## 3.6 Visual/Aesthetics

The *Visual Impact Assessment* (CirclePoint, August 2006) for the Highway 101 HOV Lane Widening Project was conducted in accordance with the guidelines provided in the *Visual Impact Assessment for Highway Projects* (FHWA, 1981). The visual analysis characterizes the project area in terms of "landscape units," which are distinct segments of the corridor that have a consistent or cohesive visual or physical character, and identifies visual quality, prominent features, and scenic resources within the landscape units. Selected viewpoints along Highway 101 where the project could affect existing visual quality are identified and evaluated. In addition, physical changes attributable to the proposed project that would cause changes to views currently experienced by residents, motorists and other users of the area are evaluated. Avoidance, minimization and/or mitigation measures to address visual effects are described in Section 3.6.5.

### 3.6.1 Regulatory Setting

NEPA establishes that the federal government use all practicable means to ensure all Americans safe, healthful, productive and aesthetically and culturally pleasing surroundings (42 USC 4331[b] [2]). In its implementation of NEPA (23 USC 109[h]), the FHWA directs that final decisions regarding projects are to be made in the best overall public interest, taking into account adverse environmental impacts, including the destruction or disruption of aesthetic values.

Likewise, CEQA establishes that it is the policy of the state to take all action necessary to provide the people of the state "with…enjoyment of aesthetic, natural, scenic and historic environmental qualities." [CA Public Resources Code Section 21001(b)].

### 3.6.2 Affected Environment

The existing visual environment is characterized by the landscape components (visual resources) and viewer groups within the project area. Visual resources are described in terms of existing visual character and quality. Viewer groups are evaluated in terms of viewer exposure (the ability to see the project area) and viewer sensitivity, which refers to the viewers' concern for scenic quality and their response to change in visual resources.

#### 3.6.2.1 EXISTING VISUAL CHARACTER AND CONTEXT

The Highway 101 HOV Lane Widening project corridor is located in Sonoma County, California, extending through the City of Santa Rosa, Town of Windsor, and unincorporated areas within Sonoma County. The overall visual character of the project area is primarily rural, with open space/agricultural uses and mature native trees bordering the highway within the project limits, with developed areas near the city centers.

A characteristic that distinguishes Sonoma County from many parts of the San Francisco Bay Area is the continued existence of separate, identifiable cities and communities. The presence of open land helps retain the rural character and avoid corridor-style urbanization. These lands may not necessarily be highly scenic in their own right, but they provide visual relief from continuous urbanization and are a special type of scenic border, known as a community separator. The Santa

Rosa/Windsor community separator is located within the project area on the west and east sides of Highway 101 between the urban growth boundaries of the City of Santa Rosa and Town of Windsor, between Shiloh Road and Hopper Avenue. This separator contains large areas of open space with no development and views to the hills to the east and west.

Another distinguishing characteristic of the existing visual setting resides in the redwood trees that line the highway. Redwood trees were planted in clusters at regular intervals to reinforce motorists' perception of the regional landscape character and Highway 101 as the "Redwood Highway." Over the years, the redwoods have become a dominant visual element of the highway corridor.

#### 3.6.2.2 EXISTING VISUAL IMAGE TYPES AND VIEWER GROUPS

For the purposes of the visual impact assessment, the study area is typically subdivided into landscape units that encompass distinct spatial areas, as described below. Each landscape unit has a distinct visual character based upon the land uses and features that comprise it. These smaller scale land uses or features within each landscape unit are called "image types." Because of the relative visual consistency throughout the Highway 101 corridor, the study area is considered to be located within one landscape unit. Six visual image types are located within the project area: mature trees, agricultural, vineyard, residential, commercial/industrial, and hillsides/distant hills.

**"**Viewer groups" are generally categorized by their views, either as highway users (from the road) or as highway neighbors (of the road). Three viewer groups were identified within the project area: 1) motorists who use Highway 101 and/or other local streets in the project vicinity as regional roads for commuting or commerce; 2) community viewer types: residents and employees and patrons of commercial uses who have views of Highway 101 from properties along the project corridor; and 3) agricultural employees who have views of Highway 101 from farms along the project corridor.

Motorists would have a low to medium sensitivity to changes in the visual character of the project area. Residents and employees of commercial uses would have high sensitivity to changes in the visual environment at locations along the highway where vegetative screens exist. Seasonal agricultural employees would have a lower sensitivity to visual changes than year-round employees because their exposure to the visual environment would be less frequent.

#### 3.6.2.3 LANDSCAPE UNITS

The project corridor was determined to be one landscape unit (see Figure 3.6-1) based on the general visual consistency of topographical and other distinguishing features within the project area. The existing visual quality of the landscape unit, including image types encompassed within the landscape unit, and viewer groups with a degree of sensitivity to the visual environment are described below and shown in Table 3.6-1.

**Landscape Unit:** The predominant visual resources within the landscape unit include mature trees and grassy berms that line the freeway on both sides. The trees vary in size and type, including redwoods and valley oaks, and create a rural, wooded character throughout most of the Highway 101 corridor. Of the approximately 8,614 mature trees that line Highway 101 within the project limits, a little more than a quarter, or about 2,374, are redwood trees. There are breaks in the roadside vegetation that expose adjacent uses and visual resources. The Luther Burbank Center for the Arts is

a man-made visual resource located on the eastern side of the highway at the southern end of the project corridor. The Center has a triangular fountain and a brick colonnade façade. Continuing north on Highway 101, breaks in the vegetation reveal commercial and industrial uses until the highway reaches the Santa Rosa/Windsor community separator. Development of community separators is restricted in Sonoma County; therefore, this area consists of green open space. The Kendall-Jackson Winery is located north of the community separator and west of Highway 101. The winery includes vineyards and a chateau-style winery structure. Commercial centers and the Airport Business Park, which includes a business park sign located in a large vineyard, are evident as the highway continues north. Single-family residences and a trailer park are located east and west of Highway 101, respectively, in the northern section of the project corridor.

**Table 3.6-1: Summary of the Landscape Unit**

| Landscape Unit | Description | |
|---|---|---|
| Landscape Unit | Image Types | Mature Trees (including redwoods and Valley oaks), Agricultural, Vineyard, Residential, Commercial/Industrial, Hillsides/Distant Hills |
| | Viewer Groups | Motorists, Community Viewer Types, and Agricultural Employees |
| | Visual Resources | Mature vegetation along Highway 101; Luther Burbank Center for the Arts; commercial, industrial, and residential uses; distant hills. |
| | Overall Visual Character | Wooded corridor, mature vegetation screens much of the development along Highway 101, and screens views of the highway from adjacent land uses. |

### Existing Visual Quality

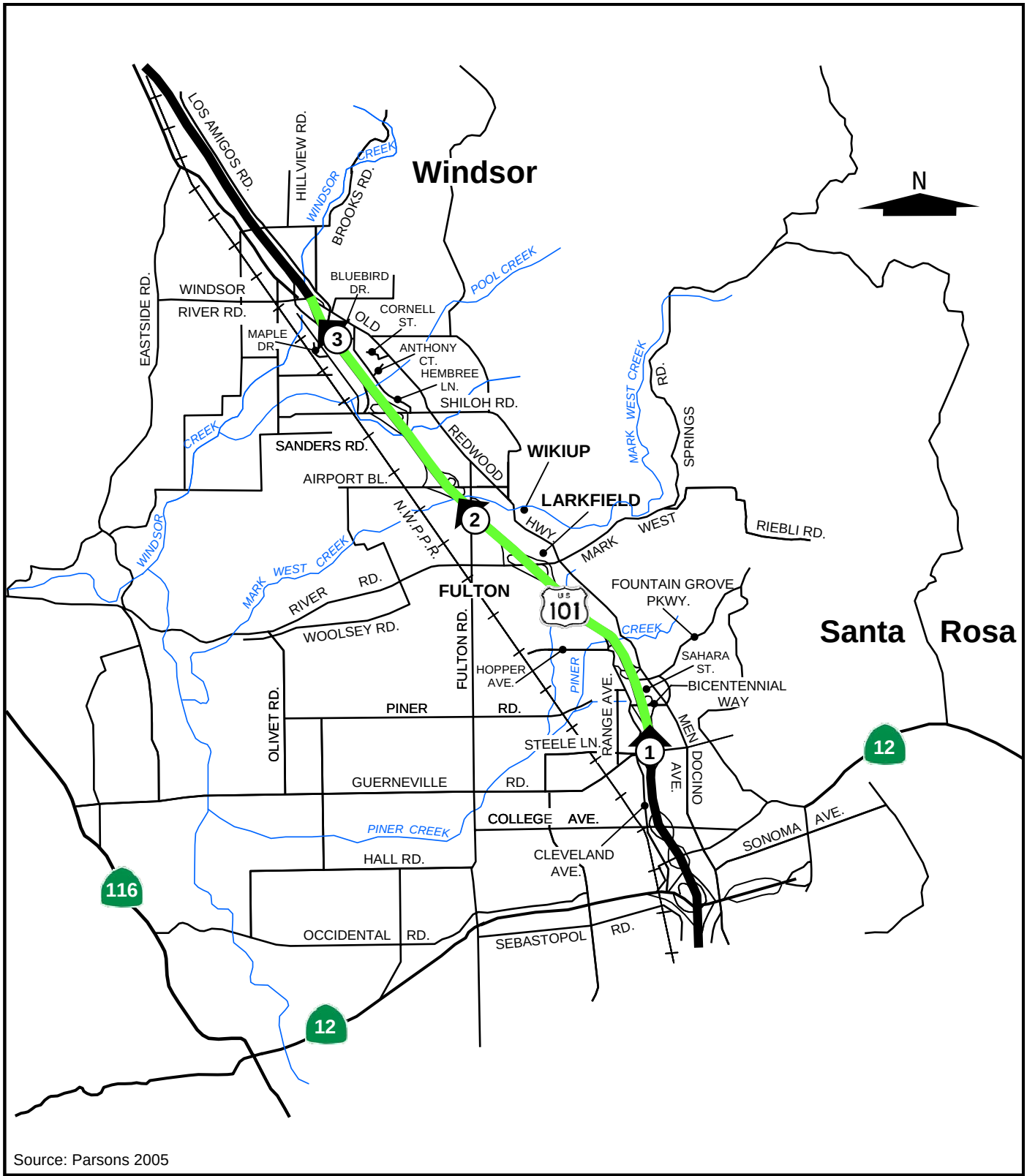
Key viewpoints, as shown on Figure 3.6-1, were identified to represent the visual character of the landscape unit and used to define visual quality. The existing visual quality for the landscape unit was evaluated based on indicators of the level of visual relationships, rather than judgments of physical landscape components. The evaluation was performed for views from the road and of the road. This approach provides a set of three evaluative criteria: vividness, intactness, and unity. These criteria are defined as follows:

**Vividness** is the visual power or memorability of landscape components as they combine in striking and distinctive visual patterns. An example within the study area is the relationship of the vineyards and the background of the distant hills.

**Intactness** is the visual integrity of the natural and man-made landscape of the immediate environs and its freedom from encroaching elements. An example within the study area is the distinctive relationship of the roadway and the natural roadside vegetation.

**Unity** is the visual coherence and compositional harmony of the viewshed. The viewshed entails all natural and man-made features found within the normal view range. In man-altered landscapes, unity frequently attests to the careful design or fit of individual components in the landscape. An example within the study area is the way man-made elements such as the residences combine with natural features such as the roadside vegetation which is used as visual screening.

Seven evaluation criteria were applied to measure visual quality: very low, low, moderately low, average, moderately high, high, and very high (FHWA, 1981)




Source: Parsons 2005

**Legend:**

1 **Viewpoint Location** **Project Area**

S C T A

**Highway 101 HOV Lane Widening Project:**
**Steele Lane, Santa Rosa to**
**Windsor River Road, Windsor**

**VIEWPOINT LOCATIONS**
**Figure 3.6-1**

The key viewpoints are typical views that people would have of or from the project, as described below. Table 3.6-2 provides a summary of the existing visual quality for each viewpoint.

**Table 3.6-2: Summary of Existing Visual Quality**

| Viewpoint Number | Setting | Vividness | Intactness | Unity | Overall Visual Quality |
|---|---|---|---|---|---|
| 1 | Looking north towards Bicentennial Way | Moderately High | Average | Average | Average |
| 2 | Looking north between Fulton Road and Airport Boulevard | High | Average | Average | Moderately High |
| 3 | Looking north, near Windsor River Road | High | Moderately High | Moderately High | Moderately High |

### Viewpoint 1

This viewpoint is looking north along Highway 101 towards the Bicentennial Way overpass. Mature vegetation with grassy shoulder areas lines both sides of the highway. Tall trees screen the residential and commercial uses from view, and a soundwall is slightly visible, on the east side of the highway. Views of distant hills are obscured by the mature vegetation and Bicentennial Way overpass. Highway 101 and the tall screen of trees on the west side of the highway are co-dominant visual elements in this view. Motorists traveling on Highway 101 are the primary viewer group in this area. However, views of the highway, from adjacent land uses, are screened by dense roadside vegetation.

**Viewpoint 1**

Visual quality in this segment is characterized by the mature trees that parallel Highway 101, and the roadway itself. The mature trees and the overpass obscure the views of the distant hills. The overpass structure causes a break in the row of trees, disrupting the continuity of mature vegetation which is relatively consistent in size and scale. The overpass, soundwall and highway itself reduce the intactness and unity of the view, resulting in an average rating. However, the mature vegetation is vivid and unique, creating a rural character, and resulting in an average overall visual quality rating.

### Viewpoint 2

This viewpoint is located on Highway 101 looking north between Fulton Road and Airport Boulevard. As the motorist travels further north on Highway 101, away from Santa Rosa and toward Windsor, the road becomes more rural in character. Within this view, the large mature redwood trees along both sides of the highway are the dominant visual element. A grassy median with metal-beam guardrails is located between the north and southbound travel lanes. Motorists traveling on Highway 101 are the primary viewer group in this area. However, views of the highway, from adjacent land uses, are screened by dense roadside vegetation.

Visual quality in this segment is characterized by the natural landscape, as it represents the rural character of the area. The large redwood trees that run parallel to the freeway blend with the surrounding trees of varying sizes and types that provide visual contrast and texture. The visual landscape is broken up by highway signage, street lights, and an overpass that detract from the unity and intactness of the view. The combination of trees and hills—although interrupted by the freeway—create a highly vivid scene with average intactness and unity, resulting in a moderately-high overall visual quality rating.

**Viewpoint 2**

### Viewpoint 3

This viewpoint is looking north along Highway 101 towards the Windsor River Road interchange at the northern project limit. In this view, Highway 101 continues straight towards the mature vegetation before veering east in the distance. Mature trees that line both sides of the freeway are the dominant visual elements. A grassy median with metal-beam guardrail separates the north and southbound travel lanes. Motorists traveling on Highway 101 are the primary viewer group in this area. However, views of the highway, from adjacent land uses, are screened by dense roadside vegetation.

Visual quality in this segment is characterized by the natural landscape, reflecting the rural character of the area. The dense trees that run parallel to the freeway blend with the surroundings, as they are characteristic of the varying sizes and types of trees in the area. In this segment, there are fewer highway signs, lights or other man-made elements to detract from the rural character. The combination of trees and hills—although interrupted by the freeway—creates a highly vivid scene with moderately-high intactness and unity, resulting in a moderately-high overall visual quality rating.

**Viewpoint 3**

### 3.6.3 Environmental Consequences

The following section analyzes the potential visual impacts of the proposed project within the landscape unit that makes up the project study area. The methodology used to assess visual impacts combines the two principal visual impact components: visual resource change and viewer response to that change. "Visual resource change" is analyzed in terms of visual dominance and other visual effects of facilities that would be constructed under the proposed project, together with the change in visual quality. "Viewer response" to these changes is interpreted on the basis of the viewer types identified. The criteria used to determine effects on viewers include: visual dominance of the project; view obstruction or view expansion; effects on community disruption; viewer orientation; and design quality issues, such as changes in vividness, intactness and unity, as described below.

**Visual Dominance** refers to the contrast between the proposed improvements and their setting described in terms of vegetation, landform, and structural changes. Dominance is a function of how potentially noticeable the project is to the viewer, ranging from:

- **Inevident** — Project is visible but generally not noticeable.
- **Subordinate** — Project is noticeable, but attracts less attention than other components of the setting.
- **Co-dominant** — Project attracts attention equally with other components of the setting.
- **Dominant** — Project dominates the view and attracts more attention than other components of the setting.

**View Obstruction or Expansion** is a criterion that may modify the adverse effect expected from the dominance evaluation. In terms of view blockage, existing views may be eliminated as a result of structural or landform additions that may block visual access. Conversely, views may be improved or made newly available as a result of existing structural and landform elements being moved or removed. View obstruction or expansion is categorized as follows:

- **Obstructed view** — Project fully or largely blocks views of notable landscape features or vistas.
- **Partial view obstruction** — Project interrupts or partly screens views of notable landscape features or vistas, but some experience of viewing features or vistas remains.
- **New or expanded view** — Project opens up views of notable landscape features or vistas.

**Community Disruption, Orientation and Privacy** considerations represent a set of criteria that reflects typical viewer responses and perceptions about the relationship of transportation corridors to the surrounding neighborhood.

Ratings used for determining the extent of impacts are defined as follows:

- **Low or negligible** impacts are minor adverse changes to the existing visual resource, with low viewer response to change in the visual environment.
- **Slightly adverse** impacts are slightly detectable within a localized area with increased viewer response.
- **Medium** impacts are those that are readily apparent with moderate viewer response.
- **High** impacts are highly detectable and would be substantial with a high viewer response level.

An overall determination of adverse and beneficial effects on viewers is based on a combined evaluation of the criteria described above. The ratings used for determining the extent of impacts are defined as follows:

**Strongly Beneficial**−substantial visual change and considerable increase in the overall visual quality, with the likelihood of strongly positive viewer responses.

**Beneficial**−moderate degrees of visual change and an increase in the overall visual quality, with the likelihood of positive viewer response.

**Minimally Beneficial**−tangible visual changes and a minimal increase in overall visual quality, with likelihood of moderately positive viewer responses.

**Negligible**−little or no visual change and no tangible reduction or increase in visual quality, without negative or positive viewer responses expected.

**Minimally Adverse**−a tangible degree of visual change and a minimal reduction in overall visual quality, with the likelihood of some moderately negative viewer responses.

**Adverse**−moderate degrees of visual change and a reduction in the overall visual quality, with the likelihood of negative viewer responses.

#### 3.6.3.1 VISUAL RESOURCE CHANGE

Visual changes as a result of the Build Alternative within the landscape unit are described below.

**Landscape Unit:** To accommodate the Highway 101 HOV lane widening and related facilities such as soundwalls, mature trees (including redwoods and valley oaks) and other vegetation would require removal, thereby affecting existing visual character and quality. Concerted efforts have been made during preliminary engineering to avoid removal of trees. Trees that would be affected by the widened roadway facilities and soundwalls, or that would be too close to the widened roadway to provide adequate safety clearances, would be removed. Of a total of approximately 8,614 trees along the highway within the limits, up to 236 mature trees would be removed. Of the mature trees affected, about 179 trees are redwoods, representing approximately 7.5 percent of the total redwoods (2,374) along the highway within the project limits.

Trees would be removed in specific locations along the corridor particularly in the Fulton Road/Airport Boulevard and Bicentennial Way interchange areas. At the Fulton Road/Airport

Boulevard interchange, tree removal would occur on the east and west side of the highway to accommodate the on/off ramps. Tree removal near the Bicentennial Way interchange would occur primarily on the west side, both north and south of the interchange.

The proposed HOV lane project would also result in the need to construct soundwalls at the northern end of the project to reduce noise levels at nearby residences. Soundwalls would be constructed on the east side of Highway 101 along Hembree Lane from Anthony Court to Cornell Street and from Bluebird Court to East Courtyards. Soundwalls would also be constructed on the west side of Highway 101 along Conde Lane from Maple Drive to Oakfield Lane. Through the Town of Windsor, where soundwalls would be constructed on both sides of the highway, motorists would be visually separated from the natural surroundings.

Although soundwalls would be designed with aesthetic treatments, the loss of vegetation combined with the addition of concrete soundwalls would result in an adverse change to the existing rural, wooded character of the corridor. Construction of the soundwalls would result in a more urbanized visual quality. However, because motorists would move quickly through this relatively short segment (approximately 0.5 miles) of the highway, there would not be a substantial visual change from the existing visual experience. In addition, a retaining wall would be constructed along Cleveland Avenue (south of Bicentennial Way).

Residents and employees of commercial land uses in the southern portion of the project area currently have partially screened views of the highway and would experience only moderate change from the tree removal. The area north of Piner Creek consists primarily of vineyards. Fewer trees exist along this segment of the highway. Tree removal would increase motorists views of the surrounding landscape. Residents and commercial employees would experience moderate changes in the visibility of the highway. In areas where soundwalls are planned, views of the highway would be blocked, a potentially beneficial effect. At some locations, current residential views of fences and mature trees, including redwoods, would be replaced by the concrete soundwall. The soundwall materials would also become a new source of reflective light contributing to glare and heat. Architectural treatments along the proposed soundwalls would soften the visual impact and further increase beneficial visual effects.

Views of the PG&E substation located north of Mark West Springs Road-River Road on the west side of Highway 101 would be more apparent to motorists. The substation is currently screened by mature trees and removal of these trees would result in a substantial visual change. This visual change would be negligible to motorists, however, because they travel quickly through the area. The immediate area around the substation is primarily vineyards with the nearest residences located on the east side of the highway. The substation would be more apparent to these residents. Due to the distance from the substation, this change would be negligible.

### 3.6.3.2 VISUAL CHANGES AND EFFECT ON VIEWER GROUPS

The following section discusses the impacts of the proposed project at the three viewpoints described in Section 3.6.2.3, Landscape Units.

#### Viewpoint 1

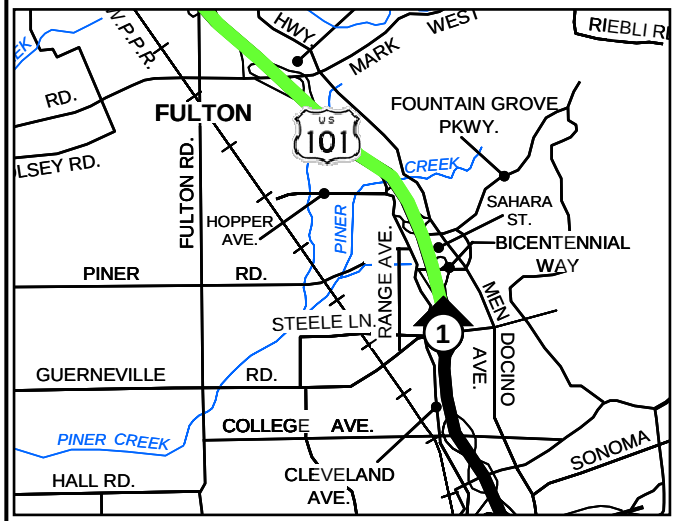
Within this view, the proposed project would widen the existing highway by paving the 14-m (46-ft) wide median to provide the new HOV lane in each direction, and widening by 0.6 m (2 ft) to the outside to provide standard 3-m (10-ft) outside shoulders. The HOV lane would be 3.6 m (12 ft) wide. A southbound ramp would be added at Bicentennial Way and the northbound Bicentennial Way exit ramp would be widened. As shown in Figure 3.6-2, highway widening to accommodate an HOV lane at this location would require the removal of mature vegetation (including redwood and Valley oak trees) on the west and east side of the freeway. Viewer groups that would be affected by the proposed project include motorists and employees of commercial businesses on the west side of the highway. Removing the mature vegetation that lines the highway would eliminate the dominant visual element within this view for motorists and remove existing visual screening for adjacent commercial uses. Removal of the redwoods would detract from the "Redwood Highway" identification of Highway 101. This would result in Highway 101 becoming the dominant visual element within the view and constitute an adverse change to the vividness and overall visual quality of the view. This visual change would also result in an adverse change to the intactness and unity of the view. Overall, the project would result in an adverse visual change to the visual quality of the view. Mitigation measures as described in Section 3.6.5, Avoidance, Minimization, and/or Mitigation Measures, would reduce the adverse visual effects to acceptable levels, as shown in Table 3.6-3 below.

**Table 3.6-3: Overall Visual Quality Change to Viewpoint 1**

| Alternative | Visual Dominance of Highway 101 | View Obstruction | Community Disruption/ Orientation/ Privacy | Vividness | Intactness | Unity | Overall Visual Quality |
|---|---|---|---|---|---|---|---|
| **Existing/ No-Build Alternative** | Co-dominant | N/A | N/A | Moderately High | Average | Average | Average |
| **Build Alternative** | Dominant | Partial View Obstruction | Slightly Adverse | Average | Moderately Low | Moderately Low | Adverse |
| **Build Alternative with Mitigation** | Co-dominant | Partial View Obstruction | Low or Negligible | Average | Average | Average | Negligible |

***Existing Condition / No-Build Alternative***

***Visual Change with Project***




S C T A

**Highway 101 HOV Lane Widening Project:**
**Steele Lane, Santa Rosa to**
**Windsor River Road, Windsor**

**VIEWPOINT 1**
**Figure 3.6-2**

### Viewpoint 2

Within this view, the proposed project would widen the existing highway by paving the 14.0-m (46-ft) wide median to provide the new HOV lane in each direction, and widening by 0.6 m (2 ft) to the outside to provide standard 3.0-m (10-ft) outside shoulders. The HOV lane would be 3.6 m (12 ft) wide. The project would also require modifications to the Fulton Road/Airport Boulevard interchange, for which there are two options in each of the northbound and southbound directions: Northbound Option A and Option B, and Southbound Option A and Option B. In the northbound direction, Option A would widen existing roadways and remove a few of the mature trees. Option B would involve a new ramp requiring a new bridge over Mark West Creek and removal of a larger number of mature trees. In the southbound direction, both Options A and B would require the removal of substantial amounts of vegetation, including many large mature trees, a substantial increase in paved surface, and a retaining wall adjacent to Mark West Creek along the frontage road on the west side of Highway 101. Option B would result in a more dramatic change because, in addition to the removal of mature vegetation, it would involve construction of an elevated overcrossing. Figure 3.6-3 depicts Southbound Option B from this viewpoint. A plan and profile of the elevated overcrossing (Southbound Option B) in relation to surrounding land uses is shown in Figure 3.6-4.

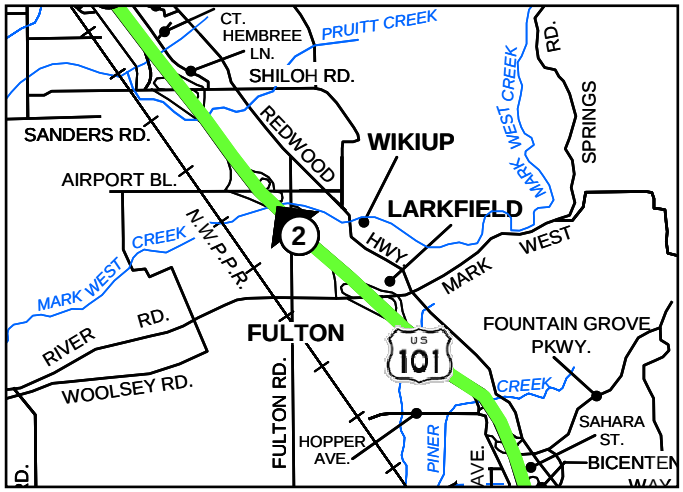
Under all interchange options, removal of the mature vegetation and paving of the median would result in Highway 101 becoming the dominant visual element within the view. This change would be adverse because it would remove the existing visual elements (mature vegetation, grassy median) that contribute to the moderately-high visual quality of this view. Viewer groups that would be affected in this location include motorists and seasonal agricultural workers. Because removal of mature vegetation would also open up motorists' views to the vineyards and riparian area surrounding Mark West Creek on the west side of the highway, the visual changes would be considered only minimally adverse. Seasonal agricultural workers would have increased views of the freeway. The overall effect on visual quality would be minimally adverse. Mitigation measures as described in Section 3.6.5 would reduce adverse visual effects to acceptable levels, as shown in Table 3.6-4 below.

**Table 3.6-4: Overall Visual Quality Change to Viewpoint 2**

| Alternative | Visual Dominance of Hwy 101 | View Obstruction | Community Disruption/ Orientation/ Privacy | Vividness | Intactness | Unity | Overall Visual Quality |
|---|---|---|---|---|---|---|---|
| **Existing/ No-Build Alternative** | Subordinate | N/A | N/A | High | Average | Average | Moderately High |
| **Build Alternative** | Dominant | New or Expanded View | Slightly Adverse | Moderately High | Average | Average | Minimally Adverse |
| **Build Alternative with Mitigation** | Co-dominant | New or Expanded View | Low or Negligible | Moderately High | Average | Average | Minimally Adverse |

***Existing Condition / No-Build Alternative***

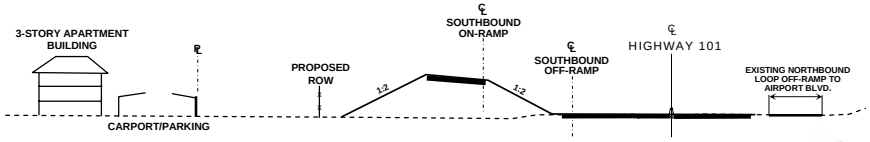
***Visual Change with Project (Southbound Option B)***




S C T A

**Highway 101 HOV Lane Widening Project:**
**Steele Lane, Santa Rosa to**
**Windsor River Road, Windsor**

**VIEWPOINT 2**
**Figure 3.6-3**

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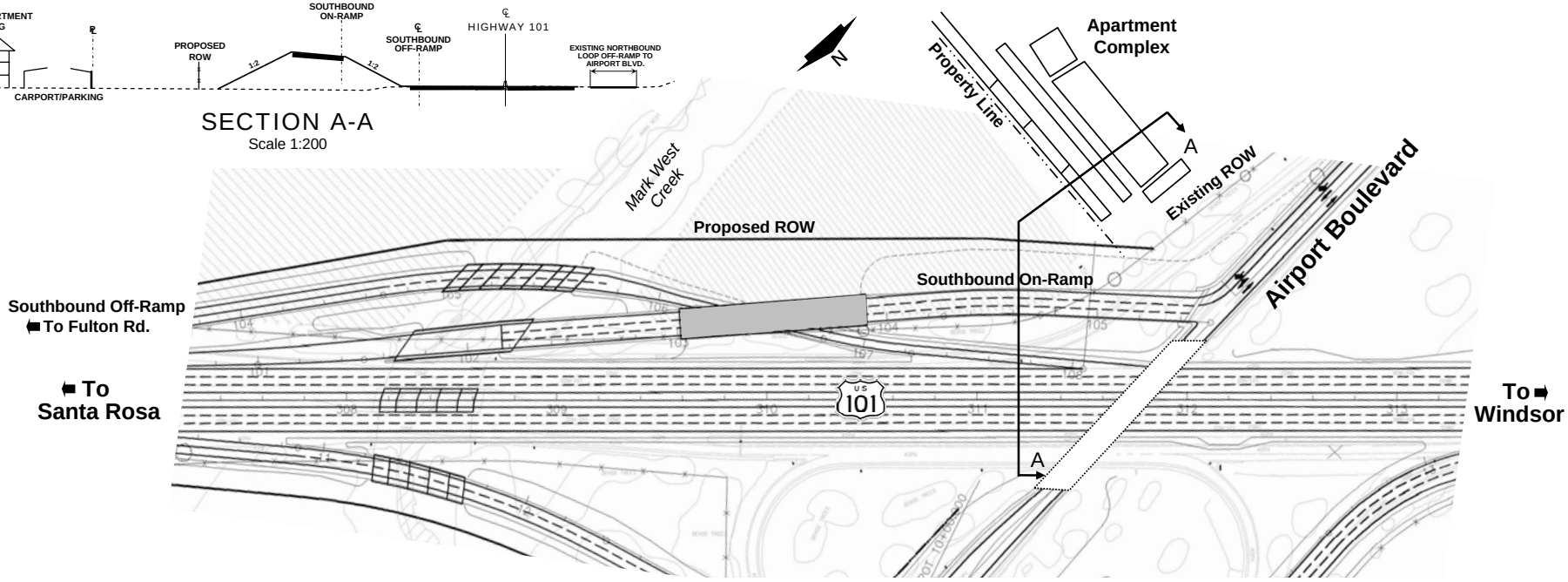


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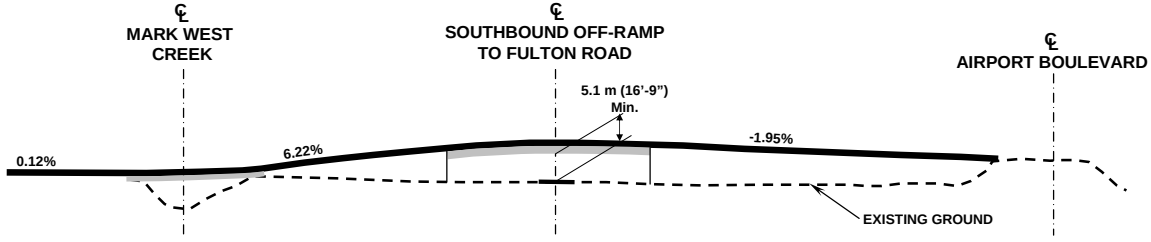


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PROFILE



**FULTON ROAD / AIRPORT BOULEVARD INTERCHANGE COMPLEX (SOUTHBOUND OPTION B)**
**Figure 3.6-4**

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### Viewpoint 3

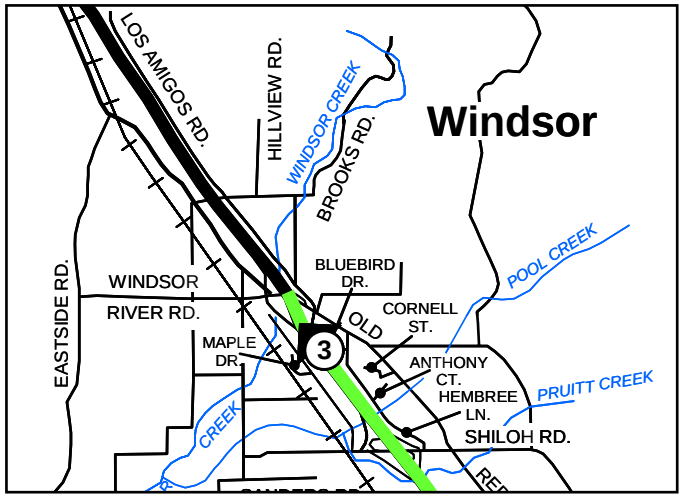
Within this view, the proposed project would widen the existing highway by paving the 14-m (46-ft) median to provide the new HOV lane in each direction, and widening by 0.6 m (2 ft) to the outside to provide standard 3-m (10-ft) outside shoulders. The HOV lane would be 3.6 m (12 ft) wide. As shown in Figure 3.6-5, highway widening to accommodate an HOV lane at this location would require the construction of soundwalls on both sides of the highway to reduce noise levels at adjacent residences. The soundwalls would be 3.7 m (12 ft) to 4.9 m (16 ft) in height and would be constructed of concrete-block materials. Architectural and landscaping treatments on the soundwalls would be implemented (see Section 3.6.5, Avoidance, Minimization, and/or Mitigation Measures). Widening the highway and constructing soundwalls on both sides would require the removal of mature vegetation along the highway and within the grassy median that currently separates the north and southbound lanes. This would be considered a change to the existing visual character because the mature vegetation along the highway and grassy median are the dominant visual elements that contribute to the moderately-high visual quality of this area. Loss of these visual elements would also create an adverse change to the vividness, intactness, and unity of the view. The soundwalls would obstruct motorist views to the surrounding areas and would make Highway 101 the dominant visual element of the view. Views of the highway from adjacent residences would be totally blocked, a potentially beneficial effect. At some locations, existing residential views of fences and mature trees, including redwoods, would be replaced by the concrete soundwall. The soundwall materials would also become a new source of light contributing to glare and heat. As a result, the proposed project would result in an adverse impact on the visual quality of this view. Mitigation measures as described in Section 3.6.5 would reduce adverse visual effects to acceptable levels, as shown in Table 3.6-5 below.

**Table 3.6-5: Overall Visual Quality Change to Viewpoint 3**

| Alternative | Visual Dominance of Hwy 101 | View Obstruction | Community Disruption/ Orientation/ Privacy | Vividness | Intactness | Unity | Overall Visual Quality |
|---|---|---|---|---|---|---|---|
| **Existing/ No-Build Alternative** | Co-dominant | N/A | N/A | High | Moderately High | Moderately High | Moderately High |
| **Build Alternative** | Dominant | Obstructed View | Medium | Moderately Low | Average | Average | Adverse |
| **Build Alternative with Mitigation** | Dominant | Obstructed View | Slightly Adverse | Average | Average | Average | Minimally Adverse |

***Existing Condition / No-Build Alternative***

***Visual Change with Project***




S C T A

**Highway 101 HOV Lane Widening Project:**
**Steele Lane, Santa Rosa to**
**Windsor River Road, Windsor**

**VIEWPOINT 3**
**Figure 3.6-5**

### 3.6.4 Consistency with Scenic/Visual Resource Plans and Policies

The General Plans for Sonoma County, the City of Santa Rosa and Town of Windsor set forth scenic/visual resource goals and policies intended to preserve, enhance, restore and respect scenic vistas and visually important landscapes in each jurisdiction. The proposed project would be generally consistent with relevant scenic/visual resources policies, as shown in Table 3.6-6 below. Avoidance, minimization, and/or mitigation measures are proposed to ensure consistency with local scenic/visual resource goals and policies (see Section 3.6.5).

**Table 3.6-6: Consistency with Scenic/Visual Resource Plans and Policies**

| | |
|---|---|
| **Sonoma County General Plan** | |
| **Goal OS-1:** Preserve the visual identities of communities by maintaining open space areas between cities and communities.<br><br>**Objective OS-1.1:** Preserve important open space areas in the community separators shown on Figures OS-5a through OS-5i of the Open Space Element.<br><br>**Objective OS-1.2:** Retain a rural character and promote low intensities of development in community separators. Avoid their annexation or inclusion in spheres of influence for sewer and water service providers. | ***Consistent.*** The project would not result in a significant loss of acreage between the urbanized areas of Santa Rosa and Windsor, and would therefore not visually affect the community separator between these communities. The project would not result in increased development within the community separators, and would not affect the amount of open space between urbanized areas of neighboring cities. However, the removal of mature vegetation, construction of soundwalls and modification of interchanges would reduce the rural character of this stretch of Highway 101 for motorists and make the highway a more prominent visual element within the community separator. |
| **Objective OS-1.4:** Preserve existing specimen trees and tree stands within community separator areas.<br><br>**Goal OS-2**: Retain the largely open, scenic character of important scenic landscape units.<br><br>**Goal OS-3**: Identify and preserve roadside landscapes which have a high visual quality as they contribute to the living environment of local residents and to the county's tourism economy. | ***Potentially Inconsistent.*** The removal of mature vegetation would result in an adverse visual impact to the community separator (the Highway 101 corridor) within the project area, unless mitigation is incorporated. Mitigation measures that include replacement planting are proposed to reduce inconsistency with this policy. Guardrails shall be installed around selected redwood tree groupings where feasible. Redwood tree clusters shall be re-established along the linear portions of the corridor where feasible. Additionally, replacement planting will occur near interchanges and points of entry into cities within the project limits. |
| **Goal RC-4:** Preserve, sustain and restore forestry resources for their economic, conservation, recreation, and open space values. | ***Consistent.*** The proposed project would remove mature vegetation (trees) along the existing roadway. However, these trees do not represent a forestry resource, nor provide economic or recreational value. |
| **City of Santa Rosa General Plan** | |
| **OSC-A-7:** Encourage preservation of open space in the Community Separators Open Space and Community Separators) between Santa Rosa and neighboring communities. Work with regional agencies to ensure maintenance of the separators as permanent open space. | ***Consistent.*** The proposed project would not result in a significant loss of open space within the community separator between the City of Santa Rosa and Town of Windsor. |

| Table 3.6-6: Consistency with Scenic/Visual Resource Plans and Policies | |
|---|---|
| **UD-A-1:** Maintain view corridors to natural ridgelines and landmarks, such as Taylor Mountain and Bennett Mountain. | ***Consistent.*** Views of the natural ridgelines for motorists traveling on Highway 101 are currently blocked in many places by mature trees. Removal of these trees would open up new views to motorists of ridgelines. In areas where existing vegetation along the highway would be removed and soundwalls constructed, the views of motorists of ridgelines would not change compared to existing conditions. |
| **UD-H-2:** Align and construct streets along natural grades. Minimize visibility of streets from other areas within the City. | ***Consistent.*** The proposed project would widen an existing highway and would not require substantial grading outside of the right-of-way. However, the removal of mature vegetation, construction of soundwalls and modification of interchanges would make the highway a more prominent visual element within the community. |
| **UD-H-6:** Minimize vegetation removal in hillside areas, and preserve large trees that partially screen development or help blend new development into views. | ***Potentially Inconsistent.*** The proposed project would require the removal of mature vegetation along Highway 101, which screens the highway from adjacent land uses in many areas. Construction of soundwalls in certain locations would replace the screening provided by the existing vegetation. Mitigation measures that include replacement landscaping are proposed to reduce visual changes associated with the project. Where feasible, important stands of redwood trees would be protected by a metal-beam guardrail. |
| **Town of Windsor General Plan** | |
| **I.1.4:** Development along the scenic U.S. 101 corridor should be setback from the highway to provide space for landscaping and recreational uses. Such landscaping should be comprehensively planned along with any proposals for soundwalls along the U.S. 101 frontage, to avoid a monotonous visual barrier that conflicts with the objective of providing visual access to the distant hillsides and ridgelines. | ***Potentially Inconsistent.*** While this policy primarily deals with the site design of adjacent land development within the Town of Windsor, the proposed project could create situations at existing developments that would be considered inconsistent with this policy. For example, the project would result in the removal of mature vegetation and construction of soundwalls within the Town of Windsor. If not mitigated, this condition would create the "monotonous visual barrier" discouraged by this policy. Mitigation measures that include replacement landscaping are proposed to avoid inconsistency with this policy. Where feasible, vines would be planted and allowed to grow on the soundwalls. |
| **I.1.5***:* Soundwalls should be avoided as much as possible, particularly along identified scenic corridors. Where soundwalls are necessary, they should be designed as attractively as possible. | ***Potentially Inconsistent.*** The proposed project would remove existing mature vegetation along Highway 101 and construct a soundwall within the Town of Windsor. Architectural treatments on soundwalls and replacement landscaping would be implemented to avoid inconsistency with this policy. Where feasible, vines would be planted and allowed to grow on the soundwalls. |
| **I.2.6:** Lands included within the Town Planning Area that are also within the County-designated Community Separator shall be preserved in open space. | ***Consistent.*** The project would not result in a substantial loss of land within the community separator between the Town of Windsor and City of Santa Rosa. |

### 3.6.5 Avoidance, Minimization, and/or Mitigation Measures

A landscaping replacement plan would be implemented and replacement trees planted. It is Caltrans policy to replace vegetation damaged or removed due to highway improvement projects. The landscape replacement plan would be developed by Caltrans with input from Sonoma County and the City of Santa Rosa and Town of Windsor to identify appropriate and feasible locations and species of trees for replacement within or near the project limits. Such replacement locations must meet safety requirements for sight distances, in addition to providing favorable conditions for tree establishment and survival. The following mitigation measures are proposed to reduce visual effects of the Build Alternative.

- Mature trees would be replaced at a minimum ratio of 1:1. This ratio may be increased based on consultation among Caltrans and the other agencies.
- Species, size, precise number, location, and spacing of replacement trees would ultimately be determined by Caltrans Office of Landscape Architecture at a future phase of the project.
- Landscape replacement would include landscaping, irrigation, and design elements, such as aesthetic treatments on wall structures that would help to maintain the corridor's existing level of visual quality. Where feasible, vines would be planted and allowed to grow on the soundwalls to help visually integrate them into the overall environment, to reduce glare and the incidence of graffiti. New retaining walls would also be given aesthetic treatment.
- A three-year plant establishment period would be implemented.
- All disturbed areas will be re-vegetated according to Caltrans standards.
- Black vinyl clad chain link fence shall be installed on top of the proposed concrete barrier left of ML Line Station 99+20 to 109+00. A 12-18-inch wide plantable area will be provided between the concrete barrier and the frontage road to plant vines along the frontage road side of the barrier.
- Design exceptions will be prepared to:
  - Reduce the width of the standard "catch line" to minimize the loss of existing desirable vegetation.
  - Install metal-beam guardrail around selected existing redwood tree groupings to retain the corridor's image of being the "Redwood Highway," especially at entry points to municipalities.
- Provide slope rounding on cuts and fills for a more natural appearance.
- Provide aesthetic surface treatments to structures that are consistent with the corridor-wide master plan (to be developed). Sound and retaining walls would be aesthetically treated with color, texture, patterning and planted with vines (where feasible), to reduce glare and deter graffiti.
- Redwood tree clusters shall be reestablished along the linear portions of the corridor where feasible. Additionally, replacement planting will occur near interchanges and points of entry into cities within the project limits.

Additional avoidance and minimization measures to be implemented during the construction phase of the project are discussed in Section 3.16.6, Construction Phase Visual/Aesthetics.

## 3.7 Cultural Resources

As used in this document, "cultural resources" refers to archaeological and historical resources including, but not necessarily limited to, districts, sites, buildings, structures, and objects. This section of the environmental document discusses the studies performed to identify and evaluate the potential for impacts to such resources.

### 3.7.1 Regulatory Setting

The primary federal laws dealing with archaeological and historic resources include:

**National Historic Preservation Act of 1966 [16 U.S.C. 470 et seq.]:**

The National Historic Preservation Act (NHPA), as amended, sets forth national policy and procedures regarding historic properties included in or eligible for the National Register of Historic Places (NRHP). Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings on such properties, following regulations issued by the Advisory Council on Historic Preservation (36 CFR 800).

**National Environmental Policy Act of 1969 [42 U.S.C. 4321 et seq.]:**

The National Environmental Policy Act (NEPA), the broad environmental law that applies to federal agencies and their activities, includes the preservation of important historic, cultural, and natural aspects of our national heritage within its general policy for environmental protection. Meeting the requirements of Section 106 and the NEPA regulations (40 CFR §1500-1508.28) are separate compliance efforts that require coordination. The Section 106 compliance documents that are prepared to meet the requirements of the National Historic Preservation Act also provide the basis for the required assessment of cultural resources, project alternatives, and historic property impacts in the environmental document prepared pursuant to NEPA.

**U.S. Department of Transportation Act of 1966 (49 U.S.C. 303 Section 4[F]):**

Transportation projects must comply with the provisions of Section 4(f) of the U.S. Department of Transportation Act (23 CFR 771). Section 4(f) applies to US Department of Transportation projects that involve the "use" (either actual take of land or a less tangible "constructive use") of land from historic properties. A Section 4(f) evaluation, which requires documentation of completion of the Section 106 process, must demonstrate that there is no prudent and feasible alternative to the use, and that all possible planning has been done to minimize harm to Section 4(f) protected resource(s).

**California Environmental Quality Act of 1970 (CEQA) [PRC §21000 et seq.]:**

Cultural resources are protected by the California Environmental Quality Act (CEQA) (PRC Division 13, Sections 21000-21178), which requires state and local agencies to take into consideration the environmental effects of their actions. Cultural resources that are listed on or determined to be eligible for listing on the NRHP and/or the California Register of Historic Resources (CRHR), as well as city-designated historic resources are protected under CEQA.

**Public Resources Code (PRC §5024.1):**

Public Resources Code 5024.1 established the California Register of Historic Resources, a listing of historic properties within the state. Section 5024.5 requires state agencies to provide notice to and to confer with the State Historic Preservation Officer (SHPO) before altering, transferring, relocating, or demolishing state-owned historical resources.

## 3.7.2 Affected Environment

### 3.7.2.1 ARCHAEOLOGICAL RESOURCES

Archaeological resources possess both scientific and cultural values. The specific site locations are confidential in order to deter vandalism and desecration. Therefore, only generalized locations associated with the proposed project are provided in the following section.

In accordance with both Section 106 of the National Historic Preservation Act and CEQA, Caltrans commenced archaeological investigations by delineating an archaeological Area of Potential Effects (APE) to include the maximum anticipated project footprint for areas that may be disturbed by the proposed project. Certain assumptions have been made, such as two meters (6.56 feet) of anticipated temporary construction easement beyond potential soundwall footing locations.

The Archaeological Survey Report (ASR) that was subsequently prepared documents the efforts to evaluate the potential for buried cultural deposits. This involved a sensitivity analysis for intact buried prehistoric and historic archaeological resources within the APE that relied on published maps, reports and databases from the following sources:

- Historical Resources Information System, Northwest Information Center (NWIC) at Sonoma State University in Rohnert Park (February 2003 and April 2004);
- McCone Hall Library Map Room, University of California, Berkeley (November 2003 and April 2004);
- Bancroft Library, University of California, Berkeley (November 2003 and April 2004);
- Sonoma County Historical Society, Sonoma County Library, Santa Rosa (November 2003);
- National Register of Historic Places (1991);
- California Register of Historical Resources (2004);
- California Historical Landmarks (1996);
- Databases from the U.S. Geological Survey (USGS), California Geological Survey (CGS), and the National Resource Conservation Service (NRCS); and
- Cultural resource studies of locations within or in close proximity to the project APE, conducted within the past decade.

The Native American Heritage Commission (NAHC) in Sacramento was contacted by letter on March 9, 2003 for a search of sacred lands files and for a list of local Native American organizations and individuals. On March 28, 2003, the NAHC indicated that no sacred lands sites were on file for the project area and provided a list of interested parties. On March 28, 2003, a letter was sent to all of the organizations and individuals named on the NAHC list and follow-up calls were made to each of the contacted parties. Native American consultation was conducted over the course of 2004 during quarterly meetings between Caltrans and the Federated Indians of Graton Rancheria. As part of the

consultation effort, the draft ASR was submitted to the Federated Indians for review in February 2005.

To evaluate the potential for buried cultural deposits in the project study area, a surface reconnaissance of the archaeological APE was conducted in April, May, and July 2003. Although much of the ground surface was obscured by freeway pavement, landscaping, and fill; terrain on both sides of the roadway within the archaeological APE was unobstructed and moderate-to-good surface survey conditions allowed for reliable archaeological inspection. Supplemental inspections were conducted in May 2004. An intensive-level survey was accomplished on accessible portions of the archaeological APE by walking parallel transects approximately 8 to 10 meters (26.2 – 32.8 ft) apart. A more cursory field inspection was accomplished for locations where substantial ground disturbance had taken place or where extensive fill was present as a result of past Highway 101 construction and safe access was not possible. Those portions of the archaeological APE that were covered with roadway pavement, parking lots, and commercial buildings, as well as private property for which access was denied, were not inspected.

**Prehistoric Archaeological Resources:** A record search at the Historical Resources Information System, Northwest Information Center (NWIC) suggests that one site has been documented within the project APE boundaries. Subsequent subsurface investigations at the site location determined that it is not a prehistoric archaeological site. Fourteen recorded sites are located within the project study area (approximately 0.8 to 1.0 km [0.5 to 0.6 mile] from the archaeological APE); temporal or cultural affiliation is documented for only two of these sites. Also, three unsubstantiated ethnographic village locations are reported to be situated approximately 0.4 to 4.0 km (0.25 to 2.5 miles) from the archaeological APE.

Based on a review of the geomorphologic and archaeological record, there initially appeared to be a possibility that buried archaeological resources could be present within the project APE. Portions of the Santa Rosa Plain contain Holocene Age sediments deposited since the earliest known human use of the Sonoma County region. Various depositional processes (alluvial/colluvial sedimentation, stream channel migration, and seismic-induced ground movement) have buried stable land surfaces that could contain prehistoric archaeological deposits. Thus, there was a potential for buried prehistoric archaeological deposits in the valleys that are transected by the Highway 101 project and surroundings. A thorough and systematic program of subsurface testing was therefore conducted, which revealed little likelihood of encountering buried cultural materials within the project APE.

**Historic Archaeological Resources:** Reviews of project information, late-nineteenth-century and twentieth-century maps, county and local histories, and cultural resource management documents were completed to determine the potential for encountering historical archaeological resources that might be eligible for the NRHP. No known Hispanic or American Period structures, features, or potential historical archaeological sites have been recorded or identified within or immediately adjacent to the archaeology APE.

#### 3.7.2.2 HISTORIC RESOURCES

Historic resources include districts, sites, buildings, structures, and objects included in or eligible for the NRHP. To assess the impacts of the project on historic resources, both a Historic Property Survey Report (HPSR) and Historic Resource Evaluation Report (HRER) were completed for the project.

A Historic Properties Survey Report was submitted to the State Historic Preservation Officer (SHPO) on October 12, 2005. The SHPO concurred in the negative eligibility findings on November 4, 2005. A copy of the SHPO's letter is provided in Appendix E, Agency Correspondece.

The architectural APE includes the area that would be directly affected by construction and generally runs either with or beyond the archaeological APE. An area one parcel deep on all sides immediately adjacent to the proposed right-of-way is allotted to provide for consideration of visual and noise impacts and changes to cultural settings of nearby historic facilities. In some instances, where there are proposed sound walls or raised structures such as overpasses, the proposed architectural APE extends beyond the one parcel limit to account for potential visual effects.

A reconnaissance survey was conducted in the field to account for all buildings, structures, and objects within the APE. This field reconnaissance helped to determine which buildings appeared to be more than 45 years of age and, therefore, would need more detailed study for this project. Data were obtained from the following sources:

- First Real Estate Solutions commercial database;
- U.S. Geological Survey (USGS) topographic maps;
- California State Library;
- Sonoma County Assessor's and Recorder's offices;
- California Department of Transportation Library, Sacramento;
- Caltrans District 4 Maps and Plans Office, Oakland;
- Shields Library at University of California, Davis;
- Petaluma Museum Research Library;
- Solano County Library Annex, Santa Rosa; and
- Healdsburg Museum and Historical Society.

A letter informing interested parties of the Highway 101 HOV Widening project was sent to area planning agencies, local governments, historical societies, and museums on June 25, 2003. A July 15, 2003 response from Sonoma County Landmarks Commission Planner Kathi Jacobs suggested the possibility that one historic resource, the Laughlin House at 418 Aviation Drive in Santa Rosa, might lie within the project area. However, review of the architectural APE indicates that the property would not be affected by the project.

The architectural APE includes 128 buildings, groups of buildings, or structures located within Sonoma County, in the cities of Santa Rosa, Fulton, and Windsor, as well as the unincorporated county lands in-between. The architectural APE contains 12 buildings, groups of buildings, or structures constructed in or before 1957. The remaining buildings, groups of buildings, or structures fall under one of the six property types exempt from evaluation as outlined in Attachment 4 of the

Programmatic Agreement between Caltrans, FHWA, ACHP, and the SHPO, which became effective January 1, 2004.

The 12 evaluated properties are evenly distributed throughout the architectural APE, with just over half located within or in the vicinity of Santa Rosa. The remaining resources are found in or near Windsor. These types of properties are evenly divided between farm properties or parcels that contain remnant farm buildings and residential lots with Ranch- or Minimal Traditional-style houses constructed during the wave of post-World War II development. While all of these resources date to the 20th-Century, over half were constructed in the 1940s and 1950s.

**Agricultural Properties:** Six properties contain buildings that were constructed as part of small farms during the 1910s and 1920s. As the region developed, land was further subdivided and, today, only remnant buildings are extant. Generally, these properties consist of a main residence constructed in one of the popular residential styles of the day such as Craftsman or Folk Victorian, tank houses, and/or various secondary sheds. These former agricultural properties ceased to function as farms in the second half of the twentieth century and, over the subsequent years, many of the farm buildings were heavily modified or demolished and new buildings constructed in their place.

**Residential Properties:** The remaining six properties consist predominately of modest Ranch-style residences constructed in the 1940s and 1950s on residential-size lots. Typically, these residences are one-story wood frame buildings ranging in size between 1,000 and 1,900 square feet; many have been altered by installation of replacement windows or siding and the construction of modern additions.

The 12 historic-era properties within the architectural APE were evaluated in accordance with applicable sections of NHPA and the implementing regulations of the ACHP as these pertain to federally funded undertakings and their impacts on historic properties. The properties also were evaluated in accordance with Section 15064.5(a) (2)-(3) of the CEQA Guidelines using the criteria outlined in Section 5024.1 of the California Public Resources Code. None of the evaluated properties appears to meet criteria for listing in the National Register of Historic Places or California Register of Historical Resources nor do they appear to be historical resources for the purposes of CEQA. Caltrans has determined that the only other properties present within the architectural APE, including state-owned resources, meet the criteria for Section 106 PA Attachment 4 (Properties Exempt from Evaluation).

## 3.7.3 Environmental Consequences

### 3.7.3.1 Impacts on Archaeological Resources

Based on the information collected during field surveys, documentary research, and subsurface testing, it is not anticipated that construction activities would encounter or disturb buried cultural resources. Measures are identified in Section 3.7.4, Avoidance, Minimization, and/or Mitigation Measures, to address late discovery of unanticipated buried cultural deposits.

### 3.7.3.2 Impacts on Historic Archaeological Resources

As a result of the archival research and field reconnaissance, the project has little or no potential to affect historic archaeological resources. Therefore, no mitigation for such impacts is proposed.

#### 3.7.3.3 IMPACTS ON ARCHITECTURAL RESOURCES

As there are no eligible historic resources, there is no potential for impact to such resources and no mitigation is proposed.

### 3.7.4 Avoidance, Minimization, and/or Mitigation Measures

#### 3.7.4.1 PREHISTORIC ARCHAEOLOGICAL RESOURCES

In the unlikely event that previously unidentified buried cultural materials are unearthed during construction of the proposed project, Caltrans and FHWA would comply with 36 CFR § 800.13 regarding late discoveries.

## 3.8 Hydrology and Floodplains

This section summarizes the regulatory setting, existing environment, potential impacts, and measures to prevent or reduce impacts to hydrologic resources and floodplains as a result of the Highway 101 HOV Lane Widening project. Documents reviewed in support of this study include the PSR/PDS, Highway 101 as-built plans, Caltrans strip topographic data, USGS quadrangles, Windsor Area Master Drainage Plan, Sonoma County design criteria, and the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs) for Sonoma County (*FEMA, 1997*). Supplemental data were gathered during site investigations and meetings with Sonoma County Water Agency staff. The flood hydrograph data used for the hydraulic studies for this environmental document are based on ultimate build-out according to the Sonoma General Plan. However, since ultimate build-out flow rates were not available in the case of Mark West Creek, FEMA flow rates (FEMA, 1997) obtained from a hydraulic model provided by Sonoma County Water Agency (SCWA) were used instead.

### 3.8.1 Regulatory Setting

**Executive Order 11988** (Floodplain Management) directs federal agencies to avoid to the extent possible adverse impacts associated with floodplains and to avoid direct or indirect support of incompatible development in floodplains. The FHWA requirements for compliance are outlined in 23 CFR 650, Subpart A. Section 650.111 of the regulations calls for location hydraulic studies to be performed with detailed engineering design drawings to avoid and/or minimize hydrological and floodplain impacts. For work in floodplains that requires permit approval, environmental documentation must explain the impacts the project would have on these areas and on the resources within these areas.

### 3.8.2 Affected Environment

This section summarizes the surface water, groundwater, and floodplain studies that were carried out in support of this project.

#### 3.8.2.1 HYDROLOGY

**Hydrologic Resources:** The primary hydrologic resources within the study area include Windsor Creek, East Windsor Creek, Pool Creek, Faught Creek, Pruitt Creek, Mark West Creek, and the Santa Rosa Flood Channel (North, Middle, and South branches). The drainage areas for the stream courses are similar, in that the upper portions of the watersheds are located in hilly terrain that transitions to alluvial valley area. Elevations along the Highway 101 alignment range from approximately 42 meters (m) (140 feet [ft]) to 55 m (180 ft) mean sea level (msl). The watersheds draining to stream courses crossing Highway 101 range in elevation from approximately 42 m (140 ft) to 690 m (2260 ft) msl and all contribute run-off to the Russian River. The portion of Highway 101 that is being widened is located within the alluvial valley areas of these watersheds.

**Climate and Precipitation:** The climatic characteristics in the vicinity of the project area are typical of basins protected from direct coastal winds by low hills. Precipitation generally occurs during a rainy season that extends from October to April. Summers are typically warm and dry, and winters are mild and wet. The average temperature for the area is approximately 14.4 degrees Celsius (58 degrees Fahrenheit). The average annual rainfall in the project area is approximately 89 centimeters (cm) (35 inches). The upper portions of the watersheds affected by the Highway 101 Widening Project receive up to 140 cm (55 inches) of rainfall annually (SCWA, 1983).

**Roadside Drainage:** Existing roadside drainage consists primarily of open grass-line swales off the shoulders and within the unpaved highway median. In some locations, the median is paved with a curb to convey roadside drainage to drop inlets and buried pipelines. Some of these drop inlets are constructed immediately above the box culvert conveying a stream course across the highway right-of-way. In these instances, an opening is made in the top of the box culvert and the drop inlet is placed over this opening, conveying roadside runoff directly to the receiving stream.

**Cross-Drainage:** Drainage is carried across Highway 101 at the following stream crossings: Windsor Creek; East Windsor Creek; Pool Creek; Faught Creek (Pool Creek Tributary); Pruitt Creek; Mark West Creek; Santa Rosa Flood Channel (North, Middle, and South Branches). In the case of culvert crossings of the highway, where these occur, the culverts are continuous from the upstream face of the northbound lanes, through the median, to the downstream face of the southbound lanes. Where bridge crossings are used over the stream course, these typically consist of twin parallel structures, one each for the northbound and southbound roadways. These current cross-drainage facilities have sufficient capacity to handle the design storm runoff flow rates. The 100-year flood elevations are contained in the channels or culverts, as described below.

- Windsor Creek: Windsor Creek originates in the hills east of the Highway 101 alignment and flows in a westerly direction towards the Russian River. It crosses Highway 101 approximately 150 m (500 ft) north of the Windsor River Road overcrossing. The drainage area at this point is approximately 620 ha (2.4 sq mi). Drainage from this watershed is conveyed under the highway via a 6.1 m x 3.7 m (20 ft x 12 ft) concrete box culvert. The culvert is approximately 128 m (420 ft) in length.
- East Windsor Creek: East Windsor Creek originates in the hills east of the highway and crosses Highway 101 approximately 200 m (660 ft) south of Windsor River Road. The drainage area is

approximately 465 ha (1.8 sq mi) and runoff is conveyed under the highway via a 3 m x 3 m (10 ft x 10 ft) concrete box culvert. The culvert is approximately 94 m (308 ft) in length.

- Pool Creek: The headwaters of Pool Creek originate in the hills east of Highway 101. The drainage area at the highway is approximately 985 ha (3.8 sq mi) and runoff is conveyed under Highway 101 via twin bridges. The bridges are approximately 20.5 m (67 ft) long and 12 m (40 ft) wide. The bridges are located approximately 610 m (2,000 ft) north of Shiloh Road.
- Faught Creek: Faught Creek (Pool Creek Tributary No. 35 as identified in the Windsor Area Master Drainage Plan (*SCWA, 1989*)] is immediately south of Pool Creek and drains approximately 180 ha (0.7 sq mi). Flows are conveyed under Highway 101 via a 3.7 m x 2.1 m (12 ft x 7 ft) concrete box culvert. However, development has occurred at the upstream end of the Highway 101 culvert and the upstream portion of the channel has been put into underground piping. The channel daylights several hundred meters east of the highway and continues upstream through a residential development as an open channel. Downstream of Highway 101 the channel is open, except for a short portion which is conveyed under the Shiloh Road off-ramp from southbound Highway 101.
- Pruitt Creek: Pruitt Creek also drains the eastern hills and is conveyed under Highway 101, which spans the creek via a pair of 20.7 m (68 ft) long bridges. The southbound Highway 101 bridge is 12 m (39 ft) wide. The width of the northbound span varies as it encompasses a portion of the off-ramp to Shiloh Road. The bridge is located approximately 370 m (1,200 ft) south of Shiloh Road. The drainage area is approximately 440 ha (1.7 sq mi).
- Mark West Creek: Mark West Creek is by far the most significant stream crossing encountered along the reach of Highway 101 under study. The drainage area at the highway is approximately 9,430 ha (36.4 sq mi). Flows are conveyed under the highway, which crosses the creek on twin 44.5 m (146 ft) long bridge spans. The bridges are midway between Fulton Road and Airport Boulevard.
- Santa Rosa Flood Channel, North Branch: The northernmost branch of the Santa Rosa Flood Channel is located approximately 1,130 m (3,700 ft) south of Mark West Springs Road and drains approximately 52 ha (0.2 sq mi). Runoff is conveyed under the highway via a 76-centimeter (30-inch) circular concrete culvert.
- Santa Rosa Flood Channel, Middle Branch: The middle branch of the Santa Rosa Flood Channel is located approximately 900 m (2,950 ft) north of the Mendocino Avenue overpass and drains approximately 285 ha (1.1 sq mi). Runoff is conveyed under the highway via twin 2.4 m x 1.5 m (8 ft x 5 ft) concrete box culverts. These culverts terminate at a drop structure downstream of the Highway 101 crossing. The downstream end of the drop structure is connected to a 1.8 m (6.0 ft) concrete pipe in which no daylight may be seen. This concrete pipe is through a commercial development and the downstream terminus of the piped system was not identified.
- Santa Rosa Flood Channel, South Branch: The south branch of the Santa Rosa Flood Channel is located near the County Administrative Center approximately 425 m (1,400 ft) north of Steele Lane. Runoff from the approximately 492 ha (1.9 sq mi) drainage area is conveyed under the highway via twin 2.9 m x 2.1 m (9.5 ft x 7 ft) concrete box culverts. The culverts are 96 m (315 ft) long.

**Erosion Potential:** Many of the stream crossings potentially affected by the Highway 101 Widening Project are protected by sack concrete, which helps to prevent bridge scour at the abutments. In general, the channel sections upstream and downstream of the crossings are heavily vegetated and appear stable. However, the Pruitt Creek channel showed evidence of bank erosion approximately 60 m (200 ft) upstream of the Highway 101 bridges. Also, there appears to be pier scour occurring at the Pool Creek bridge crossings where the bottom of the pier walls and the top of the piles are exposed above the channel bottom.

#### 3.8.2.2 FLOODPLAINS

**FEMA Floodplain Designations:** The Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) prepared by FEMA for Sonoma County were reviewed to identify areas that would be inundated by a 100-year flood. A 100-year flood is a flooding event that has a probability of occurring once in 100 years. The FIRMs indicate that the Windsor Creek, East Windsor Creek, Pool Creek, Pruitt Creek, and Mark West Creek floodplains within the Highway 101 immediate area are delineated as Zone X (areas of moderate to minimum flood risk) and Zone AE (areas of 100-year shallow flooding where depths are between one and three feet). The FIRMS delineate the portion of the project within the Santa Rosa corporate City Limits as Zone C, an area of minimal flooding. The FIRMS for the northern, middle, and southern branches of the Santa Rosa Flood Channel are not currently available and additional studies to define the flooding potential will be undertaken during final design. Within these base floodplain zones, Highway 101 is elevated above the floodplain and there is no indication that flood waters overtop the highway.

Of the stream courses in the project area, Mark West Creek has the largest drainage area and is classified as a major waterway for the 100-year (one percent annual chance) design storm recurrence interval. Windsor Creek, East Windsor Creek, Pool Creek, Pruitt Creek, and the middle and south branches of the Santa Rosa Flood Channel are classified as secondary waterways for the 25-year (four percent annual chance) design storm recurrence interval. Faught Creek and the north branch of the Santa Rosa Flood Channel are classified as minor waterways for the 10-year (10 percent annual chance) design storm recurrence interval.

The flood hydrograph data were utilized in the preparation of the hydraulic models for the stream crossings affected by the Highway 101 widening. Only those stream course crossings that have open medians that would be affected hydraulically were analyzed. Crossings that use continuous culverts (i.e. no opening in the median) were not analyzed since the hydraulic condition of these culverts would not be modified as a result of the highway widening.

**Flooding Risks:** Flooding of the Russian River and its tributaries is mentioned in the FIS (FEMA, 1997). However, detailed review of the FIS does not provide any insight into currently incompatible floodplain development.

## 3.8.3 Environmental Consequences

### 3.8.3.1 CROSS-DRAINAGE IMPACTS

Drainages that cross Highway 101 were evaluated for potential impacts against the 100-year flood. The bridges over Pool Creek, Pruitt Creek, and Mark West Creek would be widened to cover the existing open median. Hydraulic impacts may be created by the construction of additional bridge piers in or along the creek channel. Pool Creek uses pier walls for each bridge crossing; these pier walls most likely would be extended to become one continuous pier wall for each bent of the widened bridge crossing. Where circular pier bents are used, as in Pruitt Creek and Mark West Creek, additional piers supporting the widened portion of the bridge would affect the hydraulic conditions at each bridge site. Windsor Creek, East Windsor Creek, and the three branches of the Santa Rosa Flood channel, which have continuous culverts, were not analyzed since the hydraulic condition of these culverts would not be modified as a result of the highway widening.

As Highway 101 is elevated above the 100-year floodplain, crowning of the presently depressed median and addition of concrete median barrier will have no adverse impacts on cross-drainage.

### 3.8.3.2 FLOODPLAIN IMPACTS

**Changes in Water Surface Elevations:** Hydraulic analysis was performed for the Build Alternative to assess the potential for impacts to water surface elevations and flood risk for the 100-year flood (MACTEC, 2005). Because the flow rates analyzed are for build-out conditions per county standards, and because there would be negligible changes in water surface elevations for the bridges that would be modified as part of the Highway 101 Widening, no impact on the floodplain would result from the widening. Therefore, no mitigation is proposed.

**Impacts on Natural and Beneficial Floodplain Values**: The natural and beneficial floodplain values at Windsor Creek, East Windsor Creek, Pool Creek, Pruitt Creek, and Mark West Creek are natural moderation of floods, water quality maintenance, fish and wildlife habitat, plants, open space and natural beauty, and groundwater recharge. The project would not adversely impact these natural and beneficial floodplain values because the project would cause negligible changes in water surface elevations. Therefore, no mitigation measures are proposed.

**Support of Incompatible Floodplain Development:** Since the Highway 101 HOV Lane Widening Project would widen an existing highway, floodplain encroachment as a result of highway construction has already occurred. Floodplain encroachment as a result of the Highway 101 widening, if any, would not be substantial. Temporary channel obstructions can be expected to occur during construction, but all work in the channel would be expected to occur during the dry season (June 15th to October 15th) per California Department of Fish and Game 1602 Streambed Alteration Agreement requirements (see Section S-6, Agency Permits and Approvals).

The only new highway capacity to be provided by the proposed project is for high occupancy vehicles, carpools, and transit. Thus, the project would not be growth inducing (see Section 3.2.3, Growth) and would not support additional development in the floodplain.

## 3.8.4 Avoidance, Minimization, and/or Mitigation Measures

### 3.8.4.1 ROADSIDE DRAINAGE

The roadside drainage will be modified as necessary to accommodate a 25-year design flood with the exception of areas where 100-year floodwaters currently have the potential to overtop the highway. These locations are from the Fulton Road Interchange to north of Pool Creek on the north side of the Shiloh Road Interchange and from approximately 700 m (2,300 ft) south of the Windsor River Road Overcrossing to beyond the northern project limit. Culverts will be repaired or upgraded as necessary, including the previously mentioned deficiencies, and the new drainage facilities coordinated with the stormwater BMPs to provide a consistent and effective drainage system. The BMPs that will become an integral component of the drainage system will include open swales off of the outside shoulders that would be modified to accommodate the widened roadway run-off and detention basins. Where auxiliary lanes and soundwalls are constructed, drainage facilities would be maintained or replaced with a closed drainage system.

### 3.8.4.2 CROSS-DRAINAGE

Because the culverts span only the width of the existing highway right-of-way, the culverts would need to be extended to accommodate the widening work. Also, in those instances where the traveled lanes traverse the stream crossing via bridge structures, these bridges will be widened within the currently open median, closing the median. Closing the median would not cause an adverse impact on bridge hydraulics at any crossing; therefore, no mitigation is proposed.

For the three bridge structures slated for widening, slight decreases in water surface elevations were observed. These decreases would range from 0.06 – 0.18 m (0.2 – 0.6 ft) and are the result of improved hydraulic conditions presented by a single, longer structure in comparison to two shorter structures. In addition, it is assumed that the channel banks would be armored for scour protection. This further reduces friction losses through the bridge to values less than those that would result from the open channel section that contains vegetation between the two existing bridge structures. Therefore, no mitigation is indicated.

### 3.8.4.3 FLOODPLAINS

Since there would be no measurable floodplain impacts, no mitigation is proposed.

## 3.9 Water Quality and Stormwater Run-off

This section summarizes the regulatory setting, existing environment, potential impacts, and avoidance and mitigation measures proposed to prevent or reduce impacts to water quality from stormwater run-off as a result of the proposed project.

### 3.9.1 Regulatory Setting

The following federal, state, and local laws, ordinances, and guidelines provide the regulatory context for the project area:

- **Federal Clean Water Act**: The federal Clean Water Act (CWA) is the primary water resources protection statute. Three sections of the CWA, in particular, are the focus of construction-phase compliance. Sections 401 (certification of state water quality standards), 402 (provisions of the National Pollutant Discharge Elimination System [NPDES]), and 404 (discharge of fill material into waters of the United States and wetlands) apply to the proposed project. Sections 401 and 404 (see 3.15, Biological Environment) are related and result in coordinated permitting by the state Regional Water Quality Control Board (RWQCB) and the U.S. Army Corps of Engineers (USACE), respectively, because of the CWA's authorization of state-adopted water quality standards.
- **Clean Water Act, Section 401**: Under Section 401 of the CWA, the RWQCB makes a certification of compliance with state water quality standards for the project. Such certification may involve the imposition of project-specific waste discharge requirements (WDRs). The USACE will not issue a 404 permit without satisfaction of RWQCB Section 401 requirements.
- **Clean Water Act, Section 402**: The California State Water Resources Control Board (SWRCB) implements the National Pollutant Discharge Elimination System (NPDES) program, which was established by EPA to regulate discharges into receiving waters. One requirement of the NPDES program is to file a Construction General Permit for Stormwater Discharges (Water Quality Order 99-08-DWQ) with the State to regulate the discharge of pollutants that arise from construction activities. An NPDES application requires the filing of a Notice of Intent (NOI) to comply with the Statewide General Permit (see next paragraph). Prior to the start of construction, a Storm Water Pollution Prevention Plan (SWPPP) must be prepared and submitted to the RWQCB. The SWPPP is normally prepared by the construction contractor. It identifies sources of pollutants that may be generated during construction activities and the measures that have been prescribed to reduce the potential for sediment and other pollutants from entering receiving waters.
- **California Department of Transportation** (National Pollutant Discharge Elimination System Permit for Storm Water Discharges): Caltrans requires and has its own NPDES permit (Order No. 99-06-DWQ) to regulate stormwater run-off. As described above, one requirement of the NPDES program is to file a General Permit (Water Quality Order 99-08-DWQ) with the State to regulate the discharge of pollutants into receiving waters.
- **Municipal Separate Storm Sewer System (MS4) Permit**: Section 402 of the CWA also includes provisions relating to Municipal Separate Storm Sewer System (MS4) permits. In addition to the requirements of the NPDES Construction General Permit, above, construction-

phase project impacts must be addressed within the framework of the MS4 permit by means of county-specific MS4 compliance programs that are approved by the RWQCB.

- **California Porter-Cologne Water Quality Control Act**: The California Porter-Cologne Water Quality Control Act of 1969 requires that each Regional Water Quality Control Board within the State formulate and adopt water quality control plans or basin plans for all areas in the region.

## 3.9.2 Affected Environment

The Highway 101 HOV Lane Widening Project is located within the jurisdiction of the North Coast Regional Water Quality Control Board. Regulations for discharges within this area are included in the Water Quality Control Plan for the North Coast Region (Basin Plan) (December 1993). The affected stretch of highway crosses seven drainage courses; only one of these drainage courses, Mark West Creek, is included in the most recent 2002 303(d) list of impaired water bodies. Local agencies that have jurisdiction over these drainage courses include the City of Santa Rosa, the City of Windsor, and the Sonoma County Water Agency.

### 3.9.2.1 Beneficial Uses of Water Resources

The beneficial uses for the hydrologic areas as described within the Basin Plan include groundwater (referring to groundwater of the Santa Rosa Valley), which is used for municipal, agricultural, and industrial supply. None of the surface water bodies that cross the alignment are designated as having beneficial uses. To date, there are no special requirements or concerns raised by the North Coast RWQCB regarding this project.

### 3.9.2.2 Existing Drainage

Existing pavement drainage flows to open grass-lined swales off the shoulders of Highway 101 and within the unpaved highway median. Because the proposed widening would include median paving and widening of the pavement along the shoulders, the swales currently located in the median would be removed and the drainage would be routed to the outside shoulders of the freeway.

### 3.9.2.3 Water Quality

Currently, the only stream crossing the freeway within the project area that is listed as an impaired water body is Mark West Creek, which is affected by sedimentation/siltation and temperature. As described in Section 3.9.4.1, Pollutant Removal and Reduction, the proposed project would include detention basins and vegetated swales which would minimize sedimentation/siltation effects on Mark West Creek. The SWPPP would also identify placement of sediment control best management practices (BMPs) as described in Section 3.16.9, Water Quality and Stormwater Run-off.

### 3.9.2.4 Pollutants

Pollutants found on streets and freeways that could be constituents of stormwater run-off include heavy metals, organic compounds (including petroleum hydrocarbons), sediments, trash, debris, oil, and grease.

## 3.9.3 Environmental Consequences

### 3.9.3.1 STORMWATER RUN-OFF

The project would result in a minor increase in impervious surface in the project area (approximately 17 hectares of a total 12,250 hectares [30,270 acres] of watershed, or 0.1 percent). This can be expected to translate into minor localized increases in urban run-off. Due to the lag time between the peak run-off from major tributaries in each of the watersheds, and that from the freeway run-off, the peak flow from the freeway would have substantially subsided by the time the watershed peak occurs. This, coupled with the minor increase in impervious surface, would result in an insignificant increase in peak flow in each of the overall watersheds due to this project.

### 3.9.3.2 WATER QUALITY

As described previously, run-off from highways has been found to contain numerous pollutants, including metals, hydrocarbons, solids, oil, and grease. These constituents are most highly concentrated in the "first flush" of run-off that occurs from the first major rainstorm in a given period or season. After this first flush, the concentrations of highway pollutants are greatly reduced. Due to the proposed widening of Highway 101, this project will increase storm water runoff from the project site. Any impacts to water quality to the receiving water body will be addressed through the implementation of BMPs to the maximum extent practicable, in compliance with Caltrans' National Pollutant Discharge Elimination System (NPDES) Permit with the State Water Resources Control Board (SWRCB).

## 3.9.4 Avoidance, Minimization and/or Mitigation Measures

### 3.9.4.1 POLLUTANT REMOVAL AND REDUCTION

As described in the Caltrans Storm Water Management Plan (SWMP), BMPs would be designed and implemented to reduce to the maximum extent practicable the discharge of pollutants from the storm drain system. Due to site constraints within the narrow Highway 101 project corridor, the drainage system would have to balance pollutant removal with economic factors related to maintenance, right-of-way, and construction costs. Treatment BMPs that may be considered for this project include detention basins and vegetated swales. Preliminary evaluation indicates that there is adequate area to accommodate these BMPs within the existing and proposed right-of-way to mitigate 100 percent of the increased run-off attributable to this project. Run-off from the existing facility will be treated to the maximum extent practicable. These proposed BMPs are included in the estimated project construction costs. The proposed BMPs are from an approved list of BMPs known to be effective at reducing sediments and pollutants from highway run-off and would adequately remove the increased amount of pollutants attributable to this project while also removing a substantial amount of pollutants associated with the existing facility. These BMPs combined with the on-site drainage system would result in a significant reduction in trash, debris, absorbed hydrocarbons and metals, in the freeway run-off that enters streams and channels crossing the freeway. Other BMPs were investigated, but deemed inappropriate.

Additionally, this project is located in a Municipal Separate Storm Sewer System (MS4) and stenciling of drainage inlets would be required.

#### 3.9.4.2 EROSION CONTROL MEASURES

Permanent erosion control measures also would be used to address site soil stabilization and reduce deposition of sediments in adjacent surface waters. Typical measures that would be applied include the application of soil stabilizers such as hydroseeding, netting, erosion control mats, rock slope protection, velocity dissipation devices, flared-end sections for culverts, and others. Temporary erosion control measures would also be required for the construction phase of the proposed project and are discussed in Section 3.16.9, Water Quality and Stormwater Run-off.

## 3.10 Geology/Soils/Seismic/Paleontology/Topography

This section addresses geologic and seismic issues associated with project improvements. Conclusions are based on published and unpublished data, reports, and maps from federal, state, and county agencies; project files and as-built drawings of previous Caltrans projects in the area; published and online references from Sonoma County, the California Geologic Survey, and the United States Geologic Survey; aerial photos and maps; and a geological reconnaissance of the project area.

### 3.10.1 Affected Environment

#### 3.10.1.1 REGIONAL GEOLOGY

The proposed project lies entirely within the Santa Rosa Plain in central Sonoma County. Elevations range from 43 m (141 ft) mean sea level (msl) at Steele Lane to 35 m (115 ft) msl at Windsor River Road. In general, relief is flat to gently sloping down to the west. Higher relief in the hills to the east results in drainages flowing from east to west across the project area. The Highway 101 alignment was graded in the late 1950s, which resulted in the main traffic lanes being at-grade and road crossings occupying fill embankments leading to overcrossings. The fill embankments are generally 5 m (15 ft) or less in height.

#### 3.10.1.2 SOILS AND SEDIMENTS

Within the right-of-way, surface soils generally consist of porous and stiff sandy silts and clays, with lesser dense sands, gravels, and silty sands, representative of alluvium. Poorly consolidated bedrock of the Late Pliocene to Pleistocene Glen Ellen formation is exposed in the hills to the east and underlies the alluvium at depths of up to 32 m (100 ft) (*Huffman and Armstrong*, 1980). The Glen Ellen formation consists of fluvial and volcaniclastic sediments that have been subjected to tectonic influences and folding. Andesite flows and pyroclastic rocks of the Sonoma Volcanics interfinger with the Glen Ellen formation at higher elevations and develop more resistant topographic landforms. Basement bedrock of the Jurassic Cretaceous age Franciscan Assemblage is not exposed in the project vicinity.

#### 3.10.1.3 SEISMICITY

The California Coast Range province is characterized by a high level of seismic activity related to the San Andreas system of faults. Faults within this system generally strike northwesterly and exhibit right-lateral, strike-slip displacement. These faults result from the northwesterly movement of the Pacific Plate against the North American Plate. Major active faults have broken the region into numerous fault-bound blocks (an active fault is defined as one that has had surface displacement within the last 11,000 years [Holocene-age]). Much of Sonoma County, including the project site, is located within a relatively intact block bound on the west by the active San Andreas fault and on the east by the active Rodgers Creek/Healdsburg fault system.

Faults within the San Andreas system that could induce strong ground shaking in the project vicinity include the north coast segment of the San Andreas fault (capable of Moment Magnitude [Mw] 8), the Hayward fault (Mw 7½), and the Rodgers Creek/Healdsburg fault (Mw 7). There is a 27 percent probability that an event magnitude greater than Magnitude 6.7 will occur on the Rodgers Creek/Healdsburg fault within the next 30 years. A controlling earthquake of Mw 7 on the Rodgers Creek/Healdsburg fault could result in an estimated peak ground acceleration of .65 g in the project area. Active faults in the proximity of the project are included in Table 3.10-1.

**Table 3.10-1: Major Bay Area Faults, Distance from the Site, and Maximum Earthquake Magnitudes at the Site**

| Fault Name | Distance in Kilometers (Miles), from *Jennings, 1994* | *Maximum Credible Earthquake (MCE) | Estimate* Peak Ground Acceleration (g) % |
|---|---|---|---|
| San Andreas (North Coast Segment) | 32.0 (19.9) | 8 | 0.30 |
| San Andreas (offshore) | 35 (21.9) | 7 | 0.17 |
| Maacama | 9.0 (5.6) | 7 ¼ | 0.43 |
| Hayward (North Segment) | 75.0 (46.6) | 7 ½ | 0.13 |
| Rodgers Creek/ Healdsburg | 1.1 (0.7) | 7 | 0.65 |
| West Napa | 60.0 (37.3) | 6 ½ | 0.06 |

* Mualchin, 1996

#### 3.10.1.4 PALEONTOLOGY

The project area traverses broad, flat areas of the Santa Rosa Plain, which is overlain by unconsolidated surficial Quaternary sediments including alluvium and fan deposits (Huffman and Armstrong, 1980). The area near the Mendocino Avenue overcrossing may be underlain at shallow depth by the Petaluma formation (CDMG, 1988). The fan deposits are derived from bedrock source materials in the hills to the east of the Project including the Glen Ellen formation and Sonoma Volcanics, (USGS 2004) both of which are devoid of any paleontological resources, and, therefore, are of marginal sensitivity. The Petaluma formation, which consists predominately of sandstone and conglomerate, contains detritus from the older (Jurassic-Cretaceous) Franciscan Assemblage and Sonoma Volcanics. The Petaluma formation rarely contains important fossils (USGS, 1983).

North of Mark West Springs Road the surficial fan deposits transition into alluvial deposits, especially near the west flowing drainages. The alluvium appears to represent reworked sediments from the Glen Ellen formation that outcrop in the hills to the east and within the dissected drainages. Since the Glen Ellen formation contains mostly detritus from the Franciscan Assemblage as well as tuffaceaous material from the Sonoma Volcanics (USGS, 1983), the likelihood of fossils being contained within the sediments is very low. Any fossils to be found within the project area are likely to be much degraded and are not expected to have any paleontological significance.

## 3.10.2 Environmental Consequences

Geologic hazards that may affect the project include landsliding, expansive surficial soils, ground shaking, liquefaction-induced settlement, fault rupture, lateral spreading, and flooding. These geologic hazards are briefly described below.

### 3.10.2.1 LANDSLIDING

Because a majority of the Highway 101 corridor within the project limits is of low relief, landsliding is not a major geological hazard to the proposed project. A few landslides have been mapped in the hills to the east, but these do not pose an imminent hazard because of their distance from the project. The closest mapped landslide is located outside of the highway right of way approximately 76.2 m (250 ft) away from the project in the vicinity of the Mendocino Avenue interchange and the graded slopes show no evidence of movement. No work is proposed that could be anticipated to affect the stability of the landslide. All other mapped landslides in the hills to the east are generally more than a mile away from the project area.

### 3.10.2.2 EXPANSIVE SURFICIAL SOILS

The Santa Rosa Plain contains expansive surface soils. These soils may extend down 2 m (6.6 ft) or more. It is possible that some expansive soils remain following the initial grading of the four-lane freeway. Because expansive soil is subject to volume changes with seasonal changes in moisture content, certain structures or pavements could be damaged if placed directly on these expansive “adobe” soils.

### 3.10.2.3 GROUND SHAKING

The principal seismic hazard to the proposed project is the potential for moderate to severe ground shaking from earthquakes occurring on one or more regional active faults. The San Andreas fault system has displayed considerable activity in the past and is considered likely to induce strong ground shaking within the project vicinity in the future, particularly along the Rodgers Creek/Healdsburg fault, the controlling fault in this system (see Section 3.10.1.3, Seismicity).

### 3.10.2.4 LIQUEFACTION-INDUCED SETTLEMENT

Liquefaction typically occurs in loose, cohesionless, saturated, granular soils below the groundwater table. Liquefaction hazard susceptibility mapping of the greater San Francisco Bay has shown that the entire project site has a moderate to high potential for liquefaction. Based on a review of available local soil borings, it appears that a large portion of the project area is underlaid by

potentially liquefiable soils. Settlements of about 2.5 cm (less than 1 inch) could occur on pavements and embankments. Concrete structures, including bridges that are pier-supported at depth, should not settle appreciably.

#### 3.10.2.5 LATERAL SPREADING

Lateral spreading is a phenomenon associated with liquefaction where lateral movement of a soil embankment occurs along a free face. There is a possibility that this situation may occur at any of the major creek channel crossings, including Mark West Creek, Pool Creek, and Pruitt Creek where liquefaction hazard is the greatest. The consequences would be potential failure of the abutments to the bridges, possible exceedance of lateral capacities of the bridge pile supports, and potential blockage of creek flows with soil deposits.

#### 3.10.2.6 FAULT RUPTURE

Historically, fault rupture accompanying severe earthquakes has generally occurred along preexisting fault traces. The closest active fault, the Rodgers Creek/Healdsburg fault, is 1.1 kilometers (0.7 miles) away, in the vicinity of the Old Redwood Highway on-ramp. A secondary splay extends to less than 0.5 kilometers (0.3 miles) from Highway 101. This fault is not considered potentially active. Fault-related ground rupture is not likely to occur at the project site.

### 3.10.3 Avoidance, Minimization and/or Mitigation Measures

To avoid, minimize, and/or mitigate geologic and seismic hazards in the proximity of the project, site specific investigations, seismic hazard engineering analysis, and engineering recommendations for retaining walls, expansive soil treatment, cuts and fills, and bridge foundation elements would be conducted during final design using Caltrans Guidelines for Geotechnical Foundation Investigations and Reports. Specifications for construction would conform to the Caltrans Standard Specifications.

#### 3.10.3.1 EXPANSIVE SURFICIAL SOILS

Expansive clays are prevalent in the upper soil zones in the study area. These types of soils require special treatment if exposed at roadway subgrade level and if used for compacted fills. To minimize the potential for settlement or damage from expansive soils, it is recommended that existing soils be over-excavated a minimum of 0.5 m (1.6 ft) below pavement subgrade and backfilled with select non-expansive fill. Lime treatment of expansive soil subgrade is an acceptable alternative. Fills should be placed in thin, loose lifts and be well compacted.

Several creek crossings are proposed for widening, including the Pruitt Creek, Pool Creek, and Mark West Creek bridges. Existing soil borings for these structures are available and indicate stiff clays and sandy silts over dense alluvial sands and gravels. Suitable abutment and intermediate pier foundations could be either deep spread footings, drilled piers, or driven piles.

Implementation of these actions or a combination of these actions would be explored during the final design and construction process when site-specific subsurface investigations, borings, and field mapping would be performed.

#### 3.10.3.2 GROUND SHAKING

The maximum credible earthquake (MCE), defined as the largest earthquake reasonably likely to occur under presently known conditions, is used to determine the safety evaluation for freeway design. To minimize the potential damage from ground shaking, structures associated with this project must meet MCE standards, as established by the Caltrans Office of Earthquake Engineering. The MCE for this project is a magnitude 7.0 earthquake on the controlling Rodgers Creek/Healdsburg fault. All project structures would be designed to this MCE in accordance with current Caltrans design standards.

#### 3.10.3.3 LIQUIFACTION-INDUCED SETTLEMENT

To minimize potential liquifaction impacts associated with the proposed project, stone columns, sub-excavation, dynamic compaction, or de-watering methods would be implemented during construction. The most suitable method(s) would be selected based on site-specific subsurface investigations to identify the potential for liquifaction. The investigations are typically conducted during the final design phase of a project.

#### 3.10.3.4 LATERAL SPREADING

Site specific engineering recommendations to minimize impacts from lateral spreading would be incorporated into the final design plans and construction contract documents. Angled piles may be needed to lessen lateral pressures of creek banks to resist lateral spreading.

#### 3.10.3.5 FAULT RUPTURE

Site specific seismic hazard engineering analysis would be conducted during the final design phase and construction process to minimize the impacts of fault rupture.

## 3.11 Hazardous Wastes/Materials

This section summarizes potential impacts from hazardous wastes that could expose construction workers or the general public to health risks and that may require the implementation of special soil and/or groundwater management procedures. Section 3.16.10 discusses the potential impacts of hazardous materials that may be used or stored in conjunction with construction activities.

### 3.11.1 Affected Environment

Data sources used to identify previous and current land uses that could contribute to the contamination of the project area include the following:

- The Initial Site Assessment (ISA) for the Project Study Report (PSR) prepared for the Highway 101 HOV Lane Widening Project: Steele Lane, Santa Rosa to Windsor River Road, Windsor;
- The Site Investigation Report for the Highway 101 HOV Lane Widening Project: Wilfred Avenue to Route 12, pertinent because of the project's proximity to the current project corridor;
- Property specific reviews of properties identified in the Steele Lane to Windsor Road ISA as having the potential to impact the project area;

- Field or drive-by reconnaissance of the project area and vicinity; and
- Project files and as-built drawings of previous Caltrans projects in the area.
- Federal and state environmental "record sources" (e.g. the Federal Superfund list, a list of registered underground storage tanks [USTs]), to identify the locations of known hazardous waste sites in the project vicinity.

#### 3.11.1.1 IDENTIFIED HAZARDOUS WASTE SITES

Based on a review of the ISA for the PSR prepared for the Highway 101 HOV Lane Widening Project: Steele Lane, Santa Rosa to Windsor Road, Windsor, no specific properties were identified as having the potential to impact the project. The ISA did indicate that the project area has potential soil and groundwater contamination issues due to leaking underground storage tanks (LUSTs), hazardous waste material releases adjacent to the state highway, and aerial deposition of lead from motor vehicle exhaust.

Because specific properties were not identified in the PSR or the ISA, a review and evaluation of an environmental regulatory database report from Environmental Data Resources, Inc. (EDR, 2003) also was conducted. This report, previously obtained for the Sonoma Marin Area Rail Transit (SMART) project that runs along the west side of the Highway 101 corridor, identifies properties that have had hazardous waste releases to the environment and are located within one-mile of the railroad track. The location and status of these properties were evaluated to assess their potential to impact the current project.

Of the evaluated properties, four were identified as having the potential to affect subsurface conditions along the corridor, warranting additional assessment. A review of North Coast Regional Water Quality Control Board (RWQCB) regulatory files was carried out for each of these properties. A summary of the file review identifying each site, address, location within the project area, the type of hazardous material found, and its potential risk to the proposed project's scope and schedule, is presented in Table 3.11-1. The classification of each property as high-, moderate-, or low-risk is based on the type of operation, proximity to the widening alignment, anticipated hydrogeologic gradient, field observations, and historical and regulatory information. The classification criteria are as follows:

- **High Risk:** Properties with known or probable soil/groundwater contamination (e.g. LUSTs) and properties where remediation is incomplete or undocumented.
- **Moderate Risk:** Properties with identified or potential soil contamination (e.g. LUSTs), where remediation is in progress or groundwater contamination does not appear to be migrating.
- **Low Risk**: Properties that have completed remediation or have historically used only small amounts of known contaminants (e.g., Resource Conservation and Recovery Act Information System [RCRIS], small quantity generators, or underground storage tanks [USTs]).

#### 3.11.1.2 LEAD-BASED PAINT AND ASBESTOS

The proposed build alternative includes upgrading several undercrossings and overpasses. Due to the age of these structures, hazardous wastes consisting of lead-based paint and asbestos may be present

in the building materials. Lead-based paint (LBP) and asbestos in good condition do not present an immediate health risk; however, lead particles and asbestos fibers could be emitted to the air during demolition or renovation activities.

### Lead-Based Paint

Lead oxide and lead chromate commonly were used in paints until 1978, when regulations limited the allowable lead content in paint; therefore, exterior painted surfaces of the bridge crossings have the potential to contain LBP. Lead is a suspect carcinogen, a known teratogen (i.e., it has the potential to cause birth defects), and a reproductive toxin.

### Asbestos-Containing Materials

Asbestos, a known human carcinogen, was commonly used in construction materials until the 1980s, when it was phased out. Therefore, utility lines, bridge expansion joints, concrete-asbestos water lines, and other bridge building materials have the potential to contain asbestos.

**Table 3.11-1: Hazardous Waste Sites/Incidences With Potential to Affect Subsurface Conditions along the Highway 101 HOV Lane Widening Project Corridor**

| Identified Property | Property Address | Property Location | Hazardous Material | Risk Assessment |
|---|---|---|---|---|
| Shell Facility | 777 Steele Lane, Santa Rosa | Approximately 30 meters (100 feet) east of the corridor (Station 238+60) | Release from a gasoline UST (underground storage tank); some contaminated soil; groundwater investigation ongoing. | Low Risk |
| Shell Facility | 3453 Cleveland Avenue, Santa Rosa | Approximately 100 meters (330 feet) west of the corridor (Station 257+00). | Release from a gasoline UST; some contaminated soil; some remediation activities completed; groundwater monitoring ongoing. | Low Risk |
| Texaco Facility | 4601 Old Redwood Highway, Santa Rosa | Approximately 600 meters (1,970 feet) east of the corridor (Station 28+90). | Release from a gasoline UST. Extraction and monitoring of groundwater ongoing. | Low Risk |
| Former Ecodyne Cooling Facility | 930 Shiloh Road, Windsor | Approximately 400 meters (1,310 feet) west of the corridor (Station 331+20). | Release from a gasoline UST and release of wood treatment chemicals to the soil and groundwater. Extensive remediation has been performed, consisting of groundwater extraction and injection of compounds to treat hexavalent chromium. Portions of the facility have been capped with asphalt. Release to groundwater is confined to just beyond property's east boundary. | Low Risk |

Source: MACTEC Engineering and Consulting, 2005.

#### 3.11.1.3 AERIALLY DEPOSITED LEAD

Various studies have been performed in the Bay Area that have identified aerially-deposited lead (ADL) in soils near roadways, attributed to the use of lead in gasoline, a practice that was phased out beginning in the mid-1970s. Typically, ADL exists in the top 0.15 m (six in) of soil in unpaved shoulder and median areas of many freeway corridors.

In addition, any yellow traffic paint, yellow thermoplastic paint/tape, or markings placed prior to 1990 contain lead chromate as the pigment, which, when removed, might generate airborne heavy metal debris that exceeds the threshold established by Title 22 California Code of Regulations.

### 3.11.2 Environmental Consequences

Reconnaissance and investigation of the project corridor identified various hazardous waste issues associated with the proposed project, described below.

#### 3.11.2.1 HAZARDOUS WASTE RELEASES

No properties immediately adjacent to the project corridor were identified that exhibited obvious signs of hazardous wastes or waste releases. All of the hazardous waste sites identified in the corridor are currently undergoing monitoring or remediation and pose only a low risk to the proposed project.

#### 3.11.2.2 LEAD-BASED PAINT AND ASBESTOS

Field reconnaissance in the project area identified four bridges and overcrossings with the potential to contain LBP and/or asbestos, as follows:

**Mendocino Avenue Overcrossing:** Caltrans Bridge No. 20-179. Potential for the presence of asbestos-containing materials in joint caulking compounds between concrete slabs.

**Mark West Creek Bridge:** Caltrans Bridge No. 20-180. Potential for the presence of asbestos-containing materials in joint caulking compounds between concrete slabs. Observed spray paint (graffiti) is unlikely to be LBP given its recent age.

**Pruitt Creek Bridge:** Caltrans Bridge No. 20-181. Potential for the presence of asbestos-containing materials in joint caulking compounds between concrete slabs.

**Pool Creek Bridge:** Caltrans Bridge No. 20-181. Potential for the presence of asbestos-containing materials in joint caulking compounds between concrete slabs.

#### 3.11.2.3 AERIALLY DEPOSITED LEAD

Based on a review of the Site Investigation Report performed for the Wilfred Avenue to Route 12 project, selected because site conditions for this portion of Highway 101 are expected to be similar to those of the present project, it is anticipated that soil with elevated lead concentrations would be encountered during the project improvement activities. In addition, the presence of yellow traffic stripes and pavement markings in the project area creates a potential for the release of airborne contaminants during construction and renovation, which would pose a possible health risk to construction workers and residents.

## 3.11.3 Avoidance, Minimization, and/or Mitigation Measures

Protective measures to reduce or eliminate hazardous wastes-related impacts are described below.

### 3.11.3.1 HAZARDOUS WASTE RELEASES

The following general avoidance and prevention measures are proposed based on information identified to date:

- Construction contractor(s) would be required to prepare and implement a Worker Health and Safety Plan (to be approved by Caltrans and the California Department of Toxic Substances Control [DTSC] prior to onset of construction activities).
- Construction contractor(s) would be required to prepare a Stormwater Pollution Prevention Plan (SWPPP) to be approved by Caltrans prior to the onset of construction activities.
- Any contaminated groundwater that is encountered during construction would be handled in accordance with the water quality provisions outlined in Section 3.9 of this document.
- In the event that a previously undocumented hazardous waste site or underground storage tank is uncovered during construction, Caltrans would consult with the appropriate federal and state regulatory agencies to determine what action, if any, is appropriate.
- Contract special provisions would be written and construction plans prepared so that any contaminated soil excavated during construction would be handled and disposed of in accordance with applicable federal and state laws, regulations, rules, and policies.

### 3.11.3.2 LEAD-BASED PAINT AND ASBESTOS

Sampling activities in locations where LBP or asbestos-containing materials are anticipated (including the Mendocino Avenue Overcrossing, Mark West Creek Bridge, Pruitt Creek Bridge, and Pool Creek Bridge) would be conducted to identify whether potential hazards exist and whether special precautions are necessary during bridge/overcrossing renovation and or/demolition. During the course of demolition or renovation activities, construction contractors and/or Caltrans would follow regulations requiring the abatement of LBP and asbestos-containing materials to prevent exposure to nearby residents and workers.

Prior to any demolition work or upgrading or reconstruction of existing overpasses, on- or off-ramps, an asbestos-containing materials (ACM) survey would be conducted for these structures. In addition, any other structure (e.g., retaining or sound walls) requiring demolition would be tested for ACM prior to demolition. The ACM survey would be performed by an inspector who is Asbestos Hazardous Emergency Response Act (AHERA)-certified under Toxic Substances Control Act (TSCA) Title II and California Occupational Safety and Health Administration (Cal OSHA)-certified under Section 1529 of the California Code of Regulations. Prior to demolition, a notification along with the results of the ACM survey would be submitted to the Bay Area Air Quality Management District as part of the permitting process.

#### 3.11.3.3 AERIALLY DEPOSITED LEAD

Sampling activities in locations where elevated lead concentrations are anticipated or petroleum hydrocarbon-contaminated soil and groundwater could be encountered would be conducted to identify whether potential hazards exist and whether special handling of soil is required. Short-term impacts of soil excavation would be mitigated through implementation of Best Management Practices (BMPs), which may include preparation of a soils management plan (SMP) or section of the Worker Health and Safety Plan to prevent exposure of workers to potentially hazardous excavated soils and to comply with applicable waste handling and disposal regulations if offsite disposal of soil/rock is necessary. If ADL or petroleum hydrocarbon-contaminated soil were present, a variance for re-use of soil could be obtained through the DTSC if contamination meets the extractable and total lead/petroleum hydrocarbon thresholds. The RWQCB would also need to be notified and provisions for the re-use and storage of ADL and petroleum hydrocarbon contaminated soil would need to be addressed in the SWPPP prepared by the contractor for the project.

It is recommended that surface samples of soil be collected and analyzed for total lead. Any sample exceeding 1,000 milligrams/kilogram (mg/kg) should be tested for Toxicity Characteristic Leaching Procedure (TCLP). Any soil containing 5 milligrams per liter (mg/l) or more of lead is considered a Resource Conservation and Recovery Act (RCRA) hazardous waste and, therefore, would be subject to specific standards for transportation, treatment, storage, and disposal. If Caltrans were to use the affected soils on site, special provisions subject to the ADL variance provided to Caltrans by the DTSC would be used. This variance includes testing of the soils exceeding the hazardous waste thresholds via a WET-DI procedure, a waste extraction procedure using de-ionized water as a leaching agent. The SCTA and Caltrans would consult with DTSC and the San Francisco RWQCB regarding the applicability of the ADL variance and management of lead-contaminated soil. A detailed work plan and a sampling and testing program would be prepared in accordance with Caltrans guidelines during the design phase of the project.

## 3.12 Air Quality

This section reports the results of the *Air Quality Impact Technical Report* (Terry A. Hayes Associates 2005) and the *Mobile Source Air Toxics Analysis Technical Memorandum* (Parsons 2006) prepared for the project.

### 3.12.1 Regulatory Setting

Air quality in the United States is governed by the federal Clean Air Act (CAA). In addition to being subject to the requirements of CAA, air quality in California is also governed by more stringent regulations under the California Clean Air Act (CCAA). At the federal level, the CAA is administered by the United States Environmental Protection Agency (USEPA). In California, the CCAA is administered by the California Air Resources Board (CARB) at the state level and by the Air Quality Management Districts at the regional and local levels. The proposed project is located within the Bay Area Air Quality Management District (BAAQMD).

USEPA is responsible for establishing the National Ambient Air Quality Standards (NAAQS), which are required under the 1977 CAA and subsequent amendments. USEPA regulates emission sources that are under the exclusive authority of the federal government and establishes various emission standards, including those for vehicles sold in states other than California. Automobiles sold in California must meet the stricter emission standards established by CARB.

CARB, which became part of the California Environmental Protection Agency (CalEPA) in 1991, is responsible for meeting the state requirements of the federal CAA, administering the CCAA, and establishing the California Ambient Air Quality Standards (CAAQS). The CCAA requires all air districts in the state to endeavor to achieve and maintain the CAAQS, which are generally more stringent than the corresponding federal standards.

The BAAQMD is primarily responsible for assuring that the national and state ambient air quality standards are attained in the San Francisco Bay Area. The BAAQMD has jurisdiction over an approximately 5,600-square-mile area, commonly referred to as the Bay Area Air Basin (BAAB). The District's boundary encompasses most of the nine Bay Area counties: Alameda County, Contra Costa County, Marin County, San Francisco County, San Mateo County, Santa Clara County, Napa County, southwestern Solano County and southern Sonoma County. The discussion of project air quality setting and effects refers primarily to conditions within the BAAB, which from both the federal and state regulatory perspectives is considered one geographic entity.

#### 3.12.1.1 NATIONAL AND STATE AMBIENT AIR QUALITY STANDARDS

State and federal standards for major air pollutants are summarized in Table 3.12-1. Primary standards were established to protect the public health. Secondary standards are intended to protect the nation's welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation and other aspects of the general welfare. Since the CAAQS are more stringent than the NAAQS, the CAAQS are used as the standard in the air quality analysis for the Highway 101 HOV Lane Widening Project.

### Attainment Status

Under CAA and CCAA requirements, areas are designated as either attainment or non-attainment for each criterion pollutant based on whether the NAAQS or CAAQS have been achieved. Areas are designated as non-attainment for a pollutant if air quality data show that a state or federal standard for the pollutant was violated at least once during the previous three calendar years. Exceedances that are affected by highly irregular or infrequent events are not considered violations of a state standard and are not used as a basis for designating areas as non-attainment. Under the CCAA, the Sonoma County portion of the BAAB is designated as a non-attainment area for $O_3$, $PM_{10}$, and $PM_{2.5}$. Under the CAA, the Sonoma County portion of the BAAB is designated as a non-attainment area for $O_3$.

**Table 3.12-1: State and National Ambient Air Quality Standards**

| Pollutant | Averaging Period | California | | Federal | |
|---|---|---|---|---|---|
| | | Standards | Attainment Status | Standards | Attainment Status |
| Ozone ($O_3$) | 1 hour | 0.09 ppm (180 µg/m$^3$) | Non-attainment | 0.12 ppm (235 µg/m$^3$) | Non-attainment |
| | 8 hour | -- | -- | 0.08 ppm (157 µg/m$^3$) | Non-attainment |
| Respirable Particulate Matter ($PM_{10}$) | 24 hour | 50 µg/m$^3$ | Non-attainment | 150 µg/m$^3$ | Attainment |
| | Annual Arithmetic Mean | 20 µg/m$^3$ | Non-attainment | 50 µg/m$^3$ | Attainment |
| Fine Particulate Matter ($PM_{2.5}$) [1] | 24 hour | -- | -- | 65 µg/m$^3$ | Attainment |
| | Annual Arithmetic Mean | 12 µg/m$^3$ | Non-attainment | 15 µg/m$^3$ | Attainment |
| Carbon Monoxide (CO) | 8 hour | 9.0 ppm (10 mg/m$^3$) | Attainment | 9.0 ppm (10 mg/m$^3$) | Attainment |
| | 1 hour | 20 ppm (23 mg/m$^3$) | Attainment | 35 ppm (40 mg/m$^3$) | Attainment |
| Nitrogen Dioxide ($NO_2$) | Annual Arithmetic Mean | -- | -- | 0.053 ppm (100 µg/m$^3$) | Attainment |
| | 1 hour | 0.25 ppm (470 µg/m$^3$) | Attainment | -- | -- |
| Sulfur Dioxide ($SO_2$) | Annual Arithmetic Mean | -- | -- | 0.03 ppm (80 µg/m$^3$) | Attainment |
| | 24 hour | 0.04 ppm (105 µg/m$^3$) | Attainment | 0.14 ppm (365 µg/m$^3$) | Attainment |
| | 1 hour | 0.25 ppm (655 µg/m$^3$) | Attainment | -- | -- |

[1] The Federal air quality standard for $PM_{2.5}$ was adopted in 1997. Presently, no methodologies for determining impacts relating to $PM_{2.5}$ have been developed or adopted by federal, state, or regional agencies. Additionally, no strategies or mitigation programs for $PM_{2.5}$ have been developed or adopted by Federal, State, or regional agencies.

Source: California Air Resources Board and United States Environmental Protection Agency, January 2003.

### Carbon Monoxide (CO)

Carbon monoxide (CO), a colorless and odorless gas, interferes with the transfer of oxygen to the brain. It can cause dizziness and fatigue and can impair central nervous system functions. CO is emitted almost exclusively from the incomplete combustion of fossil fuels. Automobile exhausts release most of the CO in urban areas. CO dissipates relatively quickly, so ambient carbon monoxide concentrations generally follow the spatial and temporal distributions of vehicular traffic. CO concentrations are influenced by local meteorological conditions, primarily wind speed, topography, and atmospheric stability. The BAAB is in attainment for CO at both the federal and state levels.

### Ozone ($O_3$)

Ozone ($O_3$), a colorless toxic gas, is the chief component of urban smog. $O_3$ enters the blood stream and interferes with the transfer of oxygen, depriving sensitive tissues in the heart and brain of oxygen. $O_3$ also damages vegetation by inhibiting growth. $O_3$ forms in the atmosphere through a chemical reaction between reactive organic gases (ROG) and nitrogen oxides ($NO_X$) under sunlight. Motor vehicles are the major sources of ROG and $NO_X$. $O_3$ is present in relatively high concentrations within the Bay Area air basin. Under the CAA and the CCAA, the Sonoma County portion of the BAAB is designated as a non-attainment area for $O_3$.

### Nitrogen Dioxide ($NO_2$)

Nitrogen dioxide ($NO_2$), a brownish gas, irritates the lungs. It can cause breathing difficulties at high concentrations. Like $O_3$, $NO_2$ is not directly emitted, but is formed through a reaction between nitric oxide (NO) and atmospheric oxygen. NO and $NO_2$ are collectively referred to as NOx and are major contributors to ozone formation. $NO_2$ also contributes to the formation of $PM_{10}$ (see discussion of $PM_{10}$ below). The BAAB is in attainment for $NO_2$.

### Sulfur Dioxide ($SO_2$)

Sulfur dioxide ($SO_2$) is a product of high-sulfur fuel combustion. The main sources of $SO_2$ are coal and oil used in power stations, in industries, and for domestic heating. Industrial chemical manufacturing is another source of $SO_2$. $SO_2$ is an irritant gas that attacks the throat and lungs. $SO_2$ concentrations have been reduced to levels well below the state and national standards, but further reductions in emissions are needed to attain compliance with standards for sulfates and $PM_{10}$, of which $SO_2$ is a contributor. The BAAB is in attainment for $SO_2$ at both the federal and state levels.

### Suspended Particulate Matter ($PM_{10}$ and $PM_{2.5}$)

Particulate matter consists of very small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals. Respirable particulate matter ($PM_{10}$) refers to particulate matter less than 10 microns in diameter, about one/seventh the thickness of a human hair. Fine particulate matter ($PM_{2.5}$) refers to particulate matter that is 2.5 microns or less in diameter, roughly 1/28th the diameter of a human hair. $PM_{10}$ and $PM_{2.5}$ pose a greater health risk than larger-size particles. When inhaled, these tiny particles can penetrate the human respiratory system's natural defenses and damage the respiratory tract. Major sources of $PM_{10}$ include motor vehicles; wood burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning, industrial sources, windblown dust from open lands; and atmospheric chemical and photochemical reactions. $PM_{2.5}$ results from fuel combustion (from motor vehicles, power generation, industrial facilities), residential fireplaces, and wood stoves. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as $SO_2$, $NO_X$, and volatile organic compounds. The Sonoma County portion of the BAAB is a non-attainment area for $PM_{10}$ and $PM_{2.5}$ under the CCAA.

### Lead

Prior to 1978, mobile emissions were the primary source of lead in air. Between 1978 and 1987, the phase-out of leaded gasoline reduced the overall inventory of airborne lead by nearly 95 percent. Currently, industrial sources are the primary source of airborne lead. Since the proposed project does not contain an industrial component, lead emissions were not analyzed in the air quality assessment. The potential for aerially deposited lead to be in soils along Highway 101 is discussed in Section 3.11, Hazardous Waste/Materials.

#### 3.12.1.2 MOBILE SOURCE AIR TOXICS

In addition to the criteria air pollutants for which there are NAAQS, EPA also regulates a list of air toxics (64 Federal Register [FR] 38706). Air toxics are pollutants that may cause cancer, other serious health effects or adverse environmental effects. Most air toxics originate from human-made sources,

including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries).

Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics identified by the EPA. MSATs are emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as by-products. Metal air toxics result from engine wear or from impurities in oil or gasoline.

The EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources 66 FR 17229 (March 29, 2001). In the 2001 rulemaking, six of the 21 MSATs were identified by EPA as priority MSATs: *acetaldehyde, benzene, formaldehyde, diesel exhaust, acrolein*, and *1,3-butadiene* (66 FR 17230).

In its rule, EPA also examined the impacts of existing and newly formulated mobile source control programs, including its reformulated gasoline (RFG) program, its national low emission vehicle (NLEV) standards, its Tier 2 motor vehicle emissions standards and gasoline sulphur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulphur control requirements. Between 2000 and 2020, it is estimated that these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 to 65 percent, and will reduce on-highway diesel particulate matter (PM) emissions by 87 percent. See Appendix J, Mobile Source Air Toxics Analysis for a more detailed discussion.

In 1998, California identified diesel particulate matter (diesel PM) as a toxic air contaminant based on its potential to cause cancer and other adverse health impacts. In addition to diesel PM, emissions from diesel-fueled engines include over 40 other cancer causing substances. In September 2000, the CARB approved a comprehensive Diesel Risk Reduction Plan (Plan) to reduce diesel emissions from both new and existing diesel-fueled engines and vehicles. The goal of the Plan is to reduce diesel PM emissions and the associated health risk by 75 percent in 2010 and 85 percent or more by 2020. See Appendix J, Mobile Source Air Toxics Analysis for a more detailed discussion.

#### 3.12.1.3 AIR QUALITY PLANS

The BAAQMD, in coordination with the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG), is responsible for preparing air quality plans pursuant to the CAA and CCAA. Under the CAA, State Implementation Plans (SIPs) are required for areas that are designated as non-attainment for $O_3$, CO, $NO_X$, $SO_X$, or $PM_{10}$. For the BAAB, a SIP is required for $O_3$ since the region is currently designated as a Federal Non-attainment Area for $O_3$. The most current SIP is called the Bay Area 2001 Ozone Attainment Plan, which was adopted by the MTC, ABAG, and BAAQMD in October 2001. CARB adopted this Plan in November 2001, and EPA approved the associated emissions budget in February 2002.

Whereas the SIP is prepared pursuant to the CAA, the Bay Area Clean Air Plan (CAP) is prepared to meet the requirements of the CCAA. The CAP is the region's plan for reducing ground-level ozone. The CAP identifies how the BAAB would meet the state $O_3$ standard by its attainment date. The

2000 CAP focuses on identifying and implementing control measures that would reduce $O_3$. It was adopted by the BAAQMD in December 2000.

#### 3.12.1.4 AIR QUALITY CONFORMITY

Under the 1990 CAA Amendments, the U.S. Department of Transportation cannot fund, authorize, or approve federal actions to support programs or projects that are not first found to conform to CAA requirements. Transportation conformity is a way to ensure that federal funding and approval goes to those transportation activities that are consistent with air quality goals. A conformity determination demonstrates that total emissions projected for a plan or program are within the emissions limits ("budgets") established by the air quality plan or SIP and that transportation control measures (TCMs) are implemented in a timely fashion. Conformity applies to transportation plans, transportation improvement programs (TIPs), and projects funded or approved by the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA) in non-attainment or maintenance areas. Section 176 of the CAA specifies that no federal agency may approve, support, or fund an activity that does not conform to the applicable implementation plan. FHWA and FTA jointly make conformity determinations within air quality non-attainment and maintenance areas to ensure that federal actions conform to the "purpose" of SIPs. In late 1993, USEPA promulgated final rules for determining conformity of transportation plans, programs, and projects. These final rules, contained in 40 CFR Part 93, govern the conformity assessment for the proposed project.

### 3.12.2 Affected Environment

#### 3.12.2.1 CLIMATE

The Bay Area is characterized by cool, dry summers and mild, wet winters. Temperature in the project area and its vicinity averages approximately 58 degrees Fahrenheit annually, with an average maximum summer temperature of approximately 82 degrees Fahrenheit and an average minimum winter temperature of approximately 38 degrees Fahrenheit. The Eastern Pacific High, which is a strong persistent anticyclone, is the major influence on the climate in the area. The area experiences little precipitation during the summer months, when a high-pressure cell prevents storms from affecting the California coast. During the winter, the high-pressure cell weakens and shifts southward. Storms occur more frequently and winds are usually moderate. Total precipitation in the project area averages approximately 30.2 inches annually.

Low wind speeds and temperature inversions contribute to the buildup of air pollution. Low wind speed contributes to the buildup of air pollution because it allows more pollutants to accumulate in the air within a period of time. The highest air pollutant concentrations in the Bay Area generally occur during inversions, when temperature increases as altitude increases, thereby preventing air close to the ground from mixing with the air above it. As a result, air pollutants are trapped near the ground.

#### 3.12.2.2 AIR MONITORING DATA

The BAAQMD monitors air quality conditions at various locations throughout the Bay Area Air Basin. The closest air-monitoring station to the project area is the Santa Rosa–5th Street monitoring

station, which is approximately 1.6 miles south of the project area. Historical data from the Santa Rosa–5th Street monitoring station were used to characterize existing conditions within the vicinity of the proposed project area and to establish a baseline for estimating future conditions with and without the proposed project.

Criteria pollutants monitored at the station include $O_3$, CO, $NO_2$, $PM_{2.5}$, and $PM_{10}$. $SO_2$ is not monitored at this monitoring station or at any of the other monitoring stations in Sonoma County. A summary of the data recorded at the monitoring station during the 2001-2003 period is shown in Table 3.12-2, Criteria Pollutant Violations: Santa Rosa–5th Street Monitoring Station. The CAAQS and NAAQS for the criteria pollutants are also shown in the table. As table 3.12-2 indicates, criteria pollutants CO and $NO_2$ did not exceed the CAAQS or NAAQS between the years 2001 and 2003. $O_3$ exceeded the state one-hour standard once during the 2001-2003 period. $PM_{2.5}$ exceeded the federal 24-hour standard once during the period, and $PM_{10}$ exceeded the state 24-hour standard on five days during the period.

**Table 3.12-2: 2001-2003 Criteria Pollutant Violations: Santa Rosa – 5th Street Monitoring Station**

| Pollutant | Standard Exceedance | 2001 | 2002 | 2003 |
|---|---|---|---|---|
| Ozone (1 hour) | Maximum 1-hr concentration (ppm) | 0.086 | 0.077 | 0.096 |
| | Days > 0.12 ppm (Federal 1-hr standard) | 0 | 0 | 0 |
| | Days > 0.09 ppm (State 1-hr standard) | 0 | 0 | 1 |
| Ozone (8 hour) | Maximum 8-hr concentration (ppm) | 0.063 | 0.060 | 0.079 |
| | Days > 0.08 ppm (Federal 8-hr standard) | 0 | 0 | 0 |
| Carbon Monoxide | Maximum 8-hr concentration (ppm) | 2.40 | 2.10 | 1.77 |
| | Days > 9 ppm (Federal 8-hr. standard) | 0 | 0 | 0 |
| | Days > 9.0 ppm (State 8-hr standard) | 0 | 0 | 0 |
| Nitrogen Dioxide | Maximum 1-hr concentration (ppm) | 0.057 | 0.054 | 0.055 |
| | Days > 0.25 ppm (State 1-hr standard) | 0 | 0 | 0 |
| $PM_{2.5}$ | Maximum 24-hr concentration (µg/m$^3$) | 75.9 | 50.7 | 38.8 |
| | Days > 65 µg/m$^3$ (Federal 24-hr standard) | 1 | 0 | 0 |
| $PM_{10}$ | Maximum 24-hr concentration (µg/m$^3$) | 78.1 | 63.6 | 36.3 |
| | Estimated days > 150 µg/m$^3$ (Federal 24-hr standard) | 0 | 0 | 0 |
| | Estimated days > 50 µg/m$^3$ (State 24-hr standard) | 3 | 2 | 0 |

Source: California Air Resources Board.

### 3.12.2.3 BACKGROUND CARBON MONOXIDE (CO) CONDITIONS

CO concentrations are typically used as an indicator of conformity because CO levels are directly related to vehicular traffic volumes, the main source of air pollutants. A review of data from the Santa Rosa–5th Street monitoring station for the 2001-2003 period indicates that the average eight-hour background CO concentration is approximately 2.3 ppm. Assuming a typical persistence factor of 0.6, the estimated one-hour background concentration is approximately 3.9 ppm. The existing eight-hour background concentration does not exceed the state and federal eight-hour CO standard of 9.0 ppm. Additionally, the existing one-hour background concentration does not exceed the state and federal one-hour CO standards of 20.0 ppm and 35.0 ppm, respectively.

#### 3.12.2.4 SENSITIVE RECEPTORS

The following categories of people, as identified by the CARB, are considered most sensitive to air pollution: children under 14, the elderly over 65, athletes, and people with cardiovascular and chronic respiratory diseases. Locations that may contain a high concentration of these sensitive population groups are called sensitive receptors and include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, and parks. Six representative sensitive receptors have been identified within a quarter-mile of the Highway 101 project limits. They include:

- Windsor Public Library (library – 9291 Old Redwood Highway, Windsor)
- Chancellor Place (retirement/convalescent homes – 907 Adele Drive, Windsor)
- Windsor Creek Elementary School (elementary school – 8955 Conde Lane, Windsor)
- Little School House (daycare center – 270 Mark West Station Road, Windsor)
- Sonoma Academy (high school – 50 Mark West Springs Road, Santa Rosa)
- Brighton Gardens of Santa Rosa (retirement/convalescent homes – 300 Fountain Grove Parkway, Santa Rosa)

In addition to the sensitive receptors listed above, residential uses are also located within a quarter-mile of the project limits.

### 3.12.3 Environmental Consequences

#### 3.12.3.1 METHODOLOGY

CARB's EMFAC2002 emissions factor model and Caltrans' CALINE4 dispersion model were used to determine air quality impacts. Caltrans' Transportation Project-Level Carbon Monoxide Protocol was used to determine CO impacts. A quantitative analysis was conducted for this project because the traffic report identified certain roadway segments within the project area would have future level-of-service (LOS) E or F under the Build Alternative. These roadway segments were analyzed to determine whether the project would result in any CO violations. Emissions and concentrations related to lead were not analyzed because the proposed project does not contain lead emissions sources. A qualitative $PM_{10}$ hot spot analysis was conducted in accordance with 40 CFR 93.123 (b)(4), because the USEPA has not released modeling guidelines on how to perform qualitative $PM_{10}$ hot spot analysis.

The proposed project would have an adverse impact if:

- Daily operational emissions were to exceed the BAAQMD operational emissions thresholds for CO, ROG, $NO_X$, or $PM_{10}$ as shown in Table 3.12-3.
- Operational emissions were to exceed federal emissions thresholds for ROG or $NO_X$, as shown in Table 3.12-4.
- Project-related traffic were to cause CO concentrations at roadway segments to violate the CAAQS or NAAQS for either the one- or eight-hour period as shown in Table 3.12-1.

**Table 3.12-3: BAAQMD Daily Operational Emissions Thresholds**

| Criteria Pollutant | Pounds Per Day |
|---|---|
| Carbon Monoxide (CO) | 550 |
| Reactive Organic Gas (ROG) | 80 |
| Nitrogen Oxides ($NO_X$) | 80 |
| Particulates ($PM_{10}$) | 80 |

Source: Bay Area Air Quality Management District.

**Table 3.12-4: Federal Emissions Thresholds for Nonattainment Areas**

| Pollutant | Pounds per Day[1] | Tons per Year |
|---|---|---|
| ROG | 270 | 50 |
| $NO_X$ | 550 | 100 |

[1] Federal thresholds are expressed in tons per year. For ease of comparison, Federal thresholds have been converted to pounds per day.
Source: United States Code of Federal Regulations, Title 40, Part 93.

### 3.12.3.2 IMPACT ANALYSIS

#### No-Build Alternative

The No-Build Alternative assumes no major construction on Highway 101 through the project limits other than normal maintenance, rehabilitation and repair. The roadway improvements and maintenance are not anticipated to generate any new vehicle trips and, thus, would not affect the region's vehicle miles of travel (VMT). Since regional VMT is not anticipated to increase, changes in vehicle emissions are not anticipated. No substantial increase is expected in CO concentrations at sensitive receptor locations. $PM_{10}$ concentrations are not anticipated to increase. No impact is anticipated.

#### Build Alternative

The Highway 101 HOV Lane Widening Project would also not generate any new vehicle trips and, thus, would not increase vehicle emissions. Therefore, no substantial impacts associated with operational emissions are anticipated for the Build Alternative.

To provide a worst-case simulation of CO concentrations within the area, CO concentrations were calculated for nine roadway segments predicted to have LOS E or F in 2030 under the Build Alternative. At each roadway segment, traffic-related CO contributions were added to background CO conditions for the year 2010, which represents the opening year of the project and the year 2030, when traffic volumes in the project area are expected to stabilize. The proposed project would not cause CO concentrations to exceed the state or federal standards, and therefore, no substantial impact related to CO concentrations would occur under the Build Alternative.

Road dust is the primary source of operational $PM_{10}$ emissions for the proposed project. The project would not generate new vehicle trips. Additionally, the project is anticipated to improve the flow of vehicles and reduce congestion at nearby roadways. $PM_{10}$ concentrations are not anticipated to increase, and no impact is anticipated.

#### 3.12.3.3 MOBILE SOURCE AIR TOXICS IMPACT ANALYSIS

This section includes a basic analysis of the likely MSAT emission impacts of the proposed project. In 2030, the estimated Annual Average Daily Traffic (AADT) along Highway 101 in the study corridor is estimated to range from 75,000 to about 133,000 vehicles per day; therefore, a qualitative analysis was conducted.

Available technical tools do not allow for the prediction of project-specific health impacts as a result of emission changes associated with the project alternatives. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)).

##### Unavailable Information for Project Specific MSAT Impact Analysis

To date, neither NAAQS for MSATs nor national project level guidelines or guidance to study MSATs under various climatic and geographic conditions have been developed. Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including *emissions modeling*, *dispersion modeling* in order to estimate ambient concentrations resulting from the estimated emissions, *exposure modeling* in order to estimate human exposure to the estimated concentrations, and then *final determination of health impacts* based on the estimated exposure. Each of these steps (See Appendix J, Mobile Source Air Toxics Analysis) is encumbered by technical shortcomings or uncertain sciences that make the study of MSAT concentrations, exposures, and health impacts difficult and uncertain. Thus, only a qualitative analysis of these air toxics, as discussed below, is possible at this time.

##### Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs

Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or State level. EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at **http://www.epa.gov/iris**

### Project Specific MSAT Impact Analysis

As discussed above, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions-if any-from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives,* found at:

**www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm**

For each of the project alternatives, the amount of MSATs emitted would be proportional to the vehicle miles traveled, or VMT, assuming that other variables such as fleet mix are the same for each alternative. Under the Build Alternative, in both the opening year (2010) and the horizon year (2030), estimated daily VMT for Sonoma County would be slightly lower than that for the No-Build Alternative. This reflects a reduction in freeway traffic diversion onto local streets and improved travel times with the HOV lanes in place. This decrease in VMT would lead to lower MSAT emissions for the Build Alternative along the highway corridor. According to EPA's MOBILE 6 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases. Thus increased speed under the Build Alternative would further lower MSAT emission rates.

Under the No-Build Alternative, the estimated daily VMT (countywide) would be 17,560,030 miles in 2010 and 22,800,000 miles in 2030. Under the Build Alternative, the estimated daily VMT (countywide) would be 17,349,330 miles in 2010 and 22,763,330 miles in 2030. The estimated VMT in the year 2010 under the No-Build and the Build Alternatives are nearly the same, varying by only 1.2 percent. Similarly, the VMT under the No-Build and Build Alternatives would vary by only 0.16 percent in year 2030. Thus, it is expected there would be no appreciable difference in overall MSAT emissions between the No-Build and the Build Alternatives. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

Under the Build Alternative, the reconfiguration of ramps at interchanges and the addition of auxiliary lanes will have the effect of moving some traffic closer to nearby residences and other potential sensitive receptors. The potential for localized increases in MSAT concentrations would be most likely to occur along the proposed project improvements at the following locations:

**Ramp Improvements**

- Fulton Road/Airport Boulevard Interchange (Northbound Option B only)
- Mark West Springs Road-River Road
- Windsor River Road- Old Redwood Highway
- Airport Boulevard

**Addition of Auxiliary Lane**

- Between the Fulton Road on-ramp and the Airport Boulevard off-ramp (Northbound Option A only)

Consequently, there may be localized areas where ambient concentrations of MSATs could be higher under the Build Alternative than the No-Build Alternative. However, as discussed above, the magnitude and the duration of these potential increases compared to the No-Build Alternative cannot be accurately quantified due to the inherent deficiencies of current models. In sum, when proposed project improvements move traffic closer to certain sensitive receptors, the localized level of MSAT emissions for the Build Alternative may be higher relative to the No-Build Alternative, but this would be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Moreover, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, as well as CARB's Diesel Risk Reduction Plan, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be substantially lower than today.

### 3.12.4 Avoidance, Minimization, and/or Mitigation Measures

No adverse impacts are anticipated, and therefore, no minimization or mitigation measures are recommended.

### 3.12.5 Transportation Conformity Analysis

FHWA cannot approve funding for project activities beyond preliminary engineering unless the project is in conformity with USEPA transportation conformity regulations (40 CFR Part 93). The criteria that the Build Alternative must satisfy are discussed below. The federal conformity criteria are applicable only to operations emissions. They do not apply to construction emissions.

§93.110 The conformity determination must be based on the latest planning assumptions.

ABAG and MTC are the Metropolitan Planning Organizations responsible for determining areawide population and employment forecasts, modeling regional travel demand, and formulating the Regional Transportation Plan (RTP) and the Transportation Improvement Program (TIP). Assumptions used in the transportation and traffic analysis for this project, upon which the microscale CO and regional criteria pollutant analyses are based, are derived from ABAG's most recently adopted population, employment, travel, and congestion estimates. Traffic forecasts for the proposed project were developed using the Sonoma County travel demand.

§93.111 The conformity determination must be based on the latest emission estimation model available.

Emission estimates are based on the CARB EMFAC 2002 model. Caltrans CALINE4 model was used for CO modeling. The EMFAC2002 and CALINE4 models are the most recent models approved by USEPA.

§93.112 The conformity determination must be made according to the consultation procedures of this rule and in the applicable implementation plan, and according to the public involvement procedures established in compliance with 23 CFR Part 450. The conformity determination must be made according to §93.105(a)(2) and (e) and the requirements of 23 CFR Part 450.

The proposed project would follow the consultation procedures in 23 CFR Part 450, 40 CFR Part 51, and 40 CFR Part 93 (§93.105(a)(2) and (e)) before making its conformity determination. The environmental document for the proposed project would be available for public review and comment prior to adoption.

§93.114 There must be a currently conforming transportation plan and TIP at the time of project approval.

The most recent RTP in the project area is the *Transportation 2030 Plan*. The most recent TIP is the 2005 TIP. The *Transportation 2030 Plan* was adopted by MTC in February 2005. The proposed project is included in the *Transportation 2030 Plan* and the 2005 TIP. The 2005 TIP was adopted by MTC on July 28, 2004. FHWA made its conformity determination for the *Transportation 2030 Plan* on March 17, 2005 and the 2005 TIP on October 4, 2004.

§93.115 The proposed project must come from a conforming transportation plan and TIP.

The proposed project is included in the financially constrained portion of the Transportation 2030 Plan and 2005 TIP.

§93.116 The proposed project would not cause or contribute to any new localized CO or $PM_{10}$ violations or increase the frequency or severity of any existing CO or $PM_{10}$ violations in CO and $PM_{10}$ non-attainment and maintenance areas.

CO concentrations under the Build Alternative are the same or slightly lower than those under the No-Build conditions. One-hour CO concentrations under the 2030 Build Alternative would range from approximately 0.8 ppm to 1.1 ppm at worst-case sidewalk receptors. The Build eight-hour CO concentrations are anticipated to range from approximately 0.5 ppm to 0.7 ppm. None of the analyzed roadway segments are anticipated to exceed the state and federal one- and eight-hour CO standards. Qualitatively, the proposed project would not have adverse effects on $PM_{10}$ levels as the proposed project would not increase the frequency or severity of existing $PM_{10}$ violations.

§93.117 The proposed project must comply with $PM_{10}$ control measures that are contained in the applicable implementation plan.

$PM_{10}$ control measures are not available for the San Francisco Bay Area since the BAAQMD does not have an implementation plan for $PM_{10}$. The No-Build and Build Alternatives would not change VMT in the region. However, the proposed project would improve roadway conditions, which would result

in lower $PM_{10}$ concentrations. If a federal $PM_{10}$ attainment plan were required in the future, Caltrans would identify appropriate control measures for $PM_{10}$ emissions.

Based on the above, the proposed project satisfies USEPA's project-level conformity requirements (40 CFR Part 93).

## 3.13 Noise

### 3.13.1 Regulatory Setting

The FHWA and Caltrans guidelines establish methods and criteria for evaluating and mitigating highway traffic noise effects in compliance with the National Environmental Policy Act (NEPA). These noise analysis methods and abatement criteria are also in compliance with the requirements stemming from the California Environmental Quality Act (CEQA).

#### State and Federal Guidelines for Noise Impact Evaluation

The noise impact evaluation criteria for the proposed project are in agreement with the Noise Abatement Criteria (NAC) established by the FHWA in *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (23 CFR Part 772, 2004) and criteria adopted by Caltrans in *Traffic Noise Analysis Protocol for New Highway Construction and Highway Reconstruction Projects* (Protocol) (Caltrans, 1998a). For residential land uses, parks, schools, and hospitals, the FHWA outdoor noise criterion is 67 dBA, and the interior noise criterion is 52 dBA. Table 3.13-1, Activity Categories and Noise Abatement Criteria, shows noise criteria for these and other land use categories.

According to the Protocol, traffic noise impacts occur when one or both of the following occurs: 1) the project results in a substantial noise increase; 2) predicted noise levels approach or exceed the NAC. A traffic noise impact will also occur when the predicted noise levels of the project approach within 1 dBA or exceed the Noise Abatement Criteria shown in Table 13.3-1. Noise abatement measures are considered for this project when predicted future peak hour traffic noise levels are equal to or exceed 66 dBA.

**Table 3.13-1: Activity Categories and Noise Abatement Criteria**

| Activity Category | NAC, Hourly A-Weighted Noise Level, dBA Leq(h) | Description of Activity Category |
|---|---|---|
| A | 57 (Exterior) | Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. |
| B | 67 (Exterior) | Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals. |
| C | 72 (Exterior) | Developed lands, properties, or activities not included in Categories A or B above. |
| D | -- | Undeveloped lands |
| E | 52 (Interior) | Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums. |

Source: 23 CFR Part 772, 2004

The Caltrans Protocol states that if it is predicted that there would be traffic noise impacts, all reasonable and feasible noise abatement measures must be identified and implemented. The abatement must provide a minimum of 5-dBA noise reduction to be considered feasible. Additional feasibility criteria include topography, access requirements (for driveways, ramps, etc.), the presence of local cross streets, other noise sources in the area, and safety considerations.

Greater noise reductions are encouraged as long as they can be achieved under the reasonableness guidelines. The overall reasonableness of noise abatement is determined by considering a multitude of factors including but not necessarily limited to the following:

A. Cost of the abatement
B. Absolute noise levels
C. Change in noise levels
D. Noise abatement benefits
E. Date of development along the highway
F. Life cycle of abatement measure[1]
G. Environmental impacts of abatement construction
H. Views (opinions) of affected residents
I. Input from the public and local agencies
J. Social, economic, environmental, legal, and technological factors

The cost of the abatement for residential areas is compared to a calculated Reasonable Allowance per Residence. Noise abatement that exceeds the cost allowance is not considered reasonable. Normally, noise abatement is not designed for the second-floor level. However, noise abatement designed to provide a 5-dBA noise reduction for the second-floor level without exceeding the modified allowance is considered within the scope of reasonableness. (Caltrans 1998a)

The Protocol identifies four scenarios under which noise impacts or abatement considerations for a project may need to be re-analyzed. These scenarios, quoted from Section 1.4.3 of the Protocol, are as follows:

a) There has been a significant change in project design concept and /or scope from that of the most recent environmental analysis, or

b) A significant period of time has passed since the most recent environmental analysis, generally considered to be three years between project milestones, e.g. Record of Decision to Right-of-Way Certification, or

c) An undeveloped land becomes planned, designed and programmed, after the analysis, but before the date of public knowledge, or

d) An undeveloped land becomes developed after the date of public knowledge (disclosure of impacts, if any, but abatement not considered).

[1] It is normally not considered reasonable to construct a wall where planned future use would limit its useful life to less than 15 years.

### Noise Barriers and Noise Reflection

The construction of noise barriers (soundwalls) sometimes generates concern that single or parallel noise barrier configurations will provide surfaces that "bounce" noise, and thus increase noise levels for some receivers. Studies show that single barrier configurations (barriers on one side of the highway only) reflect noise toward the opposite side of the highway. The noise increase on the opposite side, however, is typically 1 to 2.4 dBA, which is barely perceptible to the human ear. Noise reflection between parallel noise barriers (barriers running along opposite sides of the highway) can slightly degrade the performance of each barrier. The Protocol specifies that the ratio of the distance between opposite barriers to the height of the barriers ("width-to-height ratio") should be at least ten to one to avoid a noticeable degradation in performance.

## 3.13.2 Affected Environment

### 3.13.2.1 NOISE FUNDAMENTALS

Noise is an unexpected or undesired sound. Most noise in the project area is traffic related. Noise is transmitted by pressure waves through the atmosphere (sound waves) and is defined by these characteristics:

- ***Frequency*** refers to the length of a single sound wave, or how many sound waves pass one point in one second (cycles per second). Frequency determines the pitch of the sound – from low to high. The unit for frequency is Hertz (Hz). The human ear can detect sound in the range of 16 (low) to 20,000 (high) Hertz.
- ***Amplitude*** is the height of the sound wave and determines the intensity of sound. A high amplitude sound wave sounds louder than a sound wave of the same frequency at low amplitude. The units are decibels (dB) and are described logarithmically. Therefore, a doubling of wave height does not result in a doubling of decibels; instead, a doubling of sound energy results in a 3-dB increase in sound.

The average healthy ear can barely perceive noise level changes of 3 dB or less. A change of 5 dB is readily perceptible, and a change of 10 dB is perceived as being twice or half as loud. As discussed previously, a doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy would result in a barely perceptible change in sound level.

Humans perceive the same amplitude as louder at some frequencies than at others. In measuring sound, to account for the frequency response of the human ear, adjustments are applied at differing frequencies to reflect the average individual's sensitivity to sound. For noise associated with traffic and similar human activity, these adjustments are referred to as A-scale weighting. Noise levels are reported in terms of A-weighted decibels, or dBA. Figure 3.13-1 shows typical A-weighted noise levels.

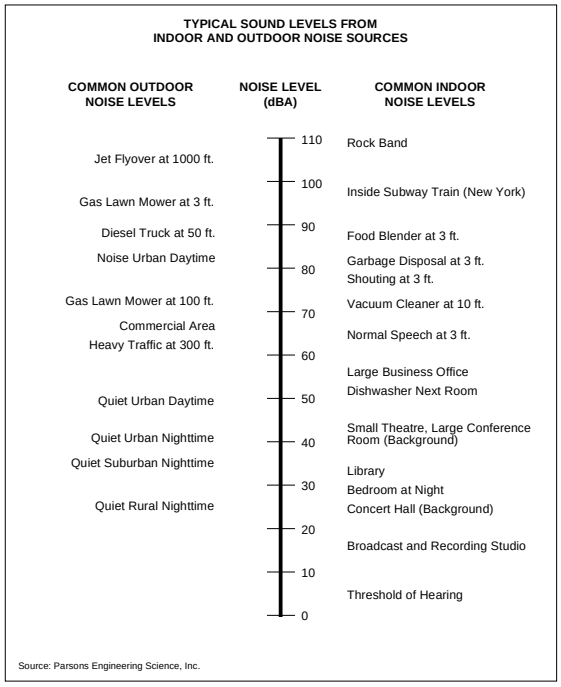



**Figure 3.13-1: Typical A-Weighted Noise Levels**

Noise levels in our daily environment fluctuate over time. Various terms have been developed to describe time-varying noise levels. The following is a list of the noise descriptors most commonly used in Caltrans/FHWA traffic noise analysis:

- ***Equivalent Sound Level (Leq)*** represents an average of the sound energy occurring over a specified period. Leq is, in effect, the steady-state sound level that, in a given period, would contain the same acoustical energy as the time-varying sound that actually occurs during the same period. The Noise Abatement Criteria (NAC) used by Caltrans and FHWA use an Leq that averages A-weighted sound over a one-hour period of time. This Leq is referred to as Leq(h).
- ***Maximum Sound Level (Lmax)*** is the highest instantaneous sound level measured during a specified period.
- ***Insertion Loss (I.L.)*** is the actual noise level reduction at a specific receiver due to construction of a noise barrier between the noise source (traffic) and the receiver. Generally, it is the net effect of the soundwall attenuation and the loss due to ground effects.

As sound travels over a distance, it changes in both level and frequency content. The manner in which noise reduces with distance depends on the following factors:

***Geometric spreading*** - The movement of the vehicles on a highway makes the source of the sound appear to emanate from a line rather than a stationary point. From a line source, the sound level attenuates (drops off) by 3dB per doubling of distance from the source.

***Ground absorption*** – Most often, the noise path between the highway and the observer is very close to the ground. When this ground path is reflective like a parking lot or a smooth body of water, no ground attenuation is assumed. If, however, the path is acoustically absorptive (like soft dirt, grass, or

scattered bushes and trees), it is assumed that the sound drops off an additional 1.5dB per doubling of distance.

***Atmospheric effects*** - Atmospheric conditions, such as wind or air temperature, can have a substantial effect on noise levels when noise receptors are located more than 60 m (200 ft) from a highway.

#### 3.13.2.2 EXISTING HIGHWAY 101 NOISE LEVELS

Noise measurements were conducted in the project vicinity from April 26 through April 30, 2004. During that time, sensitive land use areas and the location and height of existing property walls were identified. All noise measurements were conducted in accordance with the FHWA guidelines outlined in *Measuring of Highway Related Noise* (FHWA-DP-96-046).

Existing noise levels in the project corridor were measured at 17 locations representing sensitive land uses, such as homes, businesses, and motels. Short-term measurements were made at 10 of these locations, while long-term measurements were conducted at seven locations. The dominant noise source at all measurement sites was traffic on Highway 101. Local street traffic contributed to noise at some of the measurement sites, but was substantially less than the highway traffic noise. Short-term measurements were 20 minutes each in duration. Long-term measurements were for a minimum of 24 hours, during which the noise level data were stored at 20-minute intervals. The interval data were stored in the instrument's internal memory, which allowed the highest traffic noise hour to be identified during data analysis and graphical examination of the results.

Short-term measurements were adjusted to the peak-hour traffic-noise level by comparison with the highest noise level of a nearby long-term measurement. In addition, a calibration "K" factor was applied at three locations where unknown attenuation factors could not be properly modeled (Caltrans 1998). The first location was at measurement location LT1, which was modeled as receptor R4. This receptor is on the northbound side of Highway 101 just before the Bicentennial Way off-ramp. The modeled level was substantially higher than the measured level. In addition, the modeled results for receptors R16 and R18 were substantially higher than the measured results at R18 (short-term measurement site ST4) and caused the predicted future traffic noise level to be unrealistically high compared to the existing noise level. For these reasons, a "K" factor of -2.9 was applied to R4 and a "K" factor of -4.0 was applied to R16 and R18. For all other receptor locations, the differences between measured and modeled noise levels were within a range of -0.4 and +1.6 dB, which is acceptable and within the accuracy and sensitivity of the model. Three short-term sites and three long-term sites were used for model calibration. The adjusted short-term peak hour traffic noise levels range between 58 and 81 dBA and are summarized in Table 3.13-2, Short-Term Noise Measurement Results. A summary of the long-term noise monitoring results is shown in Table 3.13-3, Long-Term Noise Measurement Results.

The monitoring results indicate that existing traffic noise levels already approach or exceed the NAC at many locations along the project alignment. According to the long-term monitoring results, the peak noise hours occur during the morning commute at locations along both sides of Highway 101. Noise levels are lower during the evening commute hours. Monitoring locations are shown on Figure A (Sheets 1 through 16) in Appendix A.

## Table 3.13-2: Short-Term Noise Measurements Results

| Site No. | Street Address, City | Land Use[1] | Noise Abatement Category (Criterion)[2] | Meter Location | Measurement Dates | Start Time | Measured $L_{eq}$, dBA[3] | Adjusted Peak-Hour $L_{eq}$, dBA[4] | Adjusted using Long-Term Site |
|---|---|---|---|---|---|---|---|---|---|
| ST1 | 2760 Cleveland Avenue, Santa Rosa | Motel | B (67) | Near Bldg. | 4/27/04 | 9:45 AM | 77.0 | 81 | LT1 |
| ST2 | 3112 Loretta Way, Santa Rosa | MH | B (67) | Rear Yard | 4/28/04 | 8:10 AM | 57.8 | 61 | LT3 |
| ST3 | 101 Fountain Grove Parkway, Santa Rosa | Hotel | B (67) | Near Bldg. | 4/28/04 | 8:40 AM | 62.3 | 62 | LT2 |
| ST4 | 4221 Alba Lane, Santa Rosa | SFR | B (67) | Front Yard | 4/28/04 | 9:15 AM | 60.8 | 61 | LT2 |
| ST5 | 100 Vineyard View, Santa Rosa | SFR | B (67) | Front Yard | 4/28/04 | 10:15 AM | 60.0 | 61 | LT4 |
| ST6 | 4350 Barnes Road, Santa Rosa | Motel | B (67) | Near Bldg. | 4/28/04 | 11:30 AM | 58.6 | 60 | LT4 |
| ST8 | 5257 Whispering Creek Drive, Shiloh | MH | B (67) | Rear Yard | 4/28/04 | 3:19 PM | 57.1 | 58 | LT5 |
| ST9 | 7087 Hastings Place, Shiloh | SFR | B (67) | Rear Yard | 4/29/04 | 2:06 PM | 63.8 | 66 | LT6 |
| ST10 | 206 Courtyard East Lane, Windsor | MFR | B (67) | Side Yard | 4/29/04 | 3:50 PM | 64.7 | 65 | LT6 |
| ST11 | 8946 Oakfield Lane, Windsor | SFR | B (67) | Side Yard | 4/29/04 | 5:02 PM | 64.6 | 67 | LT7 |

Notes:
1 - SFR = Single-family Residential; MFR = Multi-Family Residential; MH = Mobile Home Park.
2 - According to Caltrans Traffic Noise Analysis Protocol.
3 - All short-term measured noise levels are a 20-minute $L_{eq}$.
4 - Measurements conducted during off-peak hours were adjusted to the peak-hour $L_{eq}$ based on a comparison with long-term noise levels which were measured at a nearby measurement site, listed in the last column.

Source: Parsons 2005.

## Table 3.13-3: Long-Term Noise Measurements Results

| Site No. | Street Address, City | Land Use[1] | Noise Abatement Category (Criterion)[2] | Meter Location | Measurement Dates | Start Time | Duration, No. of Hours | Measured Peak Hour Leq, dBA[3] | Peak-Hour Start Time |
|---|---|---|---|---|---|---|---|---|---|
| LT1 | 699 Russell Avenue, Santa Rosa | SFR | B (67) | Rear Yard | 4/26 – 4/27 | 5:00 PM | 25 | 66 | 7 AM, 6 PM |
| LT2 | 562 Angelus Street, Santa Rosa | MH | B (67) | Rear Yard | 4/26 – 4/28* | 1:40 PM | 48 | 63 | 7 AM |
| LT3 | 4201 Coffey Lane, Santa Rosa | SFR | B (67) | Front Yard | 4/27 – 4/28 | 6:00 PM | 25 | 71 | 6 AM |
| LT4 | 4420 Lavell Road, Santa Rosa | SFR | B (67) | Side Yard | 4/27 – 4/28 | 5:00 PM | 26 | 67 | 6 AM, 6 PM |
| LT5 | 490 Mark West Station Road, Windsor | SFR | B (67) | Rear Yard | 4/28 – 4/29 | 2:40 PM | 27 | 78 | 4 PM |
| LT6 | 7873 Dove Lane, Windsor | SFR | B (67) | Rear Yard | 4/28 – 4/29 | 5:20 PM | 25 | 64 | 3 PM – 4 PM |
| LT7 | 8178 Willow Street, Windsor | MH | B (67) | Rear Yard | 4/28 – 4/29 | 6:30 PM | 24 | 71 | 7 AM |

Notes:
1 - SFR = Single-family Residential; MFR = Multi-Family Residential, MH = Mobile Home Park.
2 - According to Caltrans Traffic Noise Analysis Protocol.
3 - The highest measured hourly noise level recorded during the long-term measurement period.
* - There is a break in the measurement intervals due to power failure.

Source: Parsons 2005.

### 3.13.3 Environmental Consequences

Noise impacts are assessed by comparing the future (year 2030) Build Alternative condition with the existing condition. The greatest noise generation from a roadway is when volumes are high and speeds are still close to free flow; this "worst case" condition is referred to as Level of Service C (LOS C) by traffic engineers. To approximate the worst case LOS C scenario for the Year 2030 Build condition, the noise analysis assumed freeway volumes of 1,800 vehicles per lane per hour traveling at approximately 105 km/h (65 mph). The volumes used for the HOV lanes were 1,500 vehicles per lane per hour at a speed of 105 km/h (65 mph). The projected traffic volumes for the year 2030 were used for ramps, but capped at 1,000 vehicles per lane per hour to maintain the greatest noise generation potential. The speeds used for ramp traffic were 56 km/h (35 mph) for straight ramps and 32 km/h (20 mph) for loop ramps.

Table 3.13-4, Predicted Future Noise and Barrier Analysis summarizes the results of the predicted levels at the representative receptor locations. The predicted Build Alternative peak hour Leq(h) at the representative receptors ranges from 60 to 78 dBA, exceeding the NAC at most locations. At some locations, Build Alternative noise levels would be 3 dBA less than those of the No-Build Alternative, due to the median barrier. Noise levels at receptor locations R35, R35A, and R35B differ under Options A and B for the Fulton Road and Airport Boulevard interchange complex. The Caltrans highway noise prediction computer model, SOUND 2000, PC Version 3.2, was used for the noise computations. This model is based on the highway traffic noise prediction method specified in FHWA-RD-77-108 (FHWA, 1978). Noise abatement measures considered are described in Section 3.13.4, Avoidance, Minimization and/or Mitigation Measures.

### 3.13.4 Avoidance, Minimization, and/or Mitigation Measures

Table 3.13-4, Predicted Future Noise and Barrier Analysis, lists predicted noise levels without barriers (soundwalls) and with barriers of various heights. Recommended barrier heights and locations are shown on Figure A (Sheets 1 through 16) in Appendix A. All barrier heights and locations are based on preliminary engineering. The tables and descriptions in this section include some locations where soundwalls are not feasible and others where soundwalls would not meet the Caltrans criteria for calculated Reasonable Allowance per Residence. The plan drawings in Figure A in Appendix A show only soundwalls that are considered both feasible and reasonable. A final decision concerning noise barriers will be made upon completion of the project design and public involvement processes.

## Table 3.13-4: Predicted Future Noise and Barrier Analysis

| REC. NO. | LAND USE[2] | EXISTING[1] PEAK HR. NOISE LEVELS $L_{eq(h)}$, dBA[3] | PREDICTED PEAK HOUR NOISE LEVELS[1] | | | | | | | | | | | | | | | BARRIER NO. / LOCATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | No Build WITHOUT BARRIER $L_{eq(h)}$, dBA | Build WITHOUT BARRIER $L_{eq(h)}$, dBA | NOISE INCREASE OR DECREASE | ACTIVITY CATEGORY and NAC ( ) $L_{eq(h)}$, dBA | IMPACT TYPE (A/E[4] or NONE) | NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.) | | | | | | | | | | |
| | | | | | | | | 2.4 m (8 ft) | | 3.0 m (10 ft) | | 3.7 m (12 ft) | | 4.3 m (14 ft) | | 4.9 m (16 ft) | | |
| | | | | | | | | $L_{eq(h)}$ | I.L. | $L_{eq(h)}$ | I.L. | $L_{eq(h)}$ | I.L. | $L_{eq(h)}$ | I.L. | $L_{eq(h)}$ | I.L. | |
| R3 | I | 76 E | 74 | 74 | -2 | B (67) | A/E | 74 | -- | 74 | -- | 74 | -- | 74 | -- | 74 | -- | |
| R5A | HM | 71 E | 69 | 69 | -2 | B (67) | A/E | 69 | -- | 69 | -- | 69 | -- | 69 | -- | 69 | -- | No Barrier |
| R5 | HM | 67 E | 65 | 65 | -2 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| R4 | SFR | 67 M-LT1 | 64 | 65 | -2 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No Barrier |
| R6 C | MH | 69 E | 72 | 72 | 3 | B (67) | A/E | 70 T | 2 | 69 | 3 | 67 R | 5 | 67 | 5 | 65 | 7 | East side ROW[7] |
| R6A S | MH | 65 E | 68 | 69 | 4 | B (67) | A/E | 68 | 1 | 67 | 2 | 67 T,R,5 | 2 | 66 | 3 | 65 | 4 | |
| R7 | MH | 63 M-LT2 | 66 | 67 | 4 | B (67) | A/E | 67 | 0 | 67 | 0 | 67 | 2 | 66 | 3 | 65 | 4 | No Barrier |
| R8 | MH | 65 E | 68 | 68 | 3 | B (67) | A/E | 68 | 0 | 68 | 0 | 67 | 2 | 66 | 3 | 65 | 4 | |
| R9 | MH | 60 E | 66 | 65 | 5 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| R9A | MH | 61 M-ST2 | 67 | 67 | 6 | B (67) | A/E | 67 | -- | 67 | -- | 67 | -- | 67 | -- | 67 | -- | No Barrier |
| R10 | MH | 57 E | 63 | 64 | 7 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| R12 | HM | 63 E | 65 | 65 | 2 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| R11 | HM | 62 M-ST3 | 65 | 66 | 4 | B (67) | A/E | 66 | -- | 66 | -- | 66 | -- | 66 | -- | 66 | -- | |
| R13A | HM | 58 E | 61 | 62 | 4 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No Barrier |
| R13 | HM | 57 E | 60 | 60 | 3 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| R13B | HM | 60 E | 63 | 64 | 4 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| R14 | HM | 66 E | 68 | 68 | 2 | B (67) | A/E | 68 | -- | 68 | -- | 68 | -- | 68 | -- | 68 | -- | No Barrier |

Notes:
1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile home; HM - hotel/motel; I - Institutional; COM - commercial.
3 - M - Measured noise level; E - Estimated noise level.
4 - A/E = Approach or Exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Measurement site had a property wall.
7 - Refer to the text in this section for a description of conditions at this location.
R - Minimum required height based on Caltrans Noise Analysis Protocol.
S - Second row receptor.
C - Critical design receiver.
T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.
** Soundwall heights are chosen to achieve a particular top-of-barrier elevation from the ground at that location.

## Table 3.13-4 (Cont'd): Predicted Future Noise and Barrier Analysis

| REC. NO. | LAND USE[2] | EXISTING[1] PEAK HR. NOISE LEVELS Leq(h), dBA[3] | PREDICTED PEAK HOUR NOISE LEVELS[1] | | | | | | | | | | | | | | | | BARRIER NO. / LOCATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | No Build WITHOUT BARRIER Leq(h), dBA | Build WITHOUT BARRIER Leq(h), dBA | NOISE INCREASE OR DECREASE | ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA | IMPACT TYPE (A/E[4] or NONE) | NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.) | | | | | | | | | | | |
| | | | | | | | | 2.4 m (8 ft) | | 3.0 m (10 ft) | | 3.7 m (12 ft) | | 4.3 m (14 ft) | | 4.9 m (16 ft) | | | |
| | | | | | | | | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | | |
| R15A | SFR | 64 E | 66 | 67 | 3 | B (67) | A/E | 65 | 2 | 64 | 3 | 63 T | 4 | 62 R | 5 | 61 | 6 | | |
| R17A | SFR | 69 E | 71 | 72 | 3 | B (67) | A/E | 69 | 3 | 67 | 5 | 66 T | 6 | 65 R,5 | 7 | 63 | 9 | | |
| R17 C | SFR | 73 E | 75 | 75 | 2 | B (67) | A/E | 71 | 4 | 69 T | 6 | 67 | 8 | 66 R,5 | 9 | 65 | 10 | | |
| R19 | SFR | 73 E | 75 | 75 | 2 | B (67) | A/E | 70 T | 5 | 69 | 6 | 67 R,5 | 8 | 66 | 9 | 64 | 11 | West side ROW & shoulder[7] | |
| R21 | SFR | 71 M-LT3 | 73 | 73 | 2 | B (67) | A/E | 69 | 4 | 68 T | 5 | 66 R | 7 | 65 | 8 | 64 | 9 | | |
| R23 | SFR | 72 E | 74 | 75 | 3 | B (67) | A/E | 70 | 5 | 68 T | 7 | 67 R,5 | 8 | 66 | 9 | 65 | 10 | | |
| R25 | SFR | 66 E | 68 | 69 | 3 | B (67) | A/E | 68 | -- | 68 | -- | 68 | -- | 68 | -- | 68 | -- | No Barrier | |
| R16 | SFR | 57 E | 59 | 60 | 3 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No Barrier | |
| R18 | SFR | 61 M-ST4 | 63 | 64 | 3 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | | |
| R20 | COM | 68 E | 70 | 71 | 3 | C (72) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No Barrier | |
| R22 | SFR | 61 M-ST5 | 64 | 65 | 4 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No Barrier | |
| R24 | SFR | 63 E | 66 | 67 | 4 | B (67) | A/E | 67 | -- | 67 | -- | 67 | -- | 67 | -- | 67 | -- | | |
| R27 | SFR | 60 E | 64 | 65 | 5 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No Barrier | |
| R29 | HM | 60 M-ST6 | 64 | 64 | 4 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | | |
| R26A | SFR | 67 M-LT4 | 72 | 72 | 5 | D (--) | NONE | 70 | 2 | 68 | 4 | 67 | 5 | 66 | 6 | 65 | 7 | | |
| R26 C | SFR | 67 E | 72 | 72 | 5 | B (67) | A/E | 70 | 2 | 69 | 3 | 67 | 5 | 66 T | 6 | 65 R,5 | 7 | East side ROW & shoulder[7] | |
| R28 | SFR | 64 E | 69 | 69 | 5 | B (67) | A/E | 68 | 1 | 67 | 2 | 66 | 3 | 65 T | 4 | 64 R | 5 | | |
| R28A | SFR | 63 E | 66 | 67 | 4 | B (67) | A/E | 66 | 1 | 65 | 2 | 64 | 3 | 64 T | 3 | 63 | 4 | | |

Notes:
1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile home; HM - hotel/motel; I - Institutional; COM - commercial.
3 - M - Measured noise level; E - Estimated noise level.
4 - A/E = Approach or Exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Measurement site had a property wall.
7 - Refer to the text in this section for a description of conditions at this location.
R - Minimum required height based on Caltrans Noise Analysis Protocol.
S - Second row receptor.
C - Critical design receiver.
T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.
** Soundwall heights are chosen to achieve a particular top-of-barrier elevation from the ground at that location.

## Table 3.13-4 (Cont'd): Predicted Future Noise and Barrier Analysis

| REC. NO. | LAND USE[2] | EXISTING[1] PEAK HR. NOISE LEVELS Leq(h), dBA[3] | PREDICTED PEAK HOUR NOISE LEVELS[1] | | | | | | | | | | | | | | | BARRIER NO. / LOCATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | No Build WITHOUT BARRIER Leq(h), dBA | Build WITHOUT BARRIER Leq(h), dBA | NOISE INCREASE OR DECREASE | ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA | IMPACT TYPE (A/E[4] or NONE) | NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.) | | | | | | | | | | |
| | | | | | | | | 2.4 m (8 ft) | | 3.0 m (10 ft) | | 3.7 m (12 ft) | | 4.3 m (14 ft) | | 4.9 m (16 ft) | | |
| | | | | | | | | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | |
| R30 | SFR | 70 E | 69 | 70 | 0 | B (67) | A/E | 70 | -- | 70 | -- | 70 | -- | 70 | -- | 70 | -- | No Barrier |
| R32 | SFR | 65 E | 65 | 65 | 0 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| Airport Boulevard to SB 101 On Ramp Option A | | | | | | | | | | | | | | | | | | |
| R35A | MFR | 63 E | 66 | 65 | 2 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | West side shoulder of frontage road and shoulder of Airport Bl.[7] |
| R35 C | MFR | 65 E | 68 | 66 | 1 | B (67) | A/E | 62 T | 4 | 61 R | 5 | 61 | 5 | 60 | 6 | 59 | 7 | |
| R35B | MFR | 64 E | 67 | 65 | 1 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| Airport Boulevard to SB 101 On Ramp Option B - Braided Ramp | | | | | | | | | | | | | | | | | | |
| R35A | MFR | 63 E | 66 | 63 | 0 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No Barrier |
| R35 | MFR | 65 E | 68 | 64 | -1 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| R35B | MFR | 64 E | 67 | 64 | 0 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | |
| R37 | MH | 58 M-ST8 | 64 | 64 | 6 | B (67) | NONE | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | No Barrier |
| R34 | SFR | 71 E | 69 | 70 | -1 | B (67) | A/E | 69 | 1 | 68 | 2 | 66 T | 4 | 65 R | 5 | 64 | 6 | East side ROW[7] |
| R36 | SFR | 73 E | 72 | 72 | -1 | B (67) | A/E | 70 | 2 | 69 T | 3 | 67 | 5 | 66 R,5 | 6 | 65 | 7 | |
| R38 C | SFR | 78 M-LT5 | 77 | 77 | -1 | B (67) | A/E | 73 T | 4 | 70 | 7 | 68 | 9 | 66 | 11 | 65 R,5 | 12 | |
| R38A | SFR | 72 E | 71 | 72 | 0 | B (67) | A/E | 70 | 2 | 69 | 3 | 67 T | 5 | 66 | 6 | 65 R,5 | 7 | |
| R38B | SFR | 69 E | 68 | 68 | -1 | B (67) | A/E | 67 | 1 | 66 | 2 | 65 T | 3 | 64 | 4 | 63 R | 5 | |

Notes:
1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile home; HM - hotel/motel; I - Institutional; COM - commercial.
3 - M - Measured noise level; E - Estimated noise level.
4 - A/E = Approach or Exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Measurement site had a property wall.
7 - Refer to the text in this section for a description of conditions at this location.
R - Minimum required height based on Caltrans Noise Analysis Protocol.
S - Second row receptor.
C - Critical design receiver.
T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.
** Soundwall heights are chosen to achieve a particular top-of-barrier elevation from the ground at that location.

## Table 3.13-4 (Cont'd): Predicted Future Noise and Barrier Analysis

| REC. NO. | LAND USE[2] | EXISTING[1] PEAK HR. NOISE LEVELS Leq(h), dBA[3] | PREDICTED PEAK HOUR NOISE LEVELS[1] | | | | | | | | | | | | | | | | BARRIER NO. / LOCATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | No Build WITHOUT BARRIER Leq(h), dBA | Build WITHOUT BARRIER Leq(h), dBA | NOISE INCREASE OR DECREASE | ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA | IMPACT TYPE (A/E[4] or NONE) | NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.) | | | | | | | | | | | |
| | | | | | | | | 2.4 m (8 ft) | | 3.0 m (10 ft) | | 3.7 m (12 ft) | | 4.3 m (14 ft) | | 4.9 m (16 ft) | | | |
| | | | | | | | | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | | |
| R50 [C] | SFR | 70 [E] | 70 | 71 | 1 | B (67) | A/E | 69 | 2 | 68 | 3 | 67 [T] | 4 | 67 | 4 | 66 [R] | 5 | East side ROW and shoulder[7] |
| R50A [S] | SFR | 69 [E] | 69 | 70 | 1 | B (67) | A/E | 68 | 2 | 67 | 3 | 66 [T] | 4 | 66 | 4 | 66 [R,5] | 4 | |
| R52 | SFR | 66 [M-ST9] | 66 | 67 | 1 | B (67) | A/E | -- [W] | -- | -- [W] | -- | 66 | 1 | 66 | 1 | 64 | 3 | No Barrier |
| R54 | SFR | 67 [E] | 67 | 67 | 0 | B (67) | A/E | -- [W] | -- | -- [W] | -- | 66 | 1 | 65 | 2 | 65 | 2 | |
| R54A [S] | SFR | 67 [E] | 68 | 68 | 1 | B (67) | A/E | -- [W] | -- | -- [W] | -- | 64 | 4 | 63 | 5 | 62 | 6 | |
| R56 | SFR | 66 [E] | 66 | 67 | 1 | B (67) | A/E | -- [W] | -- | -- [W] | -- | 66 | 1 | 66 | 1 | 65 | 2 | |
| R56A [S] | SFR | 66 [E] | 66 | 67 | 1 | B (67) | A/E | -- [W] | -- | -- [W] | -- | 65 | 2 | 64 | 3 | 63 | 4 | |
| R58B [S] | SFR | 69 [E] | 71 | 70 | 1 | B (67) | A/E | 67 | 3 | 66 | 4 | 65 | 5 | 64 [R,5] | 6 | 62 | 8 | S344 / East side ROW |
| R58A [S] | SFR | 71 [E] | 73 | 72 | 1 | B (67) | A/E | 68 | 4 | 67 | 5 | 66 [T] | 6 | 65 [R,5] | 7 | 63 | 9 | |
| R58 | SFR | 70 [E] | 71 | 71 | 1 | B (67) | A/E | 68 | 3 | 68 | 3 | 67 [T] | 4 | 66 [R] | 5 | 65 | 6 | |
| R60B [S] | SFR | 68 [E] | 68 | 69 | 1 | B (67) | A/E | 66 | 3 | 65 | 4 | 64 [R] | 5 | 63 | 6 | 62 | 7 | |
| R60 [C] | SFR | 76 [E] | 78 | 77 | 1 | B (67) | A/E | 70 [T] | 7 | 68 | 9 | 67 [R,5] | 10 | 65 | 12 | 64 | 13 | |
| R60A [S] | SFR | 70 [E] | 70 | 71 | 1 | B (67) | A/E | 68 | 3 | 67 | 4 | 66 [T,R] | 5 | 64 | 7 | 63 | 8 | |
| R62A [S] | SFR | 68 [E] | 69 | 69 | 1 | B (67) | A/E | 67 | 2 | 66 | 3 | 65 [T] | 4 | 63 | 6 | 62 | 7 | |
| R62 | SFR | 74 [E] | 75 | 75 | 1 | B (67) | A/E | 70 [T] | 5 | 68 [R,5] | 7 | 67 | 8 | 65 | 10 | 64 | 11 | |
| R51 | COM | 64 [E] | 66 | 67 | 3 | C (72) | NONE | 65 | 2 | 64 | 3 | 63 | 4 | 62 | 5 | 62 | 5 | West side ROW and shoulder[7] |
| R53 | COM | 65 [E] | 69 | 69 | 4 | C (72) | NONE | 66 | 3 | 65 | 4 | 64 | 5 | 63 | 6 | 62 | 7 | |
| R55 | SFR | 72 [E] | 75 | 75 | 3 | B (67) | A/E | 69 [T] | 6 | 68 | 7 | 67 [R,5] | 8 | 65 | 10 | 64 | 11 | |
| R55A | SFR | 66 [E] | 69 | 70 | 4 | B (67) | A/E | 67 [T] | 3 | 66 | 4 | 65 [R,5] | 5 | 63 | 7 | 64 | 6 | |
| R57 [C] | SFR | 74 [E] | 77 | 77 | 3 | B (67) | A/E | 70 [T] | 7 | 68 | 9 | 67 | 10 | 66 [R,5] | 11 | 64 | 13 | |
| R57A | SFR | 67 [E] | 70 | 71 | 4 | B (67) | A/E | 68 | 3 | 67 | 4 | 67 [T] | 4 | 66 [R] | 5 | 66 | 5 | |
| R64 | SFR | 65 [E] | 67 | 68 | 3 | B (67) | A/E | -- [W] | -- | -- [W] | -- | -- [W] | -- | 67 | 1 | 66 | 2 | No Barrier |
| R66 | SFR | 64 [M-LT6] | 66 | 67 | 3 | B (67) | A/E | -- [W] | -- | -- [W] | -- | -- [W] | -- | 67 | 0 | 65 | 2 | |
| R68 | SFR | 64 [E] | 66 | 67 | 3 | B (67) | A/E | -- [W] | -- | -- [W] | -- | -- [W] | -- | 67 | 0 | 67 | 0 | |

Notes:
1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile home; HM - hotel/motel; I - Institutional; COM - commercial.
3 - M - Measured noise level; E - Estimated noise level.
4 - A/E = Approach or Exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Measurement site had a property wall.
7 - Refer to the text in this section for a description of conditions at this location.
R - Minimum required height based on Caltrans Noise Analysis Protocol.
S - Second row receptor.
C - Critical design receiver.
T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.
W - There is an existing soundwall in these areas. Therefore, the predicted noise levels are not shown for wall heights that are the same or lower than the existing wall height.

## Table 3.13-4 (Cont'd): Predicted Future Noise and Barrier Analysis

| REC. NO. | LAND USE[2] | EXISTING[1] PEAK HR. NOISE LEVELS $L_{eq(h)}$, dBA[3] | PREDICTED PEAK HOUR NOISE LEVELS[1] | | | | | | | | | | | | | | | BARRIER NO. / LOCATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | No Build WITHOUT BARRIER $L_{eq(h)}$, dBA | Build WITHOUT BARRIER $L_{eq(h)}$, dBA | NOISE INCREASE OR DECREASE | ACTIVITY CATEGORY and NAC ( ) $L_{eq(h)}$, dBA | IMPACT TYPE (A/E[4] or NONE) | NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.) | | | | | | | | | | |
| | | | | | | | | 2.4 m (8 ft) | | 3.0 m (10 ft) | | 3.7 m (12 ft) | | 4.3 m (14 ft) | | 4.9 m (16 ft) | | |
| | | | | | | | | $L_{eq(h)}$ | I.L. | $L_{eq(h)}$ | I.L. | $L_{eq(h)}$ | I.L. | $L_{eq(h)}$ | I.L. | $L_{eq(h)}$ | I.L. | |
| R59 | MH | 66 E | 69 | 70 | 4 | B (67) | A/E | 67 | 3 | 67 | 3 | 66 T | 4 | 66 | 4 | 65 R | 5 | S353 / West side ROW |
| R61 | MH | 68 E | 71 | 72 | 4 | B (67) | A/E | 68 | 4 | 67 T | 5 | 66 | 6 | 65 | 7 | 65 R,5 | 7 | |
| R63 C | MH | 72 E | 75 | 75 | 3 | B (67) | A/E | 69 T | 6 | 67 | 8 | 66 | 9 | 65 | 10 | 64 R,5 | 11 | |
| R65 | MH | 70 E | 73 | 74 | 4 | B (67) | A/E | 68 | 6 | 67 T | 7 | 65 R | 9 | 64 | 10 | 63 | 11 | |
| R67 | MH | 71 E | 74 | 74 | 3 | B (67) | A/E | 69 T | 5 | 67 | 7 | 66 R,5 | 8 | 65 | 9 | 64 | 10 | |
| R67A S | MH | 66 E | 69 | 70 | 4 | B (67) | A/E | 66 | 4 | 65 T | 5 | 63 | 7 | 63 | 7 | 62 | 8 | |
| R69 | MH | 71 M-LT7 | 74 | 74 | 3 | B (67) | A/E | 69 | 5 | 68 T | 6 | 66 R | 8 | 65 | 9 | 64 | 10 | |
| R71 | MH | 69 E | 72 | 72 | 3 | B (67) | A/E | 68 | 4 | 67 T | 5 | 65 R | 7 | 64 | 8 | 63 | 9 | |
| R73 | COM | 71 E | 72 | 72 | 1 | C (72) | A/E | 70 | 2 | 69 | 3 | 67 | 5 | 67 | 5 | 66 | 6 | |
| R70A S | SFR | 68 E | 71 | 72 | 4 | B (67) | A/E | 71 | 1 | 70 | 2 | 69 T | 3 | 67 | 5 | 67 | 5 | S352 / East side ROW & shoulder |
| R70 | SFR | 74 E | 77 | 77 | 3 | B (67) | A/E | 76 | 1 | 75 T | 2 | 72 | 5 | 70 | 7 | 69 R,5 | 8 | |
| R72 | SFR | 74 E | 76 | 77 | 3 | B (67) | A/E | 74 | 3 | 73 T | 4 | 71 | 6 | 69 | 8 | 67 R | 10 | |
| R72A S | SFR | 68 E | 70 | 70 | 2 | B (67) | A/E | 69 | 1 | 69 | 1 | 67 T | 3 | 66 | 4 | 65 | 5 | |
| R74 C | SFR | 74 E | 77 | 77 | 3 | B (67) | A/E | 75 T | 2 | 73 | 4 | 71 | 6 | 69 | 8 | 67 R | 10 | |
| R74A S | SFR | 67 E | 70 | 70 | 3 | B (67) | A/E | 69 | 1 | 67 | 3 | 67 T | 3 | 66 | 4 | 64 | 6 | |
| R76 | SFR | 74 E | 75 | 76 | 2 | B (67) | A/E | 71 T | 5 | 69 R | 7 | 69 | 7 | 66 | 10 | 65 | 11 | |
| R78 | MFR | 66 E | 66 | 67 | 1 | B (67) | A/E | -- W | -- | -- W,T | -- | -- W | -- | 65 | 2 | 64 | 3 | East side ROW & shoulder[7] |
| R80 | MFR | 65 M-ST10 | 65 | 66 | 1 | B (67) | A/E | -- W | -- | -- W,T | -- | -- W | -- | 66 | 0 | 65 | 1 | |
| R82 | MFR | 66 E | 66 | 67 | 1 | B (67) | A/E | -- W | -- | -- W,T | -- | -- W | -- | 65 | 2 | 64 | 3 | |
| R84 C | MFR | 73 E | 73 | 73 | 0 | B (67) | A/E | 71 | 2 | 70 T | 3 | 68 | 5 | 67 | 6 | 66 R,5 | 7 | East side ROW; East side bridge shoulder[7] |
| R84A | MFR | 70 E | 70 | 70 | 0 | B (67) | A/E | 68 | 2 | 67 | 3 | 66 T | 4 | 65 | 5 | 65 R,5 | 5 | |
| R86A | SFR | 67 E | 67 | 68 | 1 | B (67) | A/E | 66 | 2 | 65 | 3 | 64 T | 4 | 63 R | 5 | 62 | 6 | |
| R86B | SFR | 69 E | 69 | 69 | 0 | B (67) | A/E | 67 | 2 | 66 | 3 | 65 T | 4 | 64 R | 5 | 63 | 6 | |

Notes:
1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile home; HM - hotel/motel; I - Institutional; COM - commercial.
3 - M - Measured noise level; E - Estimated noise level.
4 - A/E = Approach or Exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Measurement site had a property wall.
7 - Refer to the text in this section for a description of conditions at this location.
R - Minimum required height based on Caltrans Noise Analysis Protocol.
S - Second row receptor.
C - Critical design receiver.
T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.
W - There is an existing soundwall in these areas. Therefore, the predicted noise levels are not shown for wall heights that are the same or lower than the existing wall height.
** Soundwall heights are chosen to achieve a particular top-of-barrier elevation from the ground at that location.

## Table 3.13-4 (Cont'd): Predicted Future Noise and Barrier Analysis

| REC. NO. | LAND USE[2] | EXISTING[1] PEAK HR. NOISE LEVELS Leq(h), dBA[3] | PREDICTED PEAK HOUR NOISE LEVELS[1] | | | | | | | | | | | | | | | BARRIER NO. / LOCATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | No Build WITHOUT BARRIER Leq(h), dBA | Build WITHOUT BARRIER Leq(h), dBA | NOISE INCREASE OR DECREASE | ACTIVITY CATEGORY and NAC ( ) Leq(h), dBA | IMPACT TYPE (A/E[4] or NONE) | NOISE PREDICTION WITH BARRIER AND BARRIER INSERTION LOSS (I.L.) | | | | | | | | | | |
| | | | | | | | | 2.4 m (8 ft) | | 3.0 m (10 ft) | | 3.7 m (12 ft) | | 4.3 m (14 ft) | | 4.9 m (16 ft) | | |
| | | | | | | | | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | Leq(h) | I.L. | |
| R75 | SFR | 64 E | 65 | 66 | 2 | B (67) | A/E | 64 | 2 | 63 T | 3 | 62 | 4 | 61 | 5 | 61 R,5 | 5 | S359 / West side shoulder of S.B. HWY 101 & Windsor River Rd. On-ramp to S.B. HWY 101 |
| R77 C | SFR | 65 E | 66 | 67 | 2 | B (67) | A/E | 65 | 2 | 64 | 3 | 63 T | 4 | 62 | 5 | 62 R,5 | 5 | |
| R79 | SFR | 67 M-ST11 | 68 | 68 | 1 | B (67) | A/E | 67 | 1 | 66 | 2 | 65 | 3 | 64 | 4 | 63 T,R | 5 | |
| R81 | MOT | 67 E | 68 | 68 | 1 | B (67) | A/E | 68 | -- | 68 | -- | 68 | -- | 67 | -- | 67 | -- | No Barrier |
| R83 | MOT | 65 E | 66 | 66 | 1 | B (67) | A/E | 66 | -- | 66 | -- | 66 | -- | 66 | -- | 66 | -- | |

Notes:
1 - Existing and predicted "without barrier" noise levels include benefits provided by the existing soundwall.
2 - Land Use: SFR - single-family residence; MFR - multi-family residence; MH - mobile home; HM - hotel/motel; I - Institutional; COM - commercial.
3 - M - Measured noise level; E - Estimated noise level.
4 - A/E = Approach or Exceed NAC.
5 - Barrier height recommended to meet requirements at adjacent receptor(s).
6 - Measurement site had a property wall.
7 - Refer to the text in this section for a description of conditions at this location.
R - Minimum required height based on Caltrans Noise Analysis Protocol.
S - Second row receptor.
C - Critical design receiver.
T - Height required to cut the line-of-sight from first row receptors to heavy truck stacks.
** Soundwall heights are chosen to achieve a particular top-of-barrier elevation from the ground at that location.

### Locations Where Soundwalls Would Meet Feasible and Reasonable Criteria

**Soundwall S344** would be located on the right-of-way along the east side of Highway 101, north of Shiloh Road, between stations 342+00 and 346+30. This soundwall would reduce traffic noise at 17 single-family residences, represented by receptors R58, R60, and R62. The proposed wall would be 430 m (1,411 ft) in length and would range in height from 3.0 m (10 ft) to 4.3 m (14 ft). Figure A-14 in Appendix A shows the location of the soundwall and the receptors.

**Soundwall S352** would be located on the right-of-way along the east side of Highway 101, south of Old Redwood Highway, between stations 349+65 and 355+00. This soundwall would reduce traffic noise at 18 single-family residences, represented by receptors R70, R70A R72, R72A, R74, R74A, and R76.

The width-to-height ratio of the parallel soundwalls, S352 and S353, would be 9.5 along a short segment where the highway crosses over a creek (from station 349+65 to 350+10). Therefore, reflective noise may be an issue, but only in the creek area. See Section 3.13.1, Regulatory Setting, for further discussion of the width-to-height ratio as it relates to noise reflection and noise barriers. The proposed soundwall would be 694 m (2,277 ft) in length and would range in height from 3.0 m (10 ft) to 4.9 m (16 ft). Figures A-15 and A-16 in Appendix A show the location of the proposed soundwall and the receptors.

**Soundwall S353** would be located on the right-of-way along the west side of Highway 101, south of Windsor River Road, between stations 349+80 and 357+00. The proposed soundwall would reduce traffic noise at 42 mobile homes, represented by receptors R59, R61, R63, R65, R67, R67A R69 and R71. A commercial waterslide park, represented by receptor R73, is also in the vicinity and would be protected by soundwall S353. However, because it is a commercial property, this park is not listed as a benefited receiver.

As described above under Soundwall 352, reflective noise may be an issue in a small area where the highway crosses a creek. The proposed soundwall would be 724 m (2,376 ft) in length and would range in height from 3.7 m (12 ft) to 4.9 m (16 ft). Figures A-15 and A-16 in Appendix A show the location of the soundwall and the receptors.

**Soundwall S359:** Soundwall S359 would be located along the west shoulder of the Windsor River Road on-ramp to southbound Highway 101, between stations 356+70 and 360+00. This soundwall would reduce traffic noise at 11 single-family residences, represented by receptors R75, R77, and R79.

This soundwall would be 327 m (1,072 ft) in length and would range in height from 4.3 m (14 ft) to 4.9 m (16 ft) high. Figure A-16 in Appendix A shows the location of the proposed soundwall and the receptors.

### Locations Where Soundwalls would Exceed Reasonable Allowance

Soundwalls at the following receptor locations would achieve a 5-dbA reduction in traffic noise and be feasible to construct, but would not be cost-effective as determined by Caltrans' Reasonable Allowance per Residence. (Reasonable and feasible determinations are discussed in Section 3.13.1, Regulatory Setting.) The receptor locations for these areas are discussed below and are shown in Appendix A, Build Alternative Plan Drawings.

**Receptors R6, R6A** represent two mobile homes at the south end of the Journey's End mobile home community, located on the east side of Highway 101, north of Bicentennial Way and the Kaiser Permanente facility. The soundwall required to abate highway traffic noise for these two receptors would be 100 m (328 ft) long and would exceed reasonable allowance standards. See Figure A-2 in Appendix A.

**Receptor R14** is a motel with an exterior pool area located behind a parking lot and retail buildings. It is located on the west side of Highway 101 just south of Hopper Avenue. The soundwall required to abate highway traffic noise for this single receiver would be over 300 m (984 ft) in length and hence not practical. See Figure A-4 in Appendix A.

**Receptors R15A, R17, R17A, R19, R21, and R23** represent seven single-family residences along the west side of Highway 101. The soundwall required to abate highway traffic noise for these seven residences would be 637 m (2,089 ft) long. See Figures A-5 and A-6 in Appendix A.

**Receptors R24** represents an isolated single-family residence located on Lavell Road, approximately 100 m (328 ft) east of the main lanes of Highway 101. This area was not considered for noise abatement because the soundwall required to abate highway traffic noise for the single receiver would be over 200 m (660 ft) long. See Figure A-7 in Appendix A.

**Receptor R25** represents a single-family residence located on the west side of Highway 101 and approximately 75 m (246 ft) from the right-of-way. The area was not considered for noise abatement, because the soundwall required to abate highway traffic noise for the single receiver would be over 200 m (660 ft) long. See Figure A-6 in Appendix A.

**Receptors R26, R26A, and R28** represent three single-family residences along the east side of Highway 101.[2] The soundwall required to abate highway traffic noise for these three residences would be 300 m (984 ft) long. Thus, a soundwall at this location would exceed reasonable allowance standards. See Figure A-8 in Appendix A.

[2] It was not possible to conduct noise measurements at R26 due to dog noise and unsecured conditions. Therefore, a nearby location, Receptor R26A, was selected to represent outdoor use areas of receptor R26, which is considered to have a similar existing traffic noise level as R26A. Receptor R26A is shown on the Build Alternative Plan Drawings in Appendix A, along with Receptors R26 and R28.

**Receptor R30** represents a single-family residence located on Fulton Road, east of Highway 101. The area was not considered for noise abatement, because the soundwall required to abate highway traffic noise for this single receiver would be over 280 m (920 ft) long. Figures A-9A and A-9B show the location of this receptor.

**Receptor R35 (Fulton Road and Airport Boulevard Interchange Complex, Southbound Option A)** represents an apartment complex on the west side of Highway 101, south of and adjacent to Airport Boulevard. A soundwall at this location would exceed the reasonable allowance standards. Figure A-10A in Appendix A shows the location of the receptors.

**Receptors R34, R36, R38, R38A, and R38B** represent eight single-family residences on the east side of Highway 101, north of East Airport Boulevard. The soundwall required to abate highway traffic noise for these eight residences would be about 500 m (1,640 ft) long. Thus, a soundwall at this location would exceed reasonable allowance standards. See Figures A-10A, A-10B, A-11A and A-11B in Appendix A.

**Receptor R50, R50A** represents one single-family property on the southern end of a development along the east side of Highway 101, north of Shiloh Road where an existing berm wall ends that provides protection from traffic noise for other properties in the development. The soundwall required to abate highway traffic noise for this single receiver would be 145 m (476 ft) long and hence would exceed reasonable allowance standards. See Figure A-13 in Appendix A.

**Receptor R54A** represents four properties in front of an access opening in an existing wall at a single-family residential development, north of Shiloh Road on the east side of Highway 101. The soundwall required to abate highway traffic noise for this one receiver would be over 300 m (985 ft) long. Thus, a soundwall at this location would exceed reasonable allowance standards. See Figure A-14 in Appendix A.

**Receptors R51, R53, R55, R57 and R57A** represent five single-family residences on the west side of Highway 101, south of Conde Lane. The soundwall required to abate highway traffic noise for these receptors would be 255 m (837 ft) long and would exceed reasonable allowance standards. See Figure A-14 in Appendix A.

**Receptors R84, R84A, R86A and R86B** represent eight multi-family residences at the northern end of the Courtyard East Apartments and three single-family residences to the north of the complex, on the east side of Highway 101 south of Old Redwood Highway. Two soundwalls would be required to abate highway traffic noise for these receptors. The first would be 249 m (817 ft) in length on the right-of-way along the east side of Highway 101, and the second would be 159 m (522 ft) long along the east shoulder of northbound Highway 101 on the embankment approach to the Old Redwood Highway Undercrossing. These two walls would exceed reasonable allowance standards. See Figure A-16 in Appendix A.

### Areas Where Noise Abatement Is Not Warranted or Feasible

Some areas along the proposed project corridor would not receive noise impacts of sufficient magnitude to warrant abatement, and other areas would receive impacts requiring consideration of abatement for which abatement does not appear feasible. (State guidelines for reasonable and feasible determinations are discussed in Section 3.13.1, Regulatory Setting.). Such areas have been discussed below and where applicable, an explanation as to why abatement is not warranted or feasible has been provided. Receptor locations are shown in Appendix A, Build Alternative Plan Drawings.

**Receptor R3** represents the Empire College facilities on the west side of Highway 101. In this area, Cleveland Avenue runs parallel to Highway 101 and is located between the highway and the receptor. No apparent outdoor use areas are associated with this institutional land use; therefore, the college was not considered for noise abatement. Figure A-2 in Appendix A shows the location of this receptor.

**Receptor R4** represents a group of single-family residences clustered just south of Bicentennial Way on the east side of Highway 101. The buildings are approximately 85 m (280 ft) from the right-of-way, with a vacant field between the receptor and the highway. A long-term measurement (LT1) was taken at R4. Due to its distance from Highway 101, future traffic noise at this area would not approach or exceed the NAC and would not require noise abatement. Figure A-2 in Appendix A shows the location of this receptor.

**Receptors R5 and R5A** represent a motel located in the southwestern quadrant of the intersection of Highway 101 and the Bicentennial Way overpass. The motel has an exterior pool area behind the building with a limited view to Highway 101. Noise abatement was not considered because the future traffic noise level at the pool area, represented by R5, does not approach or exceed the NAC. This is due to its distance from Highway 101 and because the line of sight to the freeway is partially blocked by the motel building. Figure A-2 in Appendix A shows the location of these receptors.

**Receptors R7 and R8** are within the Journey's End mobile home park where there is an existing 4.3-meter (14-foot) high block wall along the east Highway 101 right-of-way. The future traffic noise would approach or exceed the NAC at these locations. Increasing the existing wall height to 4.7 m (16 ft) would not provide a minimum reduction of 5 dBA of the traffic noise. Extending the north end of the existing block wall would not achieve the minimum noise reduction, as at the south end (at S252), since the Mendocino Avenue embankment partially blocks the line of sight to Highway 101. Therefore, no soundwall is recommended for the north end. Figure A-3 in Appendix A shows the location of these receptors.

**Receptors R9, R9A and R10** represent the Coddingtown Mobile Estates mobile home park located behind a retail center on the west side of Highway 101, north of Bicentennial Way. These receptors are approximately 135 m (445 ft) from the right-of-way of Highway 101 and are partially shielded by intervening commercial buildings. A short-term measurement (ST2) was taken at R9A. The results of this measurement shows that the shielding provided by the buildings is substantial, and hence a soundwall at this location would not be warranted. Figure A-3 in Appendix A shows the location of these receptors.

**Receptor R12** represents the Sandman Motel on the west side of Highway 101 near the corner of Cleveland Avenue and Industrial Drive. The motel has an exterior pool area behind the existing restaurant building towards the back of the motel property. There is no view to Highway 101 from the pool area, which is the only outdoor use area. A soundwall at this location would not be warranted due to the distance of the receptor from the highway and its blocked line-of-sight to the highway. Figure A-3 in Appendix A shows the location of the receptor.

**Receptor R11** represents the Fountain Grove Inn and Conference Center on the east side of Highway 101, north of Fountain Grove Parkway. A short-term measurement (ST3) was taken at R11. This receptor has a single small exterior use area with a table and chairs adjacent to the hotel parking lot. Due to the elevated topography and distance from Highway 101, a soundwall would not abate future traffic noise levels. Figure A-3 in Appendix A shows the location of the receptor.

**Receptors R13, R13A, and R13B** represent the exterior patio and spa areas for the Hilton Resort Hotel. These areas are elevated approximately 130 m (425 ft) above the highway. The future traffic noise level does not approach or exceed the NAC at these exterior use areas due to their distance and elevation from Highway 101. Figure A-3 in Appendix A shows the location of these receptors.

**Receptors R16 and R18** represent two single-family residences on Alba Lane, on the east side of Highway 101 at a distance of over 85 m (279 ft) from the right-of-way. A short-term measurement (ST4) was taken at R18. The future traffic noise would not approach or exceed the NAC at these locations. Figure A-5 in Appendix A shows the location of the receptors.

**Receptor R20** represents a fine arts performance center (commercial land use) located on the east side of Highway 101, south of Mark West Springs Road, and is approximately 50 m (164 ft) from the right-of-way. Although the future traffic noise approaches the NAC, there are no exterior use areas associated with this property; therefore, the location was not considered for noise abatement. Figure A-6 in Appendix A shows the location of the receptor.

**Receptor R22** represents a cluster of single and multi-family residences located on the east side of Highway 101, near Mark West Springs Road, approximately 185 m (607 ft) from the main lanes of the highway. A short-term measurement (ST5) was taken at R22. Future traffic noise would not approach or exceed the NAC at these land uses. Figure A-7 in Appendix A shows the location of the receptor.

**Receptor R27** represents one single-family residence approximately 155 m (509 ft) from the right-of-way of Highway 101, south of River Road. The future traffic noise would not approach or exceed the NAC for this receptor. Figure A-7 in Appendix A shows the location of the receptor.

**Receptor R29** represents Vinters Inn, located approximately 180 m (591 ft) from Highway 101 and south of River Road. A short-term noise measurement (ST6) was taken at R29. The future traffic noise would not approach or exceed the NAC for this receptor. Figure A-7 in Appendix A shows the location of the receptor.

**Receptor R32** represents a single-family residence located on Fulton Road, east of Highway 101. The future traffic noise would not approach or exceed the NAC at receptor R32. Figures A-9A and A-9B in Appendix A show the location of the receptor.

**Receptors R35, R35A, and R35B (Fulton Road and Airport Boulevard Interchange Complex, Southbound Option B)** represent an apartment complex on the west side of Highway 101, south of and adjacent to Airport Boulevard. Future traffic noise would not approach or exceed the NAC at these receptors due to the noise attenuation provided by Option B, which would feature a braided ramp on substantial fill that would block the line-of-sight to a major portion of the Highway 101 mainline. Hence, noise abatement was not considered at this location. Figure A-10B in Appendix A shows the location of the receptors.

**Receptor R37** represents the Stonegate Mobile Home Park located on Whispering Creek Drive. A short-term noise measurement (ST8) was taken at R37. The future traffic noise would not approach or exceed the NAC at this receptor. Figure A-10B in Appendix A shows the location of the receptor.

**Receptors R52, R54, R54A, R56, and R56A** represent a single-family residential development, north of Shiloh Road, on the east side of Highway 101. An existing 3 m (10 ft) high berm/wall combination along this development was considered in the noise impact analysis. This development would be affected by future traffic noise levels that approach or exceed the NAC. The minimum noise reduction requirement of 5 dBA would not be met at receptors that are already protected by the existing wall, even if the height of the wall were increased from 3 m (10 ft) up to 4.9 m (16 ft). Figure A-14 in Appendix A shows the location of the receptors.

**Receptors R64, R66, and R68** represent a development of single-family residences on Dove Lane, with rear yards that are adjacent to the Highway 101 right-of-way on the east side, north of Hembree Lane. An existing 3.7 m (12 ft) high concrete wall along the right-of-way of this development was considered in the noise analysis. Although this development would be affected by future traffic noise levels, the minimum noise reduction requirement of 5 dBA would not be met by increasing the height of the existing wall from 3.7 m (12 ft) to 4.9 m (16 ft). Figures A-14 and A-15 in Appendix A show the location of the receptors.

**Receptors R78, R80, and R82** represent the Courtyard East Apartments, which are south of Old Redwood Highway on the east side of Highway 101. An existing 3.7 m (12 ft) high berm/wall combination along this development was considered in the noise impact analysis. A short-term noise measurement (ST10) was taken at R80. Although this development would be affected by future traffic noise levels, the required minimum noise reduction of 5 dBA would not be achieved, even by increasing the height of the existing wall from 3.7 m (12 ft) to 4.9 m (16 ft). Figure A-16 in Appendix A shows the location of the receptors.

**Receptors R81 and R83** represent a new motel development that was under construction, south of Windsor River Road on the west side of Highway 101, at the time of the noise analysis. Although this development would be affected by future traffic noise levels, the location of exterior uses is not known and could not be properly modeled for future traffic noise impact. Figure A-16 in Appendix A shows the location of the receptors.

## 3.14 Energy

As the impact of the project in context of the countywide travel model is too small to demonstrate substantial energy impacts, in accordance with Caltrans' Standard Environmental Reference Guidelines,[3] a qualitative energy analysis was conducted. The information presented in this section is taken from the technical memorandum, *Technical Memorandum on Energy Impacts for the Highway 101 HOV Lane Widening and Improvements Project: Steele Lane, Santa Rosa to Windsor River Road, Windsor* (Parsons 2005).

The energy impacts of transportation projects are typically divided into two components: (1) the direct energy required for ongoing operations, in this case, the use of petroleum-based fuels and alternative fuels for motor vehicle travel within the project area, and (2) the indirect energy required to produce the materials for and to carry out construction of the project. In the long term, the direct, or operating, energy requirements are usually greater and of primary importance. This discussion, therefore, focuses on the direct energy requirements for ongoing Highway 101 operations with and without the proposed project.

By 2030, without capacity improvements to Highway 101, congested traffic conditions would prevail through the project limits; the freeway would be unable to serve the projected demand. Due to insufficient mainline capacity for the forecast volumes, bottlenecks and queues would develop at certain locations along the mainline. Low travel speeds and long delays would be prevalent during peak hours. Such congested traffic conditions contribute to inefficient energy consumption as vehicles use extra fuel while idling in stop-and-go traffic or moving at slow speeds on a congested roadway.

The Build Alternative would improve average travel speeds and thereby reduce average travel times during both morning and evening peak hours. Improved travel speeds would translate to a two to 70 percent reduction in travel time. The Build Alternative would reduce overall delays by up to 16 minutes, depending on the peak hour (morning and evening) and direction of travel.

By removing bottlenecks in the study area, reducing delays and improving travel times, the Build Alternative also would reduce traffic diversion to local streets ("cut-through" traffic) by commuters who under no-build conditions, would divert to local streets to avoid bottlenecks and traffic queues on the mainline.

The Build Alternative would reduce the countywide vehicle miles traveled (VMT) and countywide vehicle hours traveled (VHT) when compared to the No-Build Alternative.[4] Under the Build Alternative, annual countywide VMT would decrease by 4.4 million kilometers (2.8 million miles) and annual countywide VHT would decrease by one million hours when compared to the No-Build Alternative. These reductions reflect the improved travel times and reduced delays under the Build

[3] Source: http://www.dot.ca.gov/ser/vol1/sec3/physical/ch13energy/chap13.htm
[4] The countywide VMT represents the total distance traveled by all vehicles in Sonoma County and countywide VHT represents the total hours traveled by all vehicles in Sonoma County.

Alternative. Because vehicle energy consumption is directly proportional to VMT, lower VMT under the Build Alternative translates to energy savings.

The HOV lanes provided under the Build Alternative would offer dedicated peak hour capacity and a high level of traffic service to transit and carpool vehicles. This would substantially improve travel time for intercity buses and carpooling commuters as they would operate at speeds of approximately 97 kph (60 mph) in the new HOV lanes. This compares to speeds as low as 11 kph (7 mph) in congested mixed flow lanes under the No-Build Alternative. Not only would transit travel time be reduced but transit schedule reliability would be improved. Carpools and vanpools also would have improved speeds and reduced travel times. The improved speeds and schedule reliability could be incentives for commuters and other travelers to carpool and/or take advantage of local and express buses that would move freely along the HOV lanes. A shift by more commuters into HOVs would lead to further energy savings.

Such improvements in traffic operations under the Build Alternative would reduce direct (operating) energy use, whether in the form of petroleum fuels or alternative sources of energy, compared to higher fuel consumption under the No-Build Alternative. The proposed project is therefore anticipated to have a beneficial effect on direct energy use compared to the No-Build Alternative. No energy mitigation measures would be needed.