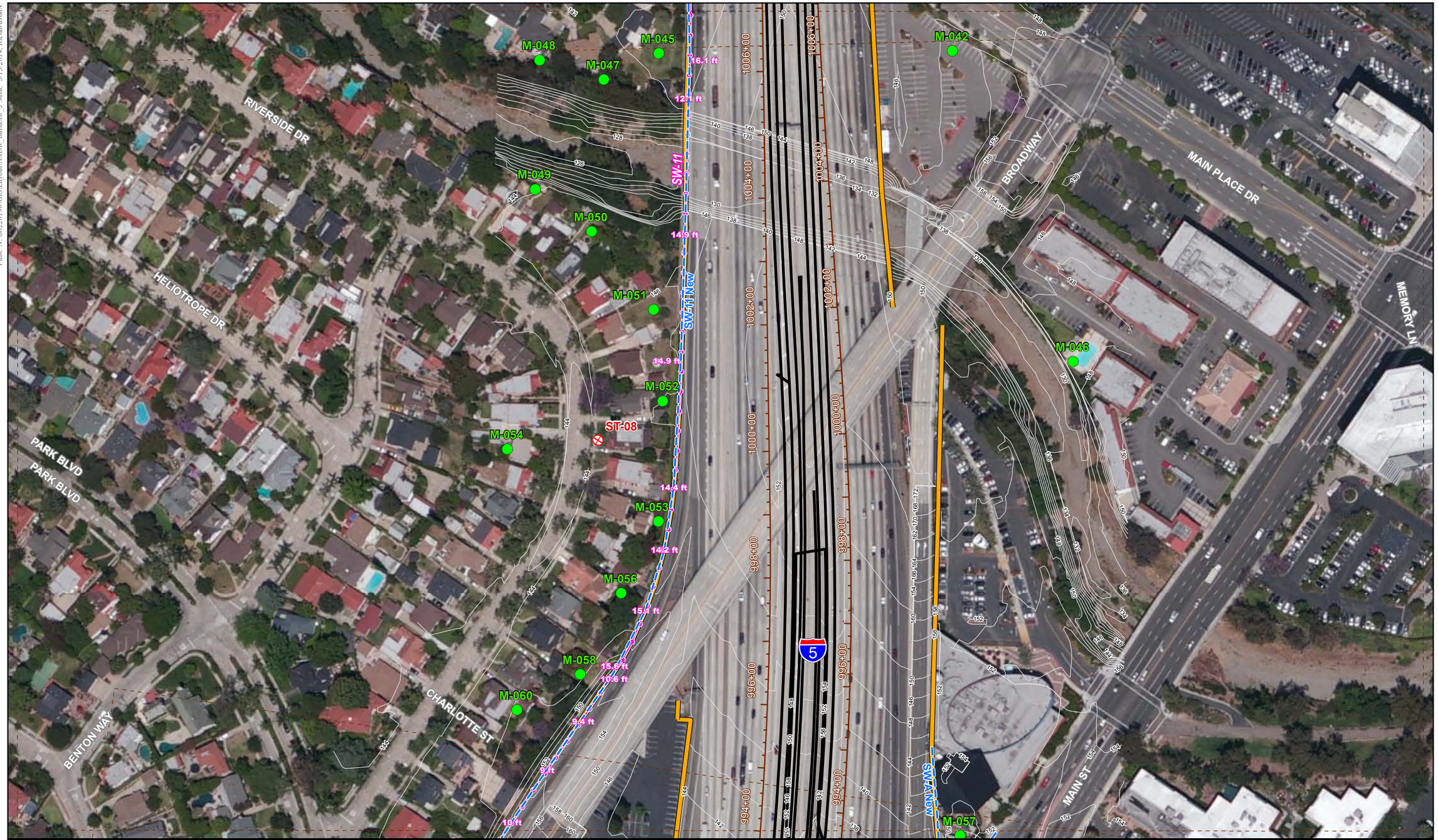


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Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

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- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
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- Stations
- Map Extent

**Figure 3-4**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

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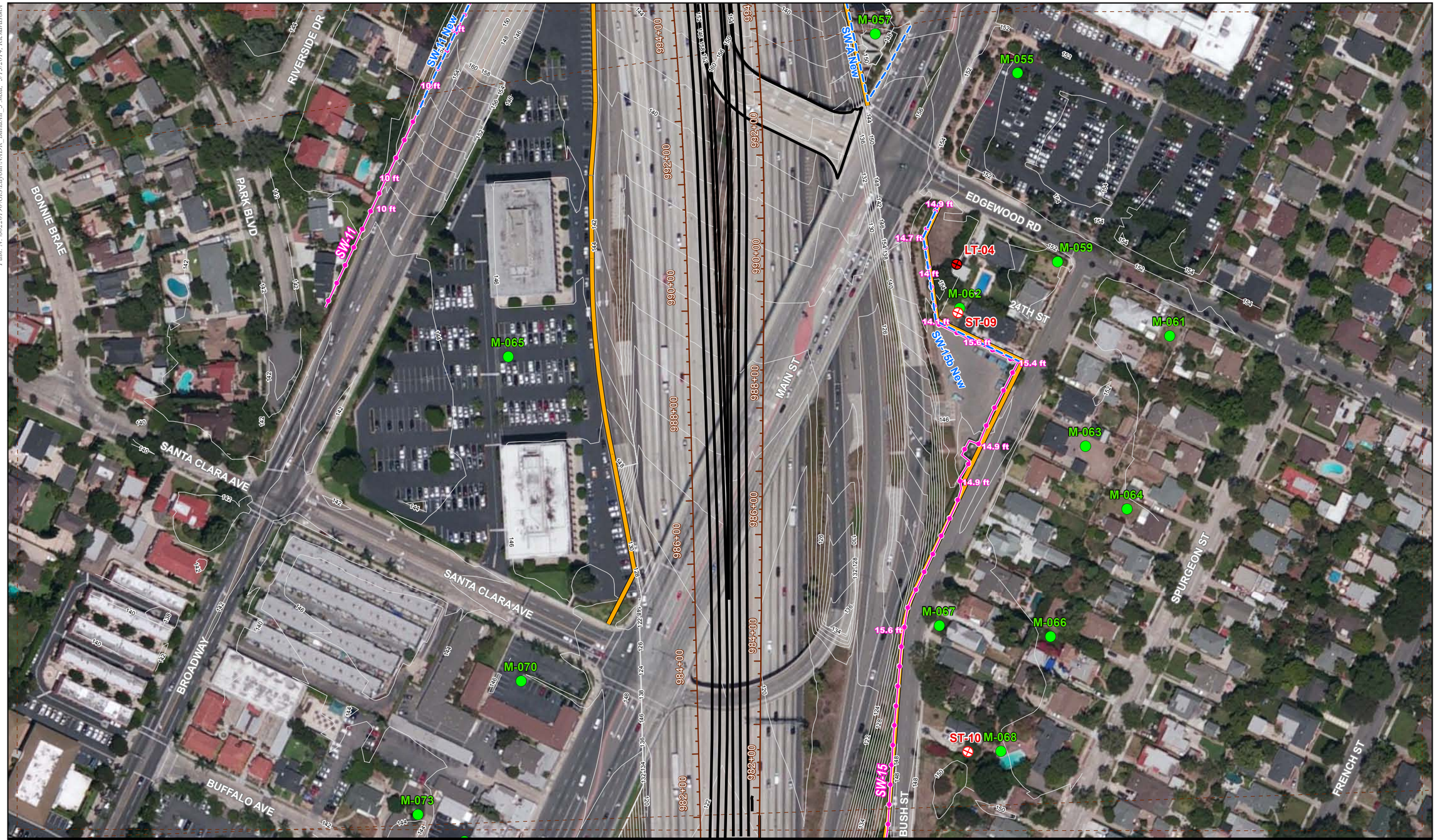


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Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
- Build Alternative 5B
- Existing ROW
- Contour Line
- Stations
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**Figure 3-5**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

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LEGEND

Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
- Build Alternative 5B
- Existing ROW
- Contour Line
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- Map Extent

**Figure 3-6**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

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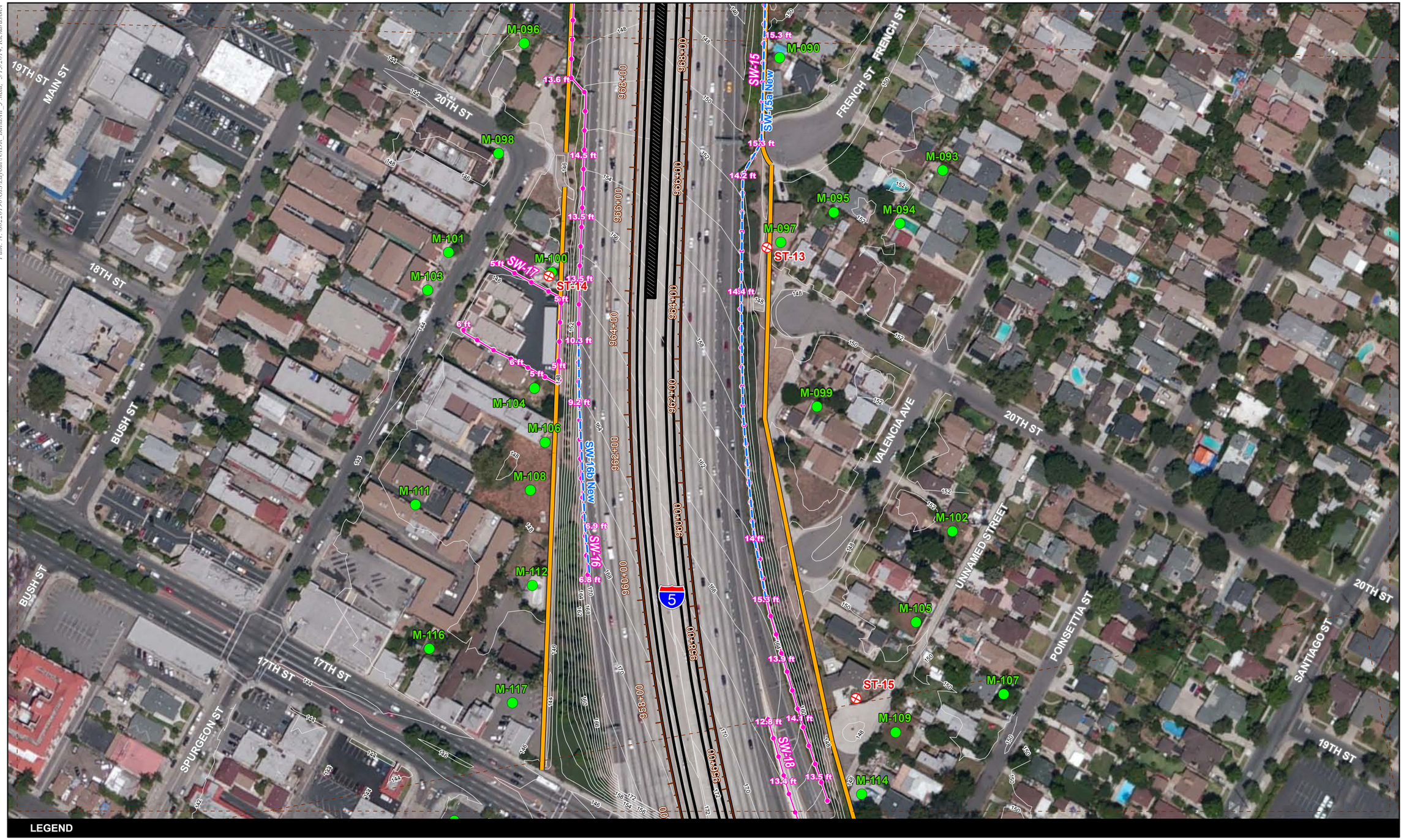


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Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
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- Contour Line
- Stations
- Map Extent

**Figure 3-7**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

Path: N:\60220190\GIS\Layout\NADR_BuildAlt_3.mxd, 5/13/2014, Richardson A

LEGEND

Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

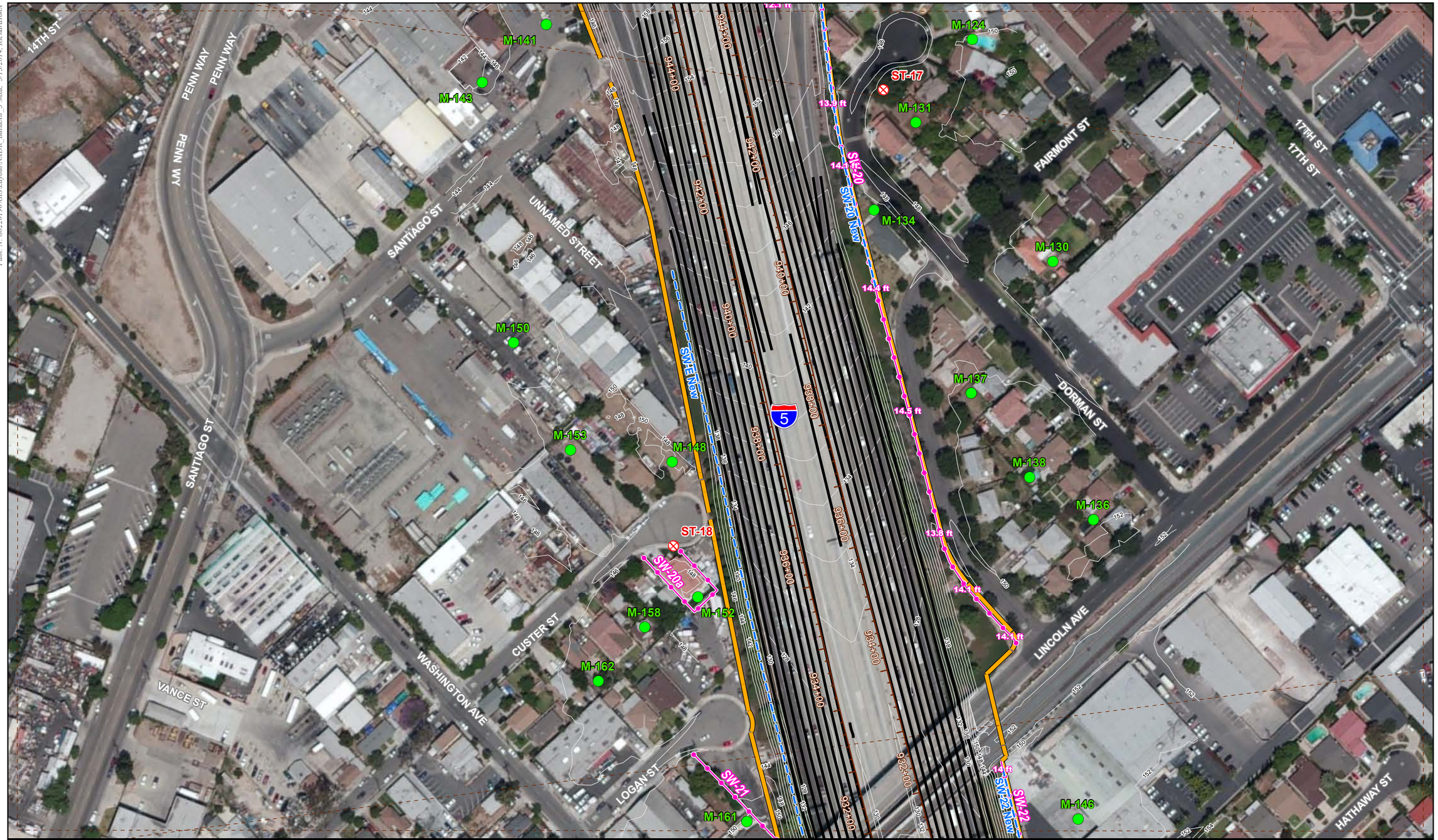
0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
- Build Alternative 5B
- Existing ROW
- Contour Line
- Stations
- Map Extent

**Figure 3-8**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

Path: N:\60220190\GIS\Layout\NADR_Build Alt_3.mxd, 5/13/2014, Richardson A




LEGEND

Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

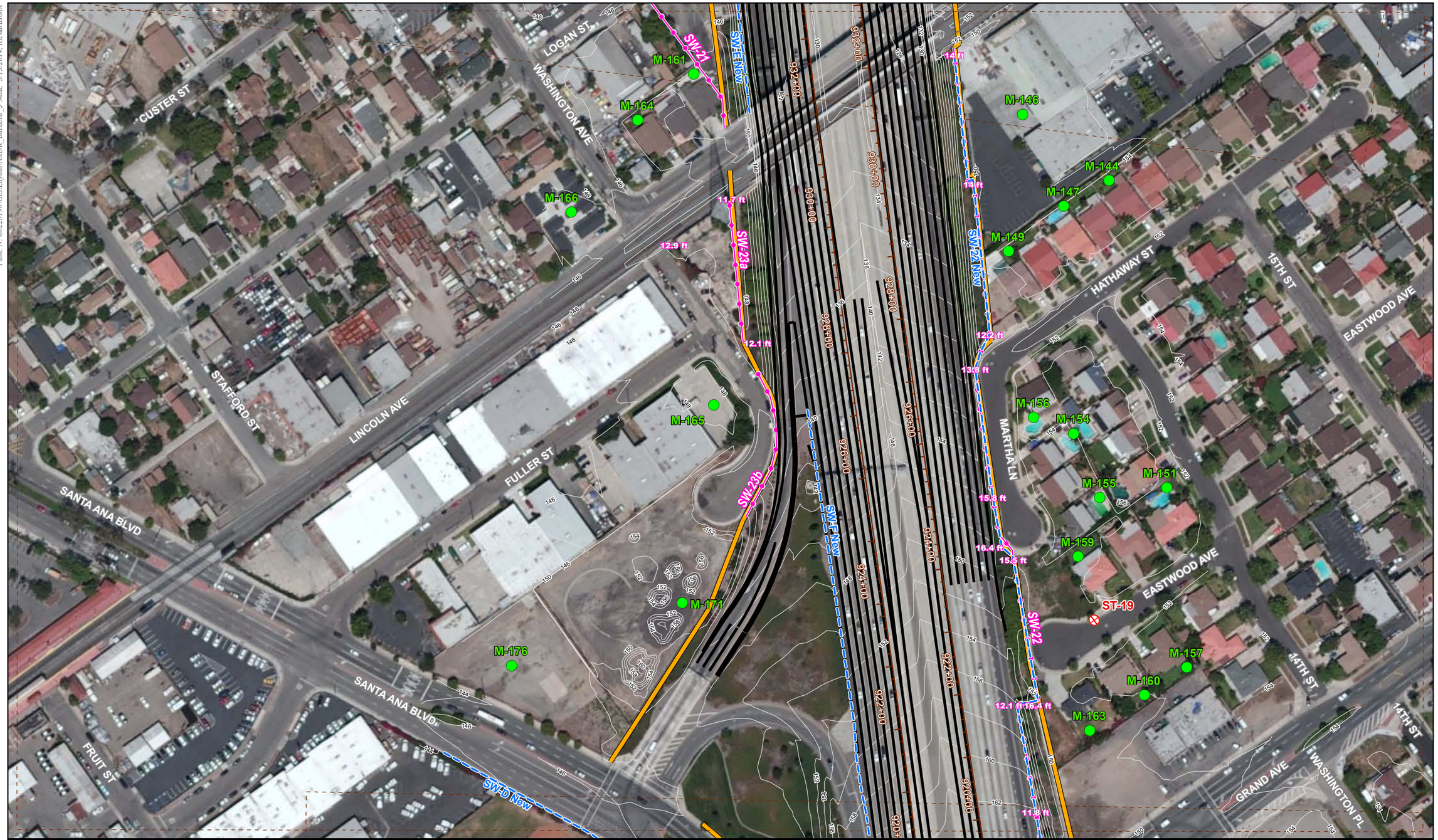
0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
- Build Alternative 5B
- Existing ROW
- Contour Line
- Stations
- Map Extent

**Figure 3-9**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

Path: N:\60220190\GIS\Layout\NADR_BuildAlt_3.mxd, 5/13/2014, Richardson A




LEGEND

Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

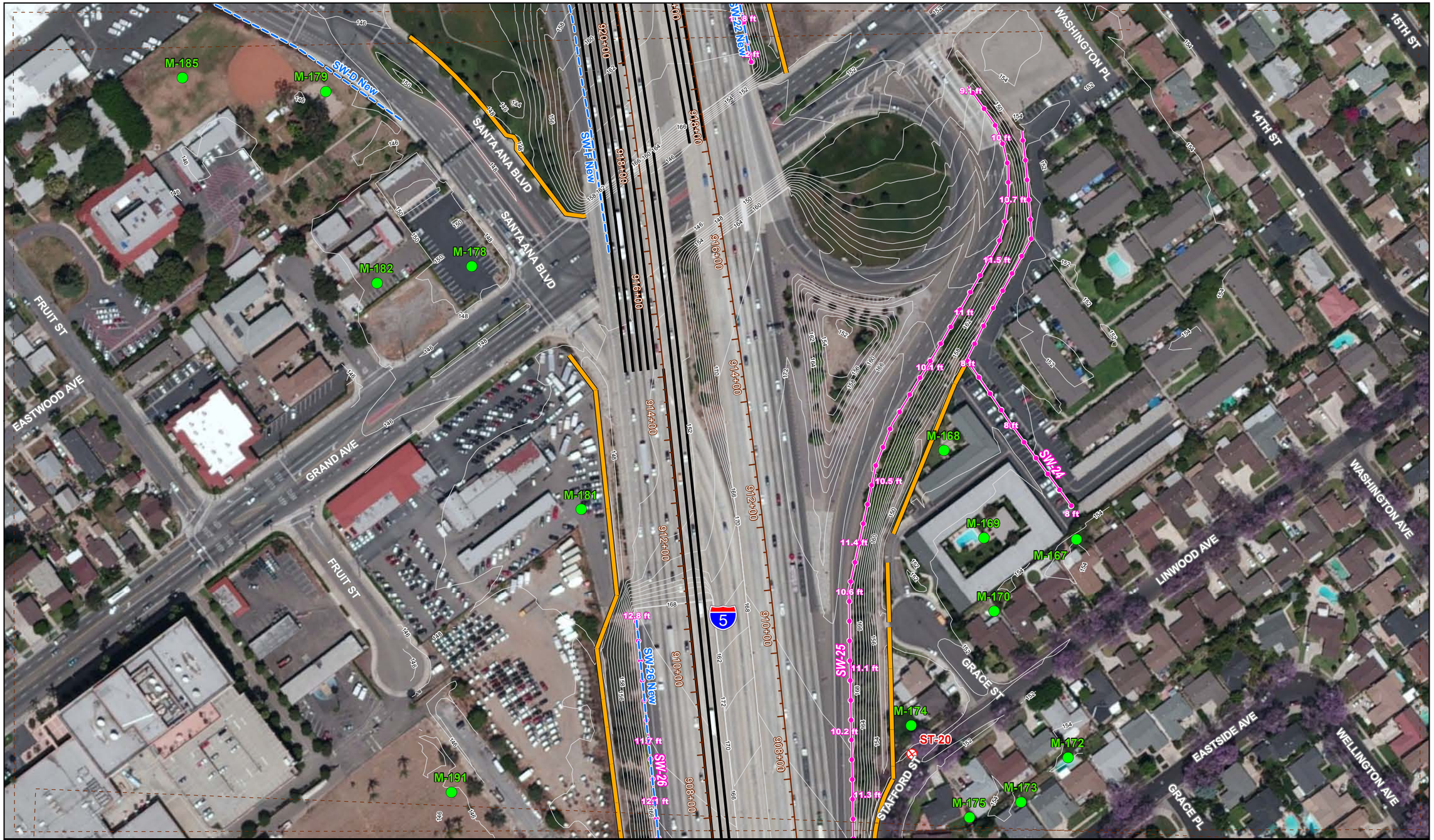
0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
- Build Alternative 5B
- Existing ROW
- Contour Line
- Stations
- Map Extent

**Figure 3-10**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

Path: N:\60220190\GIS\Layout\NADR_BuildAlt_3.mxd, 5/13/2014, Richardson A




Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

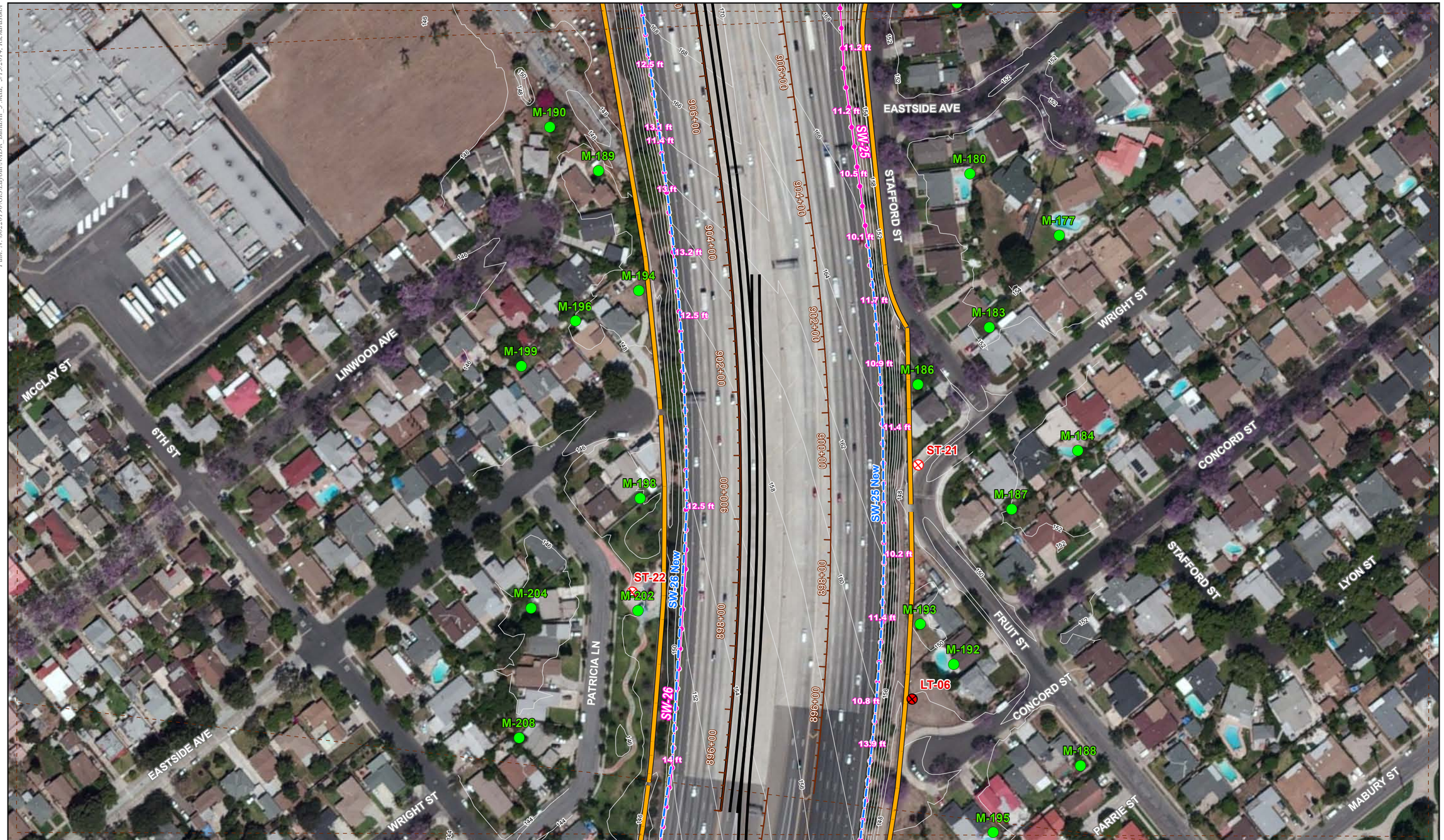
0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
- Build Alternative 5B
- Existing ROW
- Contour Line
- Stations
- Map Extent

**Figure 3-11**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

Path: N:\60220190\GIS\Layout\NADR_BuildAlt_3.mxd, 5/13/2014, Richardson A




LEGEND

Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

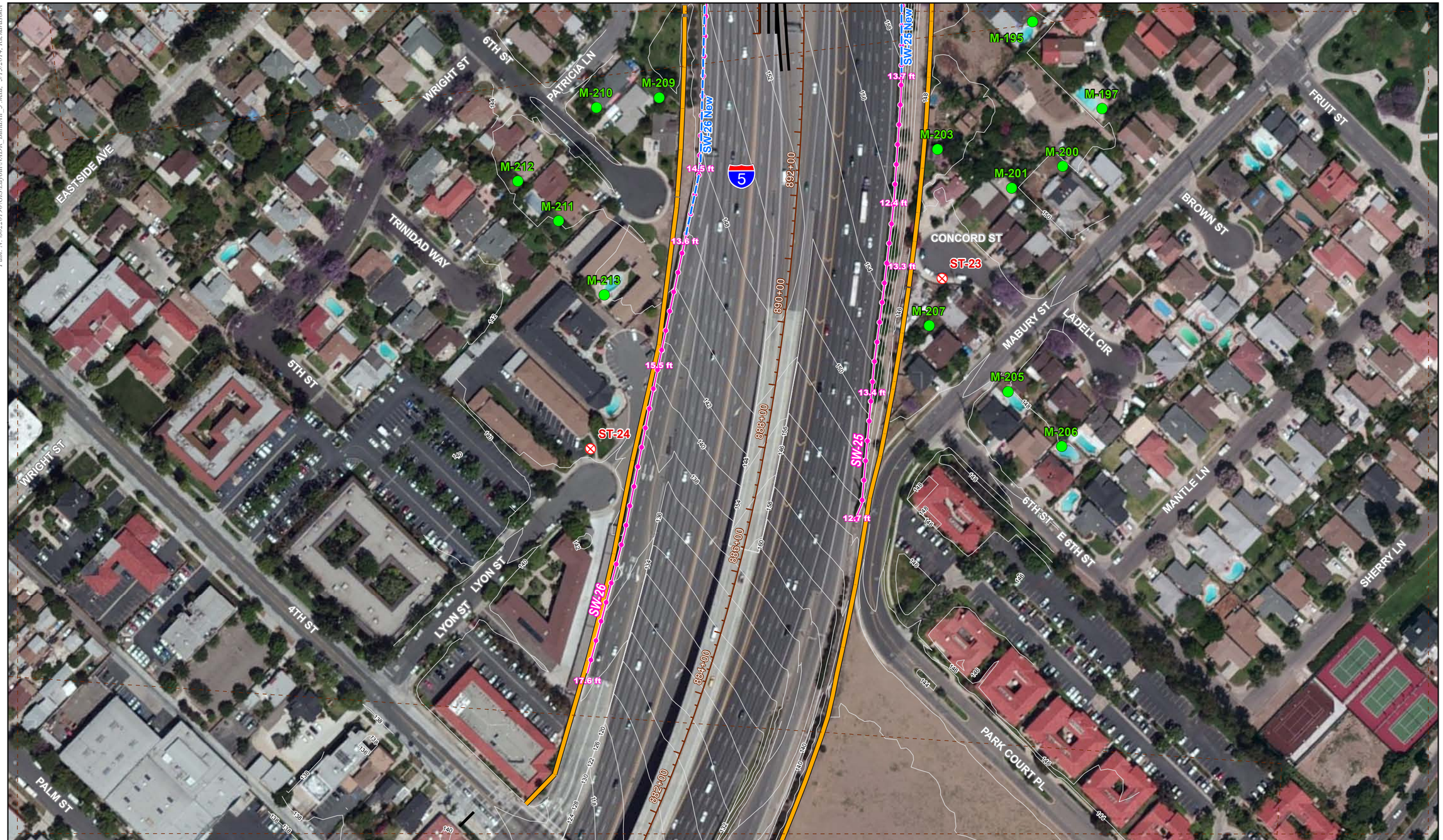
0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
- Build Alternative 5B
- Existing ROW
- Contour Line
- Stations
- Map Extent

**Figure 3-12**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

Path: N:\60220190\GIS\Layout\NADR_BuildAlt_3.mxd, 5/13/2014, RichardsonA




LEGEND

Source: AECOM 2012; SCAG Land Use 2005; Aerials Express 2010

0 50 100 200 Feet

Scale: 1 inch = 150 Feet

- Short Term Measurement Loc.
- Long Term Measurement Location
- Modeling Locations
- Modeled Sound Wall
- Existing Soundwall with Heights (ft)
- Build Alternative 5B
- Existing ROW
- Contour Line
- Stations
- Map Extent

**Figure 3-13**
**Noise Measurement, Noise Modeling and Sound Wall Locations**

## 2.2. Locations evaluated for Noise Abatement

Within the project limits, I-5 currently has near-continuous sound walls along the right-of-way on both sides of the freeway. Most of the impacted receivers are already shielded by an existing sound wall. At these locations, the feasibility of increased height and/or length of the existing sound walls was evaluated. Several impacted receiver locations were not shielded by an existing sound wall. For these receivers, potential locations for new sound walls were identified and the feasibility of those walls was evaluated. The new sound wall locations evaluated were assigned an alphabetic ID number (i.e., SW-A New and SW-D New), while the numbered sound walls indicate evaluation of an existing sound wall.

Receiver M-042 represents a commercial parking lot and there are no outdoor areas of frequent human use that would benefit from a reduced noise level. Receiver M-118 represents the parking/display area of a car dealership, a land use which would generate a secondary on-site land use. M-165 and M-178 represent office buildings and there are no outdoor areas of frequent human use that would benefit from a reduced noise level. Receiver M-070 represents the parking area for an office complex, with no outdoor areas of frequent human use that would benefit from a reduced noise level. Therefore, abatement is not considered for receivers M-042, M-070, M-118, M-165, and M-178.

A total of 15 sound walls were evaluated for feasibility based on achievable noise reduction. In addition, an acoustical design goal of 7 dB of noise reduction at one or more benefitted receivers was applied. Sound walls were evaluated ranging in height from 6 to 16 feet in two-foot increments. Sound walls that were not feasible or did not achieve the 7 dB design goal at 16 feet were evaluated at heights up to 24 feet in two foot increments.

The following sound walls were analyzed to shield the sensitive receiver location that would be exposed to traffic noise levels approaching or exceeding the NAC under the build condition:

- **SW-06 New**: Modifications to an existing sound wall located on the west side of I-5 between Sherwood Lane and Flower Street along the existing ROW line was analyzed to shield 8 receivers M-015 through M-022 (Figure 3-1). The existing sound wall is 913 feet long and varies approximately 8 to 15 feet in height. The maximum height evaluated (24 feet) for SW-06 did not achieve a minimum of 5 dB noise reduction.
- **SW-11 New:** Modifications to a 2,243 foot segment of an existing sound wall 4,176 feet in length located on the west side of I-5 between Flower Street and Broadway

along the existing ROW line was analyzed to shield 18 receivers (M-038 through M-041, M-043 through M-045, and M-047 through M-054, M-056, M-058, and M-060). SW-11 is shown in Figure 3-3. The existing sound wall varies approximately 9 to 16 feet in height. The maximum height evaluated (24 feet) for SW-11 did not achieve a minimum of 5 dB noise reduction.

- **SW-A New:** A new sound wall 386 feet in length located on the east side of I-5 near Main Street along the on-ramp edge of pavement at the Discovery Science Center was analyzed to shield receiver M-057 (Figure 3-4 and 3-5). The minimum feasible height of 6 feet also achieves the 7 dB design goal.
- **SW-15a New:** Modifications to a 1,848 foot segment of an existing sound wall 3,629 feet in length located along the existing ROW line between Edgewood Road and 17th Street was analyzed to shield 18 receivers (M-072, M-074, M-076, M-077, M-079 through M-081, M-084, M-085, M-087, M-090, M-093 through M-095, M-097, M-099, M-102, and M-105). SW-15a is shown in Figure 3-6 and 3-7. The existing sound wall varies approximately 13 to 16 feet in height. The maximum height evaluated (24 feet) did not achieve a minimum of 5 dB noise reduction.
- **SW-15b New:** Modifications to a 343 foot segment of an existing sound wall 3,629 feet in length located along the existing ROW line between Edgewood Road and 17th Street was analyzed to shield receiver M-059. SW-15b is shown in Figure 3-5. The existing wall in this area is approximately 15 feet in height at this location. The maximum wall height evaluated (24 feet) did not achieve a minimum of 5 dB noise reduction.
- **SW-16b New:** Modifications to a 387-foot long segment of an existing sound wall located on the west side of I-5 along the existing ROW line between Main Street and 17th Street was analyzed to shield 7 receivers (M-103, M-104, M-106, M-108, M-111, M-112, and M-116). The existing SW-16 is 1,887 feet in length and varies approximately 7 to 16 feet in height. SW-16b is shown in Figure 3-7. The maximum height evaluated (24 feet) did not achieve a minimum of 5 dB noise reduction.
- **SW-19 and SW-20 New:** Modifications to two existing sound walls located on the northeast side of I-5 between Lincoln Ave and 17th Street were analyzed to shield 7 receivers (M-119, M-121, M-123, M-124, M-129, M-131, and M-134). Existing SW-19 is 639 feet in length and is approximately 12 feet in height (shown in Figure 3-8). SW-20 is 1,075 feet long and is approximately 14 feet in height (shown in Figure 3-8). A 475 foot-long segment of existing SW-20 was evaluated, while the entire 639-foot length of SW-19 was evaluated. The insertion loss indicated at each perturbation height is based upon modeling a combined SW-19 and SW-20 at the

specified height. The maximum height evaluated (24 feet) did not achieve a minimum of 5 dB noise reduction.

- **SW-C New:** A new sound wall located on the west side of I-5 was evaluated to shield 8 receivers (M-125, M-126, M-127, M-128, M-132, M-133, M-135, and M-139), shown in Figure 3-8. New SW-C New is located along the I-5 western edge of pavement and is 701 feet in length. The insertion loss indicated at each perturbation height is based upon modeling SW-C New at the specified height. The maximum height evaluated (24 feet) did not achieve a minimum of 5 dB noise reduction.
- **SW-22 New:** Modifications to an existing sound wall located on the northeast side of I-5 along the residential property line between Lincoln Avenue and Grand Avenue was analyzed to shield 11 receivers (M-144, M-147, M-149, M-151, M-154, M-155, M-156, M-157, M-159, M-160, and M-163). SW-22 is shown in Figures 3-10 and 3-11. The existing sound wall is 1,314 feet in length and varies from approximately 12 to 16 feet in height. The maximum height evaluated (24 feet) did not achieve a minimum of 5 dB noise reduction.
- **SW-25 New:** Modifications to a 999-foot long segment of an existing sound wall located on the northeast side of I-5 along the edge of pavement between Grand Avenue and Park Court Place was analyzed to shield 14 receivers (M-177, M-180, M-183, M-184, M-186 through M-188, M-192, M-193, M-195, M-197, M-200, M-201, and M-203). SW-25 is shown in Figure 3-12 and 3-13. The existing height of SW-25 varies from approximately 9 feet to 14 feet. The maximum height evaluated (24 feet) did not achieve a minimum of 5 dB noise reduction.
- **SW-D New:** A new sound wall approximately 472 feet long located on private property west of I-5 along the edge of pavement of Santa Ana Boulevard was evaluated to shield 2 receivers M-179 and M-185 (Figures 3-10 and 3-11). Sound walls within the ROW and closer to I-5 were also evaluated to shield these receivers, however, sound walls within the ROW did not achieve any noise reduction for these two impacted receivers. The minimum feasible height of SW-D New is 8 feet. The minimum height at which the 7 dB design goal is achieved is 10 feet at receiver M-179.
- **SW-F New**: A new sound wall approximately 1,013 feet long located on the west side of I-5 along the edge of pavement between Lincoln Avenue and Grand Avenue was analyzed to shield 3 receivers (M-179, M-182, and M-185, shown in Figure 3-11). As shown in Table 6, the maximum height evaluated (24 feet) did not achieve a minimum of 5 dB noise reduction.

- **SW-26 New:** Modifications to a 1,887-foot long segment of an existing 2,586-foot long sound wall located on the west side of I-5 along the edge of pavement between Grand Avenue and 4th Street were analyzed to shield 14 receivers (M-189, M-190, M-194, M-196, M-198, M-199, M-202, M-204, and M-208 through M-213). SW-26 is shown in Figure 3-12 and 3-13. The maximum height evaluated (24 feet) did not achieve a minimum of 5 dB noise reduction.
- **SW-E New:** A new 941-foot long sound wall located on the west side of I-5 along the top of slope was evaluated to shield 9 receivers (M-148, M-150, M-152, M-153, M-158, M-161, M-162, M-164, and M-166,). New SW-E New is shown in Figures 3-9 and 3-10. The minimum feasible height of SW-E New is 10 feet. The minimum feasible height at which the 7 dB design goal is achieved is 24 feet at receiver M-161.

## 2.3. Feasible Sound Walls

For each sound wall found to be both acoustically feasible and to be able to achieve the 7 dB design goal, reasonable cost allowances were calculated. A total of 15 sound walls were evaluated in areas adjacent to impacted residences. The results of the modeling analysis indicate that the following 12 sound walls would not be acoustically feasible: SW-06 New, SW-11 New, SW-15a New, SW 15b New, SW-16b New, SW-19 New, SW-20 New, SW-22 New, SW-25 New, SW-26, SW-C New, and SW-F New.

Of the 15 sound walls analyzed, three were capable of reducing noise levels by 5 dBA or more and are, therefore, considered feasible. Further, the following three feasible sound walls achieved the 7 dB design goal for at least one benefitted receiver: SW-A New, SW-D New, and SW-E New. The proposed location of SW-D New, is on private property, west of I-5, parallel to Santa Ana Boulevard, along the fence limiting the property of the Phoenix House of Orange County.

Table 1 summarizes the feasible sound walls that were both accoustically feasible and achieved the 7 dB noise reduction design goal from the NSR for the proposed project. Table 1 also lists the sound wall heights, approximate lengths, receiver locations benefitted, number of benefitted units, and total reasonable allowance.

**Table 1. Summary of Feasible Sound Walls from the Noise Study Report**

| Sound Wall | Location | Approx. Station Begin | Approx. Station End | Height (feet) | Receivers Benefitted | Number of Benefitted Units | Reasonableness Allowance Per Benefitted Unit | Total Reasonable Allowance |
|---|---|---|---|---|---|---|---|---|
| SW-A New | ROW | 992+80 | 995+00 | 6 | M-057 | 4 | $55,000 | $220,000 |
| | | | | 8 | M-057 | 4 | $55,000 | $220,000 |
| | | | | 10 | M-057 | 4 | $55,000 | $220,000 |
| | | | | 12 | M-057 | 4 | $55,000 | $220,000 |
| | | | | 14 | M-057 | 4 | $55,000 | $220,000 |
| | | | | 16 | M-057 | 4 | $55,000 | $220,000 |
| | | | | 18 | M-057 | 4 | $55,000 | $220,000 |
| | | | | 20 | M-057 | 4 | $55,000 | $220,000 |
| | | | | 22 | M-057 | 4 | $55,000 | $220,000 |
| | | | | 24 | M-057 | 4 | $55,000 | $220,000 |
| SW-E New | ROW | 932+00 | 941+40 | 6 | None | 0 | $55,000 | Not Feasible |
| | | | | 8 | None | 0 | $55,000 | Not Feasible |
| | | | | 10 | M-148, M-161 | 3 | $55,000 | $165,000 |
| | | | | 12 | M-148, M-161 | 3 | $55,000 | $165,000 |
| | | | | 14 | M-148, M-161 | 3 | $55,000 | $165,000 |
| | | | | 16 | M-148, M-161 | 3 | $55,000 | $165,000 |
| | | | | 18 | M-148, M-161 | 3 | $55,000 | $165,000 |
| | | | | 20 | M-148, M-161 | 3 | $55,000 | $165,000 |
| | | | | 22 | M-148, M-161 | 3 | $55,000 | $165,000 |
| | | | | 24 | M-148, M-161 | 3 | $55,000 | $165,000 |

**Table 1. Summary of Feasible Sound Walls from the Noise Study Report** (continued)

| Sound Wall | Location | Approx. Station Begin | Approx. Station End | Height (feet) | Receivers Benefitted | Number of Benefitted Units | Reasonableness Allowance Per Benefitted Unit | Total Reasonable Allowance |
|---|---|---|---|---|---|---|---|---|
| SW-D New | Santa Ana<br><br>ROW | N/A | N/A | 6 | None | 0 | $55,000 | Not Feasible |
| | | | | 8 | M-179 | 4 | $55,000 | $220,000 |
| | | | | 10 | M-179 | 4 | $55,000 | $220,000 |
| | | | | 12 | M-179 | 4 | $55,000 | $220,000 |
| | | | | 14 | M-179 | 4 | $55,000 | $220,000 |
| | | | | 16 | M-179 | 4 | $55,000 | $220,000 |
| | | | | 18 | M-179, M-185 | 7 | $55,000 | $385,000 |
| | | | | 20 | M-179, M-185 | 7 | $55,000 | $385,000 |
| | | | | 22 | M-179, M-185 | 7 | $55,000 | $385,000 |
| | | | | 24 | M-179, M-185 | 7 | $55,000 | $385,000 |

ROW = right-of-way line
EP = edge of pavement
N/A = Not applicable, sound wall is along a local road with no stationing.

# 3. Preliminary Noise Abatement Decision

## 3.1. Summary of Key Information

Table 2 is a summary of abatement information and lists all the feasible sound walls, along with their approximate lengths, heights, noise attenuation ranges, number of benefitted units, sound wall location, reasonble allowance per unit, total reasonable allowances, and estimated sound wall construction costs, as well as whether the sound walls are reasonable.

The reasonableness of a sound wall was determined by comparing the estimated cost of sound wall construction against the total reasonable allowance. The total reasonable allowance was determined based on the number of benefitted residences multiplied by the reasonable allowance per residence. The cost estimate breakdown for each sound wall is provided in Appendix A. Aditionally, if the sound wall was not predicted to provide at least 7 dBA of noise reduction at one or more benefitted receiver, the sound wall was determined to not be reasonable.

As shown in Table 2, the estimated sound wall construction costs for feasible walls SW-A New, SW-D New, and SW-E New exceeded the total reasonable allowance at all heights evaluated.

## 3.2. Preliminary Recommendation and Decision

As shown in Table 2, sound walls SW-A New, SW-D New, and SW-E New were determined to not be reasonable. Therefore, no modifications to existing sound walls or construction of new sound walls are recommended for incorporation into the project. The preliminary noise abatement decision presented in this report is based on preliminary project alignments and profiles, which may be subject to change. As such, the physical characteristics of noise abatement described herein also may be subject to change. If pertinent parameters change substantially during the final project design, the preliminary noise abatement decision may be changed or eliminated from the final project design. A final decision to construct noise abatement will be made upon completion of the project design.

The preliminary noise abatement decision presented here will be included in the draft environmental document, which will be circulated for public review.

**Table 2. Summary of Abatement Information**

| Sound Wall | Height (feet) | Acoustically Feasible? | Noise Attenuation Range (dBA) | Number of Benefitted Units | Noise Reduction Design Goal Achieved? | Total Reasonable Allowance | Estimated Construction Cost | Cost Less than Allowance? | Reasonable? [1] |
|---|---|---|---|---|---|---|---|---|---|
| SW-A New | 6 | Yes | 8.7 | 4 | Yes | $220,000 | $335,247 | No | No |
| | 8 | Yes | 10.2 | 4 | Yes | $220,000 | $463,513 | No | No |
| | 10 | Yes | 11.4 | 4 | Yes | $220,000 | $497,875 | No | No |
| | 12 | Yes | 12.5 | 4 | Yes | $220,000 | $532,311 | No | No |
| | 14 | Yes | 13.3 | 4 | Yes | $220,000 | $647,018 | No | No |
| | 16 | Yes | 14 | 4 | Yes | $220,000 | $681,153 | No | No |
| | 18 | Yes | 14.6 | 4 | Yes | $220,000 | $712,226 | No | No |
| | 20 | Yes | 15.3 | 4 | Yes | $220,000 | $824,949 | No | No |
| | 22 | Yes | 15.8 | 4 | Yes | $220,000 | $856,022 | No | No |
| | 24 | Yes | 16.1 | 4 | Yes | $220,000 | $887,095 | No | No |
| SW-E New | 6 | No | NA | 0 | No | NF | $426,084 | No | No |
| | 8 | No | NA | 0 | No | NF | $503,951 | No | No |
| | 10 | Yes | 0.0 to 5.4 | 3 | No | $165,000 | $584,750 | No | No |
| | 12 | Yes | 0.0 to 5.4 | 3 | No | $165,000 | $671,759 | No | No |
| | 14 | Yes | 0.0 to 5.4 | 3 | No | $165,000 | $758,768 | No | No |
| | 16 | Yes | 0.0 to 5.5 | 3 | No | $165,000 | $855,437 | No | No |
| | 18 | Yes | 0.0 to 5.9 | 3 | No | $165,000 | $920,366 | No | No |
| | 20 | Yes | 0.0 to 6.4 | 3 | No | $165,000 | $985,295 | No | No |
| | 22 | Yes | 0.0 to 6.9 | 3 | No | $165,000 | $1,050,224 | No | No |
| | 24 | Yes | 0.0 to 7.2 | 3 | Yes | $165,000 | $1,115,153 | No | No |

**Table 2. Summary of Abatement Information** *(continued)*

| Sound Wall | Height (feet) | Acoustically Feasible? | Noise Attenuation Range (dBA) | Number of Benefitted Units | Noise Reduction Design Goal Achieved? | Total Reasonable Allowance | Estimated Construction Cost | Cost Less than Allowance? | Reasonable? [1] |
|---|---|---|---|---|---|---|---|---|---|
| SW-D New | 6 | No | 1.7 to 4.2 | 0 | No | NF | $225,560 | N/A | No |
| | 8 | Yes | 2.4 to 5.7 | 4 | No | NF | $262,139 | No | No |
| | 10 | Yes | 3.1 to 7.0 | 4 | Yes | $220,000 | $297,381 | No | No |
| | 12 | Yes | 3.9 to 7.7 | 4 | Yes | $220,000 | $333,959 | No | No |
| | 14 | Yes | 4.4 to 8.5 | 4 | Yes | $220,000 | $371,314 | No | No |
| | 16 | Yes | 4.9 to 8.9 | 7 | Yes | $385,000 | $408,108 | No | No |
| | 18 | Yes | 5.3 to 9.3 | 7 | Yes | $385,000 | $440,676 | No | No |
| | 20 | Yes | 5.6 to 9.6 | 7 | Yes | $385,000 | $473,244 | No | No |
| | 22 | Yes | 6.1 to 9.9 | 7 | Yes | $385,000 | $505,812 | No | No |
| | 24 | Yes | 6.3 to 10.1 | 7 | Yes | $385,000 | $538,380 | No | No |

Notes:
[1] A sound wall was considered reasonable if it achieves the 7 dBA noise reduction design goal and the estimated cost is less than the allowance.
NF = Not feasible
N/A = Not applicable, sound wall not feasible and no reasonableness allowance was calculated

# 4. References

California Department of Transportation. 2011. Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects. May.

California Department of Transportation. 2007. Highway Design Manual.

# Appendix A Sound Wall Construction Cost Estimates

# Sound Wall Construction Cost Estimates

| | | | | | | | | | Estimated Unit Costs | | | | | | Estimated Construction Costs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barrier Height | Barrier Length | Barrier area | Remove Existing Wall | Minor Concrete | Piles length | Piles numbers | Piles Total | Modify Ret Wall | Masonry | Remove Wall | Minor Concrete | Conc. Barrier | Pile | Modify Ret Wall | Masonry Cost | Remove Wall Cost | Minor Concrete Cost | Conc. Barrier Cost | Pile Cost | Modify Ret Wall Cost | Traffic Control | Mobiliz. 10% | Contingency 5% | Right of Way/ Easement | Total Cost | Cost/SF |
| ft | ft | sf | sf | cy | ft | each | ft | ls | $/sf | $/sf | $/cy | $/lf | $/lf | ls | $ | $ | $ | $ | $ | $ | $ | $ | $ | $ | $ | $ |
| Barrier SW-A New | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 386 | 2316 | 1050 | 38 | 5.5 | 26 | 143 | 1 | 35 | 25 | 625 | 0 | 75 | $ 58,000 | $ 81,060 | $ 26,250 | $ 23,455 | $0 | $ 10,725 | $ 58,000 | $ 23,160 | $ 22,265 | $ 11,132 | $ 79,200 | $ 335,247 | $ 145 |
| 8 | 386 | 3088 | 1050 | 38 | 7 | 26 | 182 | 1 | 35 | 25 | 625 | 0 | 70 | $ 140,500 | $ 108,080 | $ 26,250 | $ 23,455 | $0 | $ 12,740 | $ 140,500 | $ 23,160 | $ 33,418 | $ 16,709 | $ 79,200 | $ 463,513 | $ 150 |
| 10 | 386 | 3860 | 1050 | 38 | 8 | 26 | 208 | 1 | 35 | 25 | 625 | 0 | 75 | $ 140,500 | $ 135,100 | $ 26,250 | $ 23,455 | $0 | $ 15,600 | $ 140,500 | $ 23,160 | $ 36,406 | $ 18,203 | $ 79,200 | $ 497,875 | $ 129 |
| 12 | 386 | 4632 | 1050 | 38 | 9.5 | 26 | 247 | 1 | 35 | 25 | 625 | 0 | 75 | $ 140,500 | $ 162,120 | $ 26,250 | $ 23,455 | $0 | $ 18,525 | $ 140,500 | $ 23,160 | $ 39,401 | $ 19,700 | $ 79,200 | $ 532,311 | $ 115 |
| 14 | 386 | 5404 | 1050 | 38 | 10 | 29 | 290 | 1 | 35 | 25 | 625 | 0 | 75 | $ 210,000 | $ 189,140 | $ 26,250 | $ 23,455 | $0 | $ 21,750 | $ 210,000 | $ 23,160 | $ 49,375 | $ 24,688 | $ 79,200 | $ 647,018 | $ 120 |
| 16 | 386 | 6176 | 1050 | 38 | 10.5 | 31 | 325.5 | 1 | 35 | 25 | 625 | 0 | 75 | $ 210,000 | $ 216,160 | $ 26,250 | $ 23,455 | $0 | $ 24,413 | $ 210,000 | $ 23,160 | $ 52,344 | $ 26,172 | $ 79,200 | $ 681,153 | $ 110 |
| 18 | 386 | 6948 | 1050 | 38 | 10.5 | 31 | 325.5 | 1 | 35 | 25 | 625 | 0 | 75 | $ 210,000 | $ 243,180 | $ 26,250 | $ 23,455 | $0 | $ 24,413 | $ 210,000 | $ 23,160 | $ 55,046 | $ 27,523 | $ 79,200 | $ 712,226 | $ 103 |
| 20 | 386 | 7720 | 1050 | 38 | 10.5 | 31 | 325.5 | 1 | 35 | 25 | 625 | 0 | 75 | $ 281,000 | $ 270,200 | $ 26,250 | $ 23,455 | $0 | $ 24,413 | $ 281,000 | $ 23,160 | $ 64,848 | $ 32,424 | $ 79,200 | $ 824,949 | $ 107 |
| 22 | 386 | 8492 | 1050 | 38 | 10.5 | 31 | 325.5 | 1 | 35 | 25 | 625 | 0 | 75 | $ 281,000 | $ 297,220 | $ 26,250 | $ 23,455 | $0 | $ 24,413 | $ 281,000 | $ 23,160 | $ 67,550 | $ 33,775 | $ 79,200 | $ 856,022 | $ 101 |
| 24 | 386 | 9264 | 1050 | 38 | 10.5 | 31 | 325.5 | 1 | 35 | 25 | 625 | 0 | 75 | $ 281,000 | $ 324,240 | $ 26,250 | $ 23,455 | $0 | $ 24,413 | $ 281,000 | $ 23,160 | $ 70,252 | $ 35,126 | $ 79,200 | $ 887,095 | $ 96 |
| Barrier SW-E New | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 941 | 5646 | 0 | 91 | 11.5 | 60 | 690 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 169,380 | $ - | $ 57,179 | $0 | $ 51,750 | $ - | $ 56,460 | $ 33,477 | $ 16,738 | $ 41,100 | $ 426,084 | $ 75 |
| 8 | 941 | 7528 | 0 | 91 | 14 | 60 | 840 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 225,840 | $ - | $ 57,179 | $0 | $ 63,000 | $ - | $ 56,460 | $ 40,248 | $ 20,124 | $ 41,100 | $ 503,951 | $ 67 |
| 10 | 941 | 9410 | 0 | 91 | 16 | 64 | 1024 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 282,300 | $ - | $ 57,179 | $0 | $ 76,800 | $ - | $ 56,460 | $ 47,274 | $ 23,637 | $ 41,100 | $ 584,750 | $ 62 |
| 12 | 941 | 11292 | 0 | 91 | 16 | 80 | 1280 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 338,760 | $ - | $ 57,179 | $0 | $ 96,000 | $ - | $ 56,460 | $ 54,840 | $ 27,420 | $ 41,100 | $ 671,759 | $ 59 |
| 14 | 941 | 13174 | 0 | 91 | 16 | 96 | 1536 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 395,220 | $ - | $ 57,179 | $0 | $ 115,200 | $ - | $ 56,460 | $ 62,406 | $ 31,203 | $ 41,100 | $ 758,768 | $ 58 |
| 16 | 941 | 15056 | 0 | 91 | 16 | 119 | 1904 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 451,680 | $ - | $ 57,179 | $0 | $ 142,800 | $ - | $ 56,460 | $ 70,812 | $ 35,406 | $ 41,100 | $ 855,437 | $ 57 |
| 18 | 941 | 16938 | 0 | 91 | 16 | 119 | 1904 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 508,140 | $ - | $ 57,179 | $0 | $ 142,800 | $ - | $ 56,460 | $ 76,458 | $ 38,229 | $ 41,100 | $ 920,366 | $ 54 |
| 20 | 941 | 18820 | 0 | 91 | 16 | 119 | 1904 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 564,600 | $ - | $ 57,179 | $0 | $ 142,800 | $ - | $ 56,460 | $ 82,104 | $ 41,052 | $ 41,100 | $ 985,295 | $ 52 |
| 22 | 941 | 20702 | 0 | 91 | 16 | 119 | 1904 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 621,060 | $ - | $ 57,179 | $0 | $ 142,800 | $ - | $ 56,460 | $ 87,750 | $ 43,875 | $ 41,100 | $ 1,050,224 | $ 51 |
| 24 | 941 | 22584 | 0 | 91 | 16 | 119 | 1904 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 677,520 | $ - | $ 57,179 | $0 | $ 142,800 | $ - | $ 56,460 | $ 93,396 | $ 46,698 | $ 41,100 | $ 1,115,153 | $ 49 |
| Barrier SW-D New | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 472 | 2832 | 0 | 46 | 5.5 | 31 | 170.5 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 84,960 | $ - | $ 28,681 | $0 | $ 12,788 | $ - | $ 28,320 | $ 15,475 | $ 7,737 | $ 47,600 | $ 225,560 | $ 80 |
| 8 | 472 | 3776 | 0 | 46 | 7 | 31 | 217 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 113,280 | $ - | $ 28,681 | $0 | $ 16,275 | $ - | $ 28,320 | $ 18,656 | $ 9,328 | $ 47,600 | $ 262,139 | $ 69 |
| 10 | 472 | 4720 | 0 | 46 | 8 | 31 | 248 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 141,600 | $ - | $ 28,681 | $0 | $ 18,600 | $ - | $ 28,320 | $ 21,720 | $ 10,860 | $ 47,600 | $ 297,381 | $ 63 |
| 12 | 472 | 5664 | 0 | 46 | 9.5 | 31 | 294.5 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 169,920 | $ - | $ 28,681 | $0 | $ 22,088 | $ - | $ 28,320 | $ 24,901 | $ 12,450 | $ 47,600 | $ 333,959 | $ 59 |
| 14 | 472 | 6608 | 0 | 46 | 10 | 35 | 350 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 198,240 | $ - | $ 28,681 | $0 | $ 26,250 | $ - | $ 28,320 | $ 28,149 | $ 14,075 | $ 47,600 | $ 371,314 | $ 56 |
| 16 | 472 | 7552 | 0 | 46 | 10.5 | 38 | 399 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 226,560 | $ - | $ 28,681 | $0 | $ 29,925 | $ - | $ 28,320 | $ 31,349 | $ 15,674 | $ 47,600 | $ 408,108 | $ 54 |
| 18 | 472 | 8496 | 0 | 46 | 10.5 | 38 | 399 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 254,880 | $ - | $ 28,681 | $0 | $ 29,925 | $ - | $ 28,320 | $ 34,181 | $ 17,090 | $ 47,600 | $ 440,676 | $ 52 |
| 20 | 472 | 9440 | 0 | 46 | 10.5 | 38 | 399 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 283,200 | $ - | $ 28,681 | $0 | $ 29,925 | $ - | $ 28,320 | $ 37,013 | $ 18,506 | $ 47,600 | $ 473,244 | $ 50 |
| 22 | 472 | 10384 | 0 | 46 | 10.5 | 38 | 399 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 311,520 | $ - | $ 28,681 | $0 | $ 29,925 | $ - | $ 28,320 | $ 39,845 | $ 19,922 | $ 47,600 | $ 505,812 | $ 49 |
| 24 | 472 | 11328 | 0 | 46 | 10.5 | 38 | 399 | 0 | 30 | 25 | 625 | 0 | 75 | 0 | $ 339,840 | $ - | $ 28,681 | $0 | $ 29,925 | $ - | $ 28,320 | $ 42,677 | $ 21,338 | $ 47,600 | $ 538,380 | $ 48 |