Executive Summary

The proposed Parkway 1e11 (Parkway) will provide the Coachella Valley with an outstanding opportunity to significantly improve air quality and reduce greenhouse gas emissions (GHG). The multi-use facility will not only be used to make an estimated 48 million pedestrian and bicycle trips and 30 million Neighborhood Electric Vehicle trips(NEVs) from the opening of the first phase through the study period ending in 2035, but will also serve as an economic and recreational amenity for residents and visitors alike moving into the future. In fact, as an infrastructure project with an anticipated 75 year life span, the Parkway will continue to accrue emission reduction benefits long after other technological solutions have become obsolete.

The Parkway will serve as a regional and national example of innovative and effective solutions to enhancing mobility, improving air quality and reducing GHG. The Parkway will save an estimated 117.5 million pounds of carbon dioxide and 1.2 million pounds of criteria air pollutants, including oxides of nitrogen, carbon monoxide, and particulate matter by 2035, through the elimination of 43.5 million vehicle trips and 144.5 million vehicle miles traveled. In the planning horizon year 2035 alone, the Parkway is estimated to reduce 12.1 million vehicle miles traveled due to the petroleum displacement caused by the substitution of walking, bicycling, and NEVs for personal vehicle trips.

As part of the Regional Transportation Plan, and a viable alternative to SR-111, the Parkway is a meaningful part of the broad plan to emphasize zero-emission transportation technologies, transit, and active transportation. With a long history of leadership in improving air quality, CVAG is excited about Parkway 1e11 and its associated air quality benefits. In a region where most vehicle trips are short, offering alternatives to gasoline powered cars/trucks through the construction of Parkway 1e11 is a key strategy to achieve state and local air quality objectives. This report provides detailed estimates of the air quality benefits that will result from future use of proposed Parkway 1e11.

Transportation Benefits

Parkway 1e11 is envisioned as a backbone for walking, bicycling, and NEV travel in the Coachella Valley. Consistent with Objective B from the Coachella Valley Non-Motorized Plan, 2010 Update, the Trail will be a long distance cycling corridor that provides an alternative to SR-111 for Valley-wide connectivity, accommodating a range of users for commuting and other trip purposes. Furthermore, as a Class 1 NEV route, the facility will recognize and accommodate other key activities such as golf cart and Neighborhood Electric Vehicle (NEV) use.

A 45.7-mile multi-modal urban trail that will span the Coachella Valley from Palm Springs to the City of Coachella, it connects eight incorporated cities.[1] The travel benefits of the trail are in part a function of its deep integration into a community rich with suitable destinations and a fine transit and road

[1] The Parkway is expected to eventually extend to Desert Hot Springs, the Salton Sea, Mecca and North Shore.

network infrastructure. The land use and transportation context of the Parkway position it well for a variety of trip purposes and distances.

While the Parkway will be the largest of its type in the country when completed, it will not be the first. NEV networks and multi-use facilities exist in places such as Lincoln, CA, Peach Tree City, GA, and The Villages, FL. It is, however, the first true regional NEV facility that parallels a major transportation corridor such as SR 111, and connects the hearts of several communities in the region. As such, it will attract a large percentage of the shorter trips people currently make—and change the transportation patterns in the Valley.

The Parkway will provide a safe corridor for pedestrians, bicyclists, and NEV users that is not currently available in our region. This multi-modal Parkway will result in significant increases to walking, bicycle ridership, and NEV/golf cart use. The air quality and GHG benefits of the Parkway will begin to accrue as the phases of the parkway are completed over a ten year period, and continue long after the construction is complete.

Air Quality Impacts

The solicitation for proposals from the AQMD demands that funded projects demonstrate emission reductions. Parkway/pathway construction to reduce congestion and promote walking, bicycling and/or near-zero or zero emission vehicles is one of several types of projects that qualify for application, based on their potential to lead to emission reductions. The project will promote walking, bicycling and NEV use, both through the parkway itself and through the conveniently located charging stations.

In a region where most vehicle trips are short, offering alternatives to gasoline powered cars/trucks is a key strategy to achieve state and local air quality objectives. For example, PM_{10}, fine particulates, is a major air pollutant in the Coachella Valley resulting in part from on-road vehicles grinding local sandy soils to finer particles. One strategy to reduce PM_{10} production is to reduce trips taken by personal automobiles. Increasing non-motorized transportation and use of cleaner NEVs reduces VMT and improves our air.

The proposed Parkway 1e11 will also contribute to GHG reduction by providing alternatives to driving personal automobiles, and consequently reducing emissions from mobile on-road sources. This multi-modal Parkway will result in increased pedestrian traffic, bicycle ridership, and NEV/golf cart use, compared to the status quo.

Policy Support

Emissions from mobile on-road sources are one of the most significant contributors to GHG in the Coachella Valley. The Parkway is one of the strategies proposed to

meet not only the regional Climate Action Plan, but also the goals of local and regional plans, including the Southern California Association of Governments (SCAG) Regional Transportation Plan (RTP) and Sustainable Communities Strategy (SCS) (Draft RTP/SCS available); Coachella Valley State Implementation Plan for Air Quality (CVSIP); Coachella Valley Economic Blueprint; Coachella Valley Natural Community Conservation Plan (NCCP); California Transportation Plan (CTP); and CVAG Non-motorized Transportation Plan Update (NMTP, 2010).

CVAG has worked diligently with SCAG to analyze and help develop its SB 375 Framework and Guidelines for our sub-region, to ensure that our Plan doesn't conflict with other regional plans. SCAG's Draft 2012-2035 RTP/SCS contains a regional commitment for broad deployment of zero/near-zero emission transportation technologies, emphasizing transit and active transportation. As such, CVAG's Parkway project supports SCAG's Active Transportation component of the draft RTP/SCS and will be used by the SCAG Region to attain its goals (see SCAG support letter). SCAG staff is working on including the Parkway in its final RTP. CVAG has a state of the art program for PM_{10} control as part of its CVSIP. Reductions in vehicle miles traveled called for in the CVSIP to benefit air quality will also result in GHG emissions reduction.

Technical Analysis

The technical analysis conducted by Alta Planning + Design, a national firm specializing in non-motorized transportation modeling, conclusively shows how the Parkway meets the AQMD's regional air quality goals along with the goals of State and Federal Clean Air Plans.

This report provides a detailed analysis of these benefits along with documentation of all assumptions.

The impact of the Parkway on the following is assessed on an annual and cumulative basis:

- Reduced vehicle trips due to walking, bicycling, and NEV Use
- Reduced vehicle miles traveled due to walking, bicycling, and NEV Use
- Air Quality improvements through measureable reductions in carbon monoxide, NOx, particulate matter (PM_{10} and $PM_{2.5}$), and other indicators

Alta uses the Seamless Travel Demand Model and projections of NEV trip making to empirically estimate the number of essential car trips that will be replaced by personal pedestrian, bicycle, and NEV trip making in the area on the trail. NEV trip making rates are based on their potential to replace short automobile trips, as described in this report. Average trip length and trip purpose values, derived from the 2009 National Household Travel Survey, and Non-Motorized Transportation Pilot Project are utilized to calculate the resulting reduction in vehicle miles traveled and the associated emissions reductions in the immediate area of the trail. Separate estimations are conducted for walking, bicycling and NEV use of the trail for essential trips.

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Air Quality Benefits Report

Introduction

An empirically derived estimate of the number of essential trips on the proposed Parkway 1e11 is used to calculate the emission reductions attributable to fewer vehicle miles traveled in the immediate area of the trail. Separate estimations are conducted for walking, bicycling, and NEV use.

Proposed Parkway 1e11Background

Parkway 1e11 (also referred to as Whitewater Trail) is envisioned as a backbone for walking, bicycling, and NEV travel in the Coachella Valley. Consistent with Objective B of the Coachella Valley Non-Motorized Plan, 2010 Update, the Parkway will be a long distance cycling corridor that provides an alternative to SR-111 for Valley wide connectivity, accommodating a range of users for commuting and other trip purposes. Furthermore, as a Class 1 NEV route, the facility will recognize and accommodate other key activities such as golf cart and Neighborhood Electric Vehicle (NEV) use.

A 45.7 mile multi-modal urban trail that will span the Coachella Valley from Palm Springs to the City of Coachella, it connects eight incorporated cities.[2] The travel benefits of the trail are in part a function of its deep integration into a community rich with suitable destinations and a fine transit and road network infrastructure. Figure 1 and 2 below show the land use and transportation context of Parkway 1e11, including crossing locations.

The solicitation for proposals from the AQMD demands that funded projects demonstrate emission reductions. Parkway/pathway construction to reduce congestion & promote walking, bicycling and/or near-zero or zero emission vehicles is one of several types of projects that qualify for application, based on their potential to lead to emission reductions. The project will promote walking, bicycling and NEV use, both through the parkway itself and through the conveniently located charging stations. The resulting vehicle miles traveled reduction and petroleum displacement will have notable emission reduction benefits.

[2] The Parkway is expected to eventually extend to Desert Hot Springs, the Salton Sea, Mecca and North Shore.

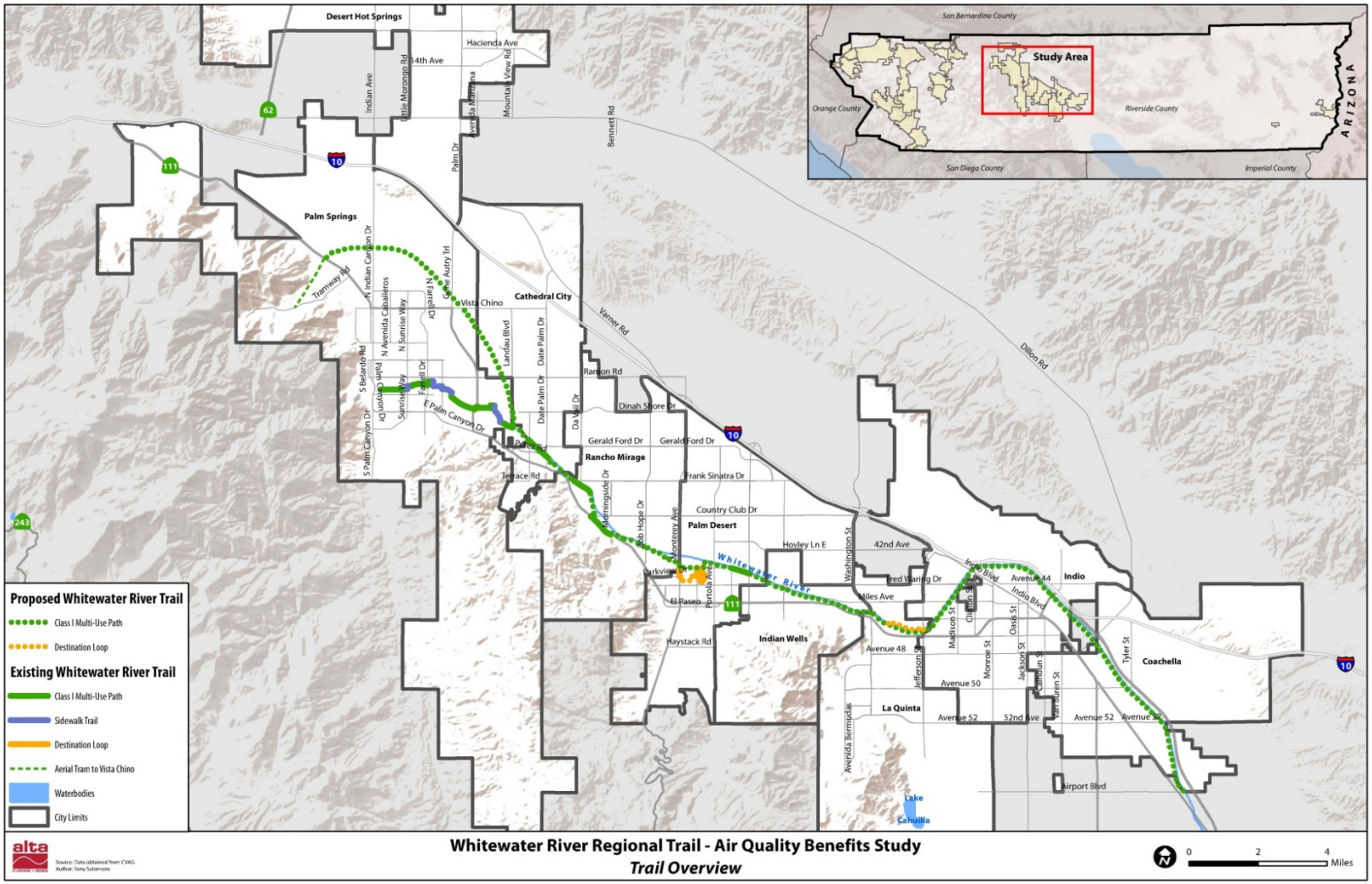


Figure 1. Trail Overview

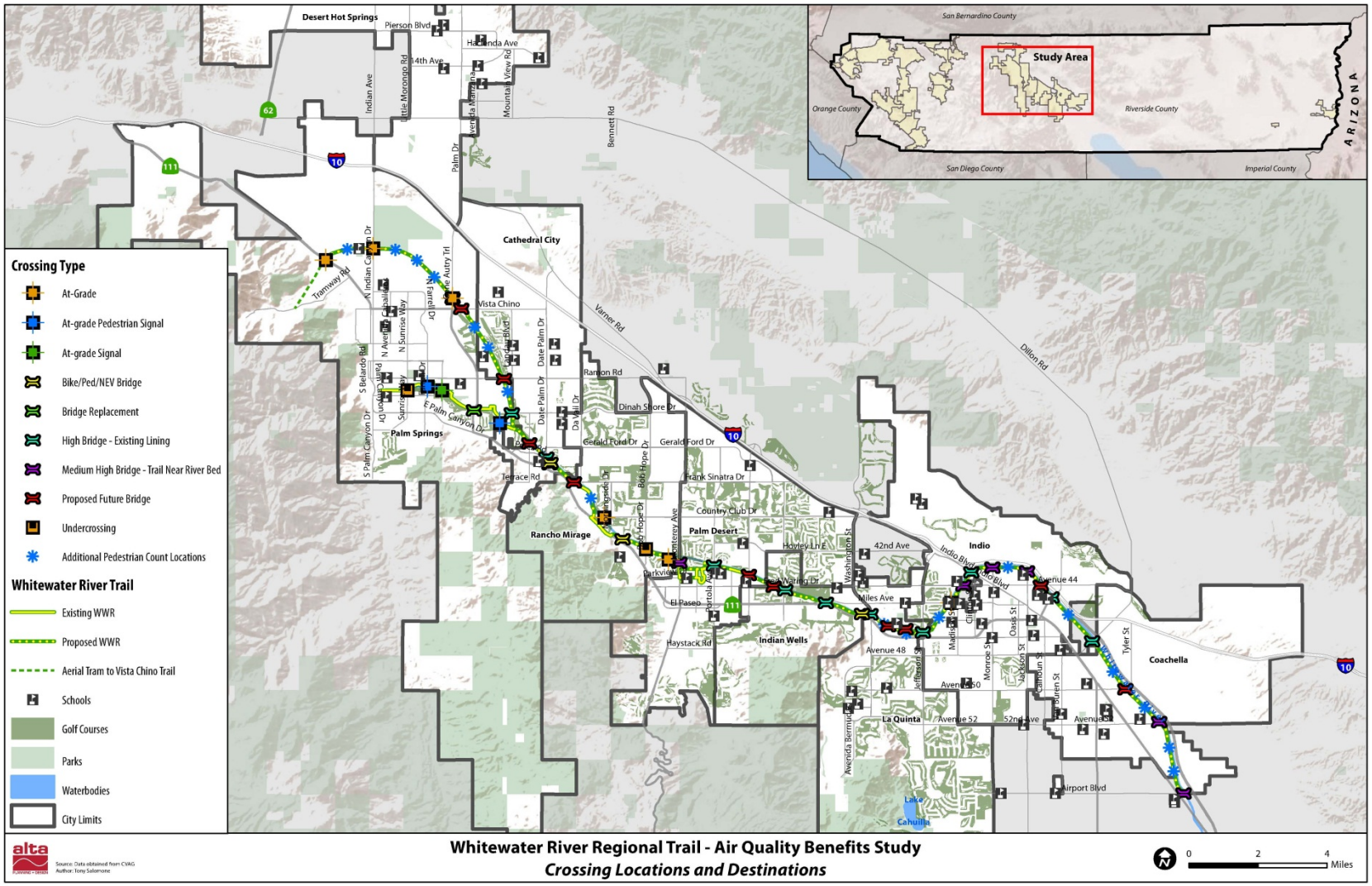
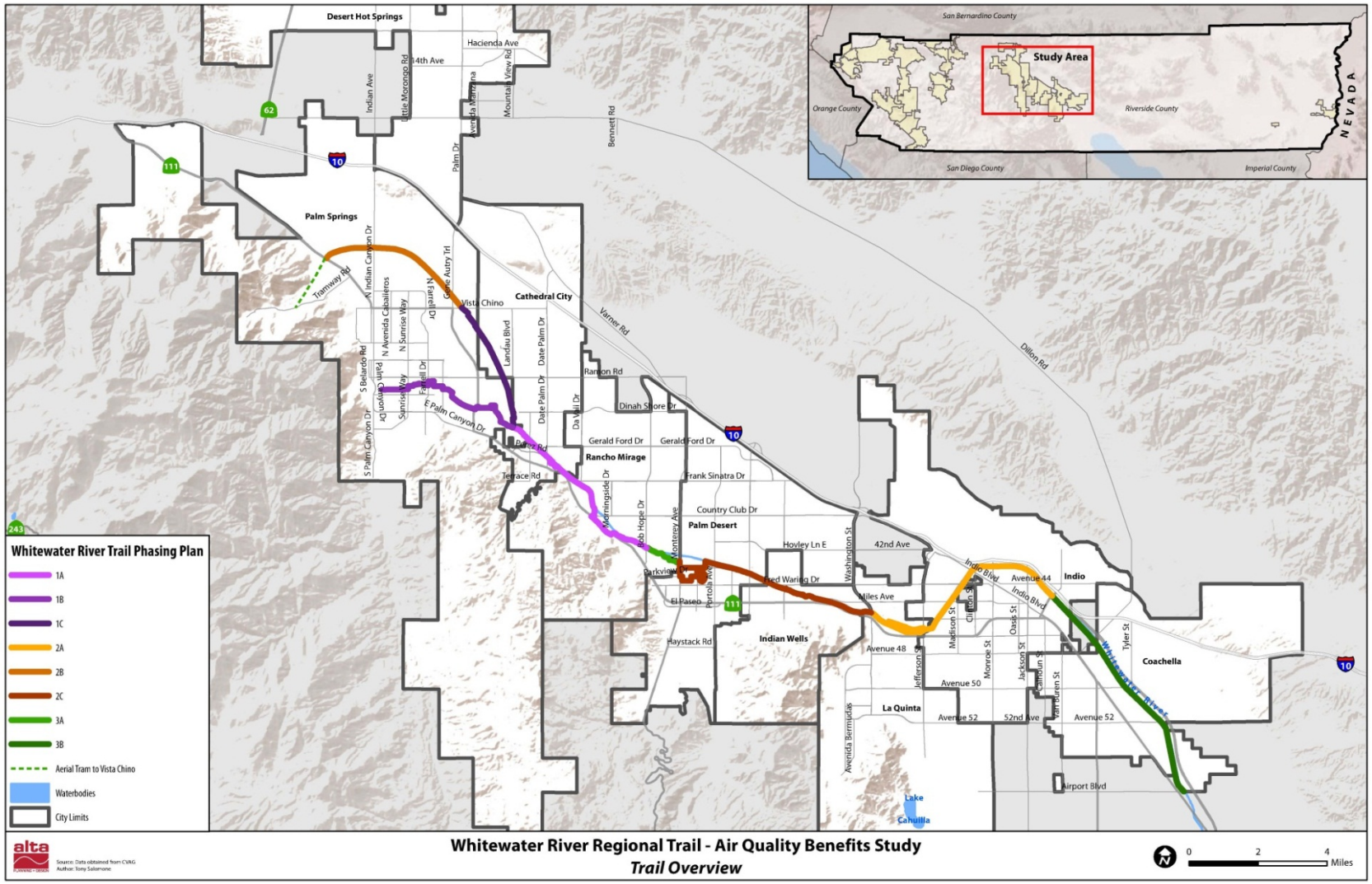


Figure 2. Crossing Locations and Destinations

Air Quality Benefits Report



Parkway 111

Figure 3. Parkway Phases

Statement of Work - Emissions Reductions Resulting from Replacement of Vehicle Trips with Walking, Bicycling and Neighborhood Electric Vehicle (NEV) Trips

The Statement of Work (Appendix A) provides a qualitative and quantitative discussion of the methodologies and assumptions used to estimate the air quality benefits of the proposed Parkway 1e11. Separate methodologies are used to estimate bicycle and pedestrian versus Neighborhood Electric Vehicle (NEV) activity based on differences in available data and modeling tools. The results of the analysis are provided in the Overview section of the Appendix, followed by separate discussions of the bicycle /pedestrian and NEV methodologies. The results of the analyses are also summarized in the following section.

Description of Vehicle Miles Traveled and Air Quality Benefits Resulting from Replacement of Vehicle Trips with Walking, Bicycling and NEV use of Parkway 1e11

The proposed Parkway 1e11 will provide residents and visitors in the Coachella Valley with alternatives to driving their automobiles for essential and commute trips. The Parkway will offer a safe corridor for pedestrians, bicyclists and NEV users that is not currently available in our region. Therefore, this multi-modal Parkway will facilitate a reduction of mobile on road emissions through the replacement of personal vehicle trips with walking, bicycling, and NEV use.

Parkway 1e11 will provide the Coachella Valley with an outstanding opportunity for petroleum displacement that will significantly improve air quality and reduce greenhouse gas emissions (GHG). The facility will not only be used to make an estimated 48 million pedestrians and bicycle trips and 30 million NEV trips from the opening of the first phase of the trail through the study period ending in 2035, but will also serve as an economic and recreational amenity for residents and visitors alike. In fact, as an infrastructure project with an anticipated 75 year life span, the Parkway will continue to accrue emission reduction benefits long after other technological solutions have become obsolete.

The Parkway will serve as a regional and national example of innovative and effective solutions to enhancing mobility, improving air quality and reducing GHG. The Parkway will save an estimated 117.5 million pounds of carbon dioxide and 1.2 million pounds of criteria air pollutants, including oxides of nitrogen, carbon monoxide, and particulate matter through the planning horizon year 2035, due to the elimination of 43.5 million vehicle trips and 144.5 million vehicle miles traveled. In the planning year 2035 alone, the Parkway is estimated to reduce 12.1 million vehicle miles traveled.

Alta uses the Seamless Travel Demand Model and projections of NEV trip making to empirically estimate the number of car trips that will be replaced by personal pedestrian, bicycle, and NEV trip making in the area on the trail. Essential or utilitarian trips that are predicted to be made by walking or bicycling are considered to replace vehicle trips. NEV trip making replacement rates are based on their potential to replace short automobile trips, as described in this report. Based on the 2009 National Household Travel Survey, average one way trip lengths of 2.6 miles for bicycling, 0.7 miles for walking, and 2.5 miles for golf carts are used to estimate the reduction in

vehicle miles traveled. The associated emissions reductions in the immediate area of the trail are based on California Air Resources Board (CARB) and Environmental Protection Agency (EPA) emission reductions factors. Separate estimations are conducted for walking, bicycling and NEV use of the trail for essential trips. Detailed information about the relative contributions of walking, bicycling and NEV use are provided in the following tables.

Vehicle Miles Traveled Saved by Construction Phase

Trips per year per mode are described below in sample years, representative of the second year after a new phase comes on line. New pedestrian, bicycle and NEV activity is associated with activity on the new trail segments. In other words: 2017 reflects activity associated with the projects constructed in Project Years 4&5 (Tahquitz Creek to Bob Hope Drive, Tahquitz Creek Trail Connector Retrofit, Vista Chino to Tahquitz Creek); 2020 reflects activity associated with the projects constructed in Project Years 6 & 7 (Aerial Tram to Vista Clinic and Monterey Ave to Washington Street); and 2021 reflects activity associated with the projects constructed in Project Years 8 & 9 (Bob Hope Drive to Monterey Ave. and Golf Center Parkway to Avenue 56).

Table 1 shows a snapshot of annual savings, while Table 2 shows the cumulative benefits over the planning horizon ending in 2035. A relatively conservative estimate of the trip making and VMT reduction shows that the annual trip making on the trail will be approximately 4.4 million, with an estimated reduction in VMT of 12.1 million miles. The estimated impacts for the 2012-2035 study period is 43.5 million trips resulting in a VMT reduction of 144.5 million miles.

Table 1: Annual Vehicle Miles Reduced by Construction Phase
Due to Increased Pedestrian, Bicycle and NEV Activity for Non-Discretionary Trips

	Construction			
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
Pedestrian Trips				
Annual Pedestrian Trips	327,810	1,202,995	1,655,853	2,541,862
Reduced Motor Vehicle Trips	157,349	601,498	861,044	1,372,605
Reduced Motor Vehicle Miles	220,289	842,097	1,205,461	1,921,647
Bicycle Trips				
Annual Bicycle Trips	252,783	566,041	723,655	874,759
Reduced Motor Vehicle Trips	96,057	237,737	332,881	437,380
Reduced Motor Vehicle Miles	499,498	1,236,235	1,730,983	2,274,374
NEV Trips				
Annual NEV Trips	122,690	550,993	1,181,542	2,772,163
Reduced Motor Vehicle Trips	116,555	523,443	1,122,465	2,633,555
Reduced Motor Vehicle Miles	349,666	1,570,329	3,367,396	7,900,664
Total Reduced Motor Vehicle Miles	**1,069,453**	**3,648,660**	**6,303,840**	**12,096,685**

Table 2: Cumulative Vehicle Miles Reduced
Due to Increased Pedestrian, Bicycle and NEV Activity Through 2035 for Non-Discretionary Trips

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
Pedestrian Trips				
Accumulated Pedestrian Trips	327,810	2,678,910	4,823,046	34,207,050
Reduced Motor Vehicle Trips	157,349	1,327,982	2,424,887	8,452,193
Reduced Motor Vehicle Miles	220,289	1,859,174	3,394,842	25,284,602
Bicycle Trips				
Accumulated Bicycle Trips	252,783	1,432,942	2,400,215	13,589,114
Reduced Motor Vehicle Trips	96,057	584,141	1,012,105	6,403,931
Reduced Motor Vehicle Miles	499,498	3,037,533	5,262,946	33,300,444
NEV Trips				
Accumulated NEV Trips	122,690	1,178,944	2,478,346	30,154,282
Reduced Motor Vehicle Trips	116,555	1,119,997	2,354,428	28,646,568
Reduced Motor Vehicle Miles	349,666	3,359,992	7,063,285	85,939,704
Total Reduced Motor Vehicle Miles	**1,069,453**	**8,256,699**	**15,721,074**	**144,524,750**

Air Quality Benefits by Construction Phase

The Parkway air quality benefits estimate assumes a baseline of January, 2012, for the purposes of using census and other locally available data that are relatively current today. The horizon year of 2035 is chosen due to its selection as a future modeling year for local travel forecasting and air pollution modeling. Benefits will continue past this year. Table 3 shows the emissions factors used to convert the VMT savings to air quality benefits. The emission factors were selected based on their suitability for the region during the planning horizon for this project. The CARB factors for Particulate Matter for light-duty automobiles were used in order to account for the running exhaust, tire and brake wear, entrained road dust, and trip end factor emissions components

Table 3. Emission Factors

Emission Factor	Pounds/mile	Source
Hydrocarbons	0.00300	EPA report 420-F-05-022 "Emission Facts: Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks." 2005.
Particulate Matter PM10	0.00049	California Air Resources Board. Emission Factor Tables. 2010.
Particulate Matter PM2.5	0.00011	California Air Resources Board. Emission Factor Tables. 2009. This number specifically for use by the South Coast Air Quality Management District.
Nitrous Oxides	0.00042	California Air Resources Board. Emission Factor Tables. 2010.
Carbon Monoxide	0.00451	California Air Resources Board. Emission Factor Tables. 2010.
Carbon Dioxide	0.81351	From EPA report 420-F-05-022 "Emission Facts: Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks." 2005.

Table 4 shows a snapshot of the resulting annual savings, while Table 5 shows the accumulation of benefits over the planning horizon ending in 2035. Most importantly for the Coachella Valley, by 2035, the annual reduction of criteria air pollutants, including oxides of nitrogen, carbon monoxide and particulate matter will be 78,000 pounds. The annual carbon dioxide reduction is 7.5 million pounds. Impact for the 2017 – 2035 study period is a 1.2 million pound reduction in criteria air pollutants and 117.5 million pounds of carbon dioxide.

Table 4: Annual Air Quality Benefits Due to Increased Pedestrian, Bicycling, and NEV Activity

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
AIR QUALITY BENEFITS - Pedestrians				
Reduced Hydrocarbons (pounds)	661	1,594	3,071	4,691
Reduced Particulate Matter PM10 (pounds)	108	260	501	765
Reduced Particulate Matter PM2.5 (pounds)	25	60	115	176
Nitrous Oxides (pounds)	92	221	427	651
Carbon Monoxide (pounds)	993	2,394	4,613	7,046
Carbon Dioxide (pounds)	179,207	432,130	832,854	1,271,967
AIR QUALITY BENEFITS - Bicycles				
Reduced Hydrocarbons (pounds)	1,498	2,604	4,451	6,008
Reduced Particulate Matter PM10 (pounds)	244	425	726	980
Reduced Particulate Matter PM2.5 (pounds)	56	98	167	225
Nitrous Oxides (pounds)	208	362	618	834
Carbon Monoxide (pounds)	2,251	3,911	6,686	9,025
Carbon Dioxide (pounds)	406,347	706,018	1,206,931	1,629,199
AIR QUALITY BENEFITS - NEV				
Reduced Hydrocarbons (pounds)	1,049	10,080	7,407	16,902
Reduced Particulate Matter PM10 (pounds)	171	1,644	1,208	2,757
Reduced Particulate Matter PM2.5 (pounds)	39	378	278	633
Nitrous Oxides (pounds)	146	1,400	1,029	2,348
Carbon Monoxide (pounds)	1,576	15,141	11,125	25,388
Carbon Dioxide (pounds)	284,457	2,733,387	2,008,444	4,583,340
AIR QUALITY BENEFITS - TOTAL				
Reduced Hydrocarbons (pounds)	3,208	14,277	14,929	27,601
Reduced Particulate Matter PM10 (pounds)	523	2,329	2,436	4,503
Reduced Particulate Matter PM2.5 (pounds)	120	535	560	1,034
Nitrous Oxides (pounds)	446	1,983	2,073	3,834
Carbon Monoxide (pounds)	4,819	21,445	22,424	41,459
Carbon Dioxide (pounds)	870,011	3,871,535	4,048,229	7,484,506

Table 5: Cumulative Air Quality Benefits
Due to Increased Pedestrian, Bicycle, and NEV Activity through 2035

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
AIR QUALITY BENEFITS - Pedestrians				
Reduced Hydrocarbons (pounds)	661	5,578	10,185	75,854
Reduced Particulate Matter PM10 (pounds)	108	910	1,662	12,375
Reduced Particulate Matter PM2.5 (pounds)	25	209	382	2,843
Nitrous Oxides (pounds)	92	775	1,415	10,535
Carbon Monoxide (pounds)	993	8,378	15,298	113,939
Carbon Dioxide (pounds)	179,207	1,512,457	2,761,738	20,569,277
AIR QUALITY BENEFITS - Bicycles				
Reduced Hydrocarbons (pounds)	1,498	9,113	15,789	99,901
Reduced Particulate Matter PM10 (pounds)	244	1,487	2,576	16,298
Reduced Particulate Matter PM2.5 (pounds)	56	342	592	3,744
Nitrous Oxides (pounds)	208	1,266	2,193	13,875
Carbon Monoxide (pounds)	2,251	13,688	23,716	150,060
Carbon Dioxide (pounds)	406,347	2,471,063	4,281,459	27,090,244
AIR QUALITY BENEFITS - NEVs				
Reduced Hydrocarbons (pounds)	1,049	10,080	21,190	257,819
Reduced Particulate Matter PM10 (pounds)	171	1,644	3,457	42,061
Reduced Particulate Matter PM2.5 (pounds)	39	378	794	9,663
Nitrous Oxides (pounds)	146	1,400	2,943	35,809
Carbon Monoxide (pounds)	1,576	15,141	31,829	387,266
Carbon Dioxide (pounds)	284,457	2,733,387	5,746,053	69,912,809
AIR QUALITY BENEFITS - TOTAL				
Reduced Hydrocarbons (pounds)	3,208	24,770	47,163	433,574
Reduced Particulate Matter PM10 (pounds)	523	4,041	7,694	70,734
Reduced Particulate Matter PM2.5 (pounds)	120	928	1,768	16,250
Nitrous Oxides (pounds)	446	3,440	6,551	60,220
Carbon Monoxide (pounds)	4,819	37,207	70,843	651,264
Carbon Dioxide (pounds)	870,011	6,716,907	12,789,251	117,572,330

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Appendix A: Statement of Work- Emissions Reductions Resulting from Replacement of Vehicle Trips with Walking, Bicycling, and Neighborhood Electric Vehicle (NEV) Trips

This Statement of Work provides a qualitative and quantitative discussion of the methodologies and assumptions used to show the air quality benefits of the proposed Parkway 1e11. Separate methodologies are used to estimate pedestrian and bicycle versus Neighborhood Electric Vehicle (NEV) activity based on differences in available data and modeling tools. The results of the analysis are summarized first in the Overview, followed by separate discussions of the pedestrian /bicycle and NEV methodologies.

Overview

The total Vehicle Miles Traveled (VMT) and Air Quality Benefits of the Parkway 1e11 are documented below in Tables 1 through 5.

Table 1: Annual Vehicle Miles Reduced by Construction Phase
Due to Increased Pedestrian, Bicycle, and NEV Activity

	Construction			
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
Pedestrian Trips				
Annual Pedestrian Trips	327,810	1,202,995	1,655,853	2,541,862
Reduced Motor Vehicle Trips	157,349	601,498	861,044	1,372,605
Reduced Motor Vehicle Miles	220,289	842,097	1,205,461	1,921,647
Bicycle Trips				
Annual Bicycle Trips	252,783	566,041	723,655	874,759
Reduced Motor Vehicle Trips	96,057	237,737	332,881	437,380
Reduced Motor Vehicle Miles	499,498	1,236,235	1,730,983	2,274,374
NEV Trips				
Annual NEV Trips	122,690	550,993	1,181,542	2,772,163
Reduced Motor Vehicle Trips	116,555	523,443	1,122,465	2,633,555
Reduced Motor Vehicle Miles	349,666	1,570,329	3,367,396	7,900,664
Total Reduced Motor Vehicle Miles	**1,069,453**	**3,648,660**	**6,303,840**	**12,096,685**

Table 2: Cumulative Vehicle Miles Reduced
Due to Increased Pedestrian, Bicycle, and NEV Activity Through 2035

	Construction			
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
Pedestrian Trips				
Accumulated Pedestrian Trips	327,810	2,678,910	4,823,046	34,207,050
Reduced Motor Vehicle Trips	157,349	1,327,982	2,424,887	8,452,193
Reduced Motor Vehicle Miles	220,289	1,859,174	3,394,842	25,284,602
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Reduced Motor Vehicle Trips	116,555	1,119,997	2,354,428	28,646,568
Reduced Motor Vehicle Miles	349,666	3,359,992	7,063,285	85,939,704
Total Reduced Motor Vehicle Miles	**1,069,453**	**8,256,699**	**15,721,074**	**144,524,750**

Table 3 shows the emissions factors used to convert the VMT savings to air quality benefits. The emission factors were selected based on their suitability for the region during the planning horizon for this project. The CARB factors for Particulate Matter for light-duty automobiles were used in order to account for the running exhaust, tire and brake wear, entrained road dust, and trip end factor emissions components.

Table 3. Emission Factors

Emission Factor	Pounds/mile	Source
Hydrocarbons	0.00300	EPA report 420-F-05-022 "Emission Facts: Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks." 2005.
Particulate Matter PM10	0.00049	California Air Resources Board. Emission Factor Tables. 2010.
Particulate Matter PM2.5	0.00011	California Air Resources Board. Emission Factor Tables. 2009. This number specifically for use by the South Coast Air Quality Management District.
Nitrous Oxides	0.00042	California Air Resources Board. Emission Factor Tables. 2010.
Carbon Monoxide	0.00451	California Air Resources Board. Emission Factor Tables. 2010.
Carbon Dioxide	0.81351	From EPA report 420-F-05-022 "Emission Facts: Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks." 2005.

Table 4 shows a snapshot of the resulting annual savings, while Table 5 shows the accumulation of benefits over the planning horizon ending in 2035.

Table 4: Annual Air Quality Benefits Due to Increased Pedestrian, Bicycle, and NEV Activity

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
AIR QUALITY BENEFITS - Pedestrians				
Reduced Hydrocarbons (pounds)	661	1,594	3,071	4,691
Reduced Particulate Matter PM10 (pounds)	108	260	501	765
Reduced Particulate Matter PM2.5 (pounds)	25	60	115	176
Nitrous Oxides (pounds)	92	221	427	651
Carbon Monoxide (pounds)	993	2,394	4,613	7,046
Carbon Dioxide (pounds)	179,207	432,130	832,854	1,271,967
AIR QUALITY BENEFITS - Bicycles				
Reduced Hydrocarbons (pounds)	1,498	2,604	4,451	6,008
Reduced Particulate Matter PM10 (pounds)	244	425	726	980
Reduced Particulate Matter PM2.5 (pounds)	56	98	167	225
Nitrous Oxides (pounds)	208	362	618	834
Carbon Monoxide (pounds)	2,251	3,911	6,686	9,025
Carbon Dioxide (pounds)	406,347	706,018	1,206,931	1,629,199
AIR QUALITY BENEFITS - NEV				
Reduced Hydrocarbons (pounds)	1,049	10,080	7,407	16,902
Reduced Particulate Matter PM10 (pounds)	171	1,644	1,208	2,757
Reduced Particulate Matter PM2.5 (pounds)	39	378	278	633
Nitrous Oxides (pounds)	146	1,400	1,029	2,348
Carbon Monoxide (pounds)	1,576	15,141	11,125	25,388
Carbon Dioxide (pounds)	284,457	2,733,387	2,008,444	4,583,340
AIR QUALITY BENEFITS - TOTAL				
Reduced Hydrocarbons (pounds)	3,208	14,277	14,929	27,601
Reduced Particulate Matter PM10 (pounds)	523	2,329	2,436	4,503
Reduced Particulate Matter PM2.5 (pounds)	120	535	560	1,034
Nitrous Oxides (pounds)	446	1,983	2,073	3,834
Carbon Monoxide (pounds)	4,819	21,445	22,424	41,459
Carbon Dioxide (pounds)	870,011	3,871,535	4,048,229	7,484,506

Table 5: Cumulative Air Quality Benefits
Due to Increased Pedestrian, Bicycle, and NEV Activity through 2035

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
AIR QUALITY BENEFITS - Pedestrians				
Reduced Hydrocarbons (pounds)	661	5,578	10,185	75,854
Reduced Particulate Matter PM10 (pounds)	108	910	1,662	12,375
Reduced Particulate Matter PM2.5 (pounds)	25	209	382	2,843
Nitrous Oxides (pounds)	92	775	1,415	10,535
Carbon Monoxide (pounds)	993	8,378	15,298	113,939
Carbon Dioxide (pounds)	179,207	1,512,457	2,761,738	20,569,277
AIR QUALITY BENEFITS - Bicycles				
Reduced Hydrocarbons (pounds)	1,498	9,113	15,789	99,901
Reduced Particulate Matter PM10 (pounds)	244	1,487	2,576	16,298
Reduced Particulate Matter PM2.5 (pounds)	56	342	592	3,744
Nitrous Oxides (pounds)	208	1,266	2,193	13,875
Carbon Monoxide (pounds)	2,251	13,688	23,716	150,060
Carbon Dioxide (pounds)	406,347	2,471,063	4,281,459	27,090,244
AIR QUALITY BENEFITS - NEVs				
Reduced Hydrocarbons (pounds)	1,049	10,080	21,190	257,819
Reduced Particulate Matter PM10 (pounds)	171	1,644	3,457	42,061
Reduced Particulate Matter PM2.5 (pounds)	39	378	794	9,663
Nitrous Oxides (pounds)	146	1,400	2,943	35,809
Carbon Monoxide (pounds)	1,576	15,141	31,829	387,266
Carbon Dioxide (pounds)	284,457	2,733,387	5,746,053	69,912,809
AIR QUALITY BENEFITS - TOTAL				
Reduced Hydrocarbons (pounds)	3,208	24,770	47,163	433,574
Reduced Particulate Matter PM10 (pounds)	523	4,041	7,694	70,734
Reduced Particulate Matter PM2.5 (pounds)	120	928	1,768	16,250
Nitrous Oxides (pounds)	446	3,440	6,551	60,220
Carbon Monoxide (pounds)	4,819	37,207	70,843	651,264

Carbon Dioxide (pounds)	870,011	6,716,907	12,789,251	117,572,330

Pedestrian and Bicycle Methodology Background

The air quality benefits of proposed Parkway 1e11 were calculated using the Seamless Travel Demand Model (Seamless).

Seamless was designed to:

- Evaluate existing pedestrian and bicycle data sources and collection methods
- Conduct comprehensive counts and surveys of pedestrians and bicyclists in a consistent manner using the National Bicycle & Pedestrian Documentation Project (NBPD) as a template
- Conduct counts and surveys using San Diego County (with extensive historical count information) as a model community
- Analyze how pedestrian and bicycle activity levels relate to facility quality and factors such as land use and demographics
- Identify factors that are highly correlated with increased walking and bicycling,
- Provide methods for quantifying usage and demand that will enhance research on benefits and exposure
- Evaluate how the transit-linkage (pedestrian and bicycle connections to transit) can be improved [3]

The Seamless Project outcomes that are most relevant to the Parkway 1e11 (Parkway) Air Quality Benefits Estimation Project are the identification of factors correlated with walking and bicycling plus the development of a method for quantifying usage and demand.

The Seamless Bicycle and Pedestrian Demand Model was used to develop estimates of weekday peak hour (7am – 9am) cycling and walking activity at locations along the Parkway. These values were extrapolated to estimate the number of annual bicycle and pedestrian trips along the Parkway. Seamless is a regression model that integrates a variety of spatial data with geographic information systems (GIS) processing tools. Seamless uses data that reflects where people, live, work and utilize multi-use path networks as bicyclists and pedestrians.

[3] Jones, Ryan, Donlon, Ledbetter, Ragland, and Arnold (2010), Seamless Travel: Measuring Bicycle and Pedestrian Activity in San Diego County and its Relationships to Land Use, Transportation, Safety, and Facility Type. (UC Berkeley Traffic Safety Center, Institute of Transportation Studies, Caltrans Task Order 6117).

Seamless Model Development

The Seamless Travel Model was developed by Alta Planning + Design for Caltrans in response to similar needs around the state of California for quantitative demand estimates of potential non-motorized activity. The Seamless Model is a predictive formula used to estimate pedestrian and bicycle activity based on over two years of count and survey data from multipurpose pathways in various San Diego County geographic settings.

The Seamless Model was created and tested using pedestrian and bicycle count data and available GIS data. Separate pedestrian demand and bicycle demand models were created, reflecting the unique characteristics of trip-making of each mode.

Over thirty independent variables likely to affect walking and bicycling were screened for correlation with the dependent variables of pedestrian and bicycle counts, respectively. Independent variables that reliably predicted pedestrian and bicycle activity (at a <0.10 confidence level) include population density, employment density, and presence of a multipurpose path.

The analysis used in the development of the Seamless models included:

- Correlation and skewness testing of independent variables to reduce multicollinearity
- Comparison of built environment and socio-economic factors at low and high pedestrian activity locations
- Development of pedestrian attractor and generator models
- Ordinary Least Squares regression analysis using both stepwise and enter methodologies
- Residual analysis, including development of refinement variables

The Seamless Model is the only non-motorized predictive model based on multiple years of pedestrian and bicycle count data, surveys, and analysis of factors that influence biking and walking. Historic bicycle and pedestrian counts, land use, demographic and other GIS data were included in the tests. Its robust data sources and vigorous statistical analysis make Seamless the most relevant and useful predictive model to date and thus it is increasingly being adapted and applied to forecasting in a wide range of communities.

Morning existing and future peak pedestrian activity is calculated using the following model.

$$EXP\ (P_{AM}) = 1.555 + (0.723 * \ln(ED)) + (0.526 * \ln(PD)) - (1.090 * \ln(R))$$

Where:

P_{AM} = Morning peak pedestrian activity
ED = Employment density within a half mile
PD = Population density within a quarter mile
R = Presence of commercial land uses within a half mile

Morning existing and future peak bicycle activity is calculated using the following model.

$$EXP\ (B_{AM}) = -4.279 + (0.718 * \ln(C)) + (0.438 * \ln(ED))$$

Where:

B_{AM} = Morning peak bicycle activity
C = Length of Class I Bicycle Path within a quarter mile
ED = Employment density within quarter mile

The key data sources used for the Seamless Model in Coachella Valley include:

- Population and employment density derived from the 2010 US Census, Riverside County
- The location of existing and future Class I multipurpose pathways that accommodate both pedestrians and bicyclists
- Land use data from the Southern California Association of Governments (SCAG)

Methodology for Estimating Pedestrian and Bicycle Parkway 1e11 Activity

The model formulas were applied to local Coachella Valley population and employment density data to predict trail use near crossing locations on Parkway 1e11. Seamless creates separate estimates of pedestrian and bicycle activity that are then combined to show total predicted activity.

The following metrics are required to run the Seamless model:

- Total population by place of residence (current and/or projected)
- Total employment by place of employment (current and/or projected)
- Land use designations (current and/or projected)
- Existing and proposed multiuse (Class 1) trails
- Count locations

Figures 1 and 2 illustrate relevant population and employment densities proximal to the Parkway.

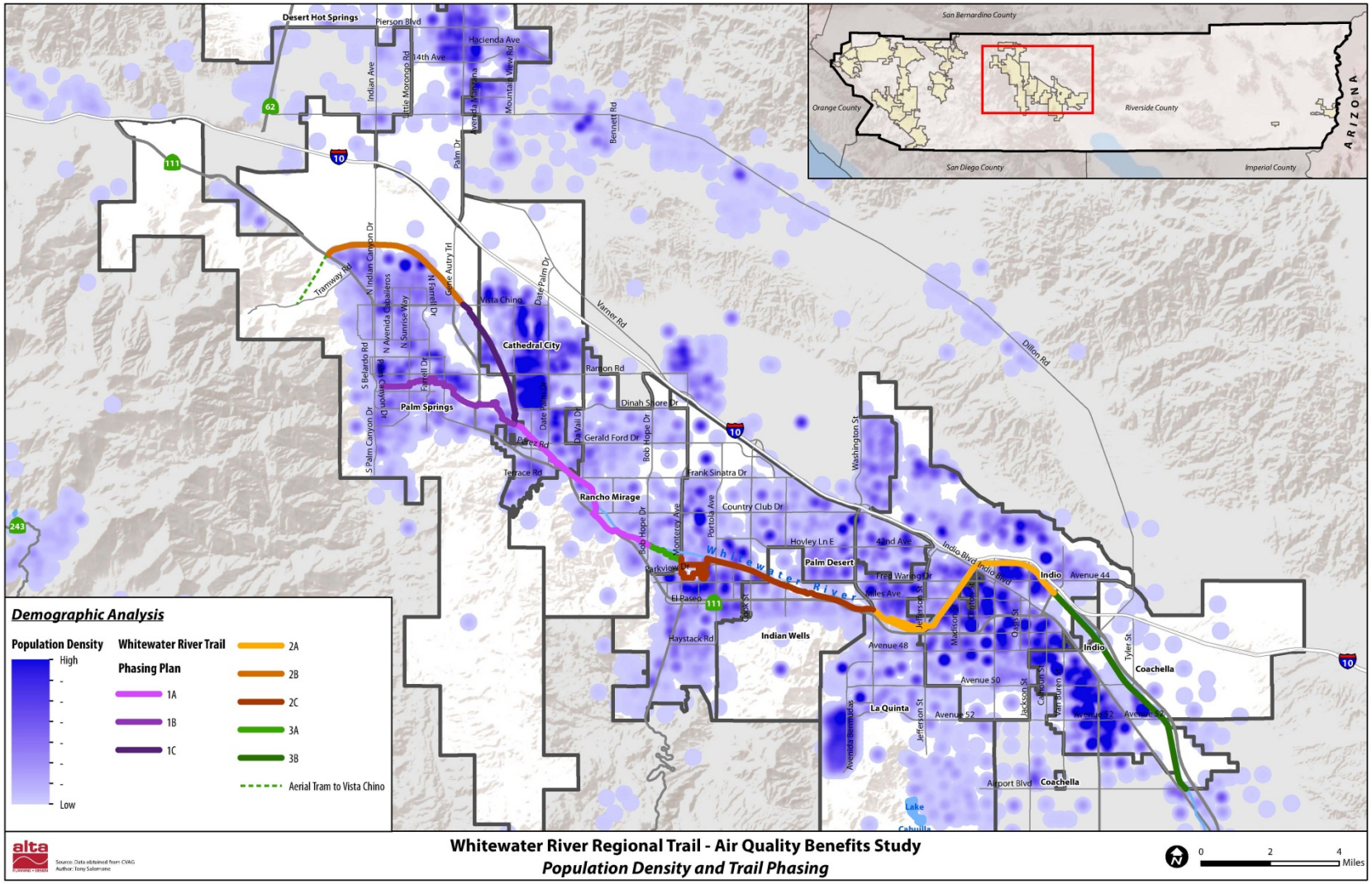

Figure 1: Population Density within Study Area

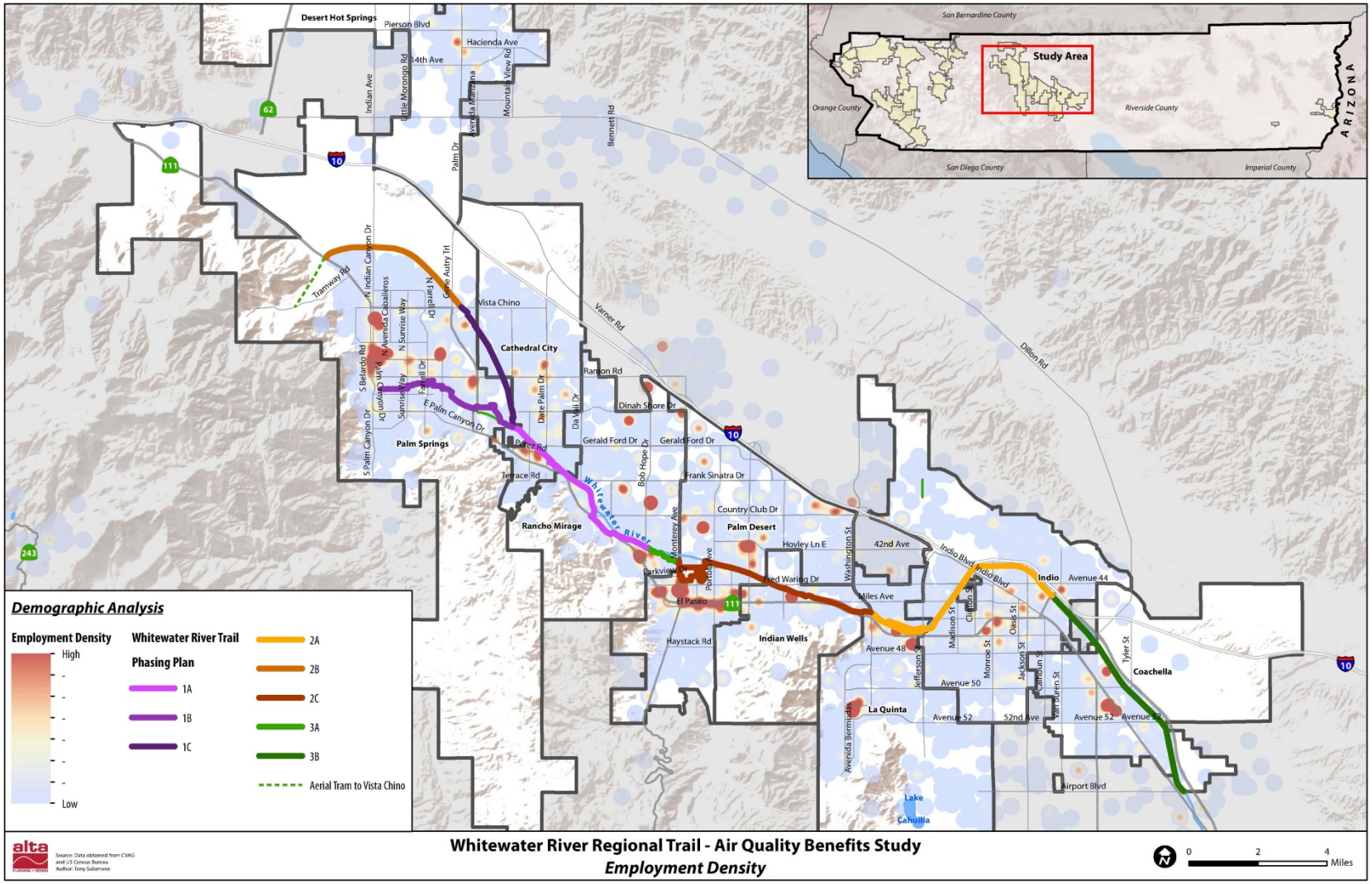

Figure 2: Employment Density within Study Area

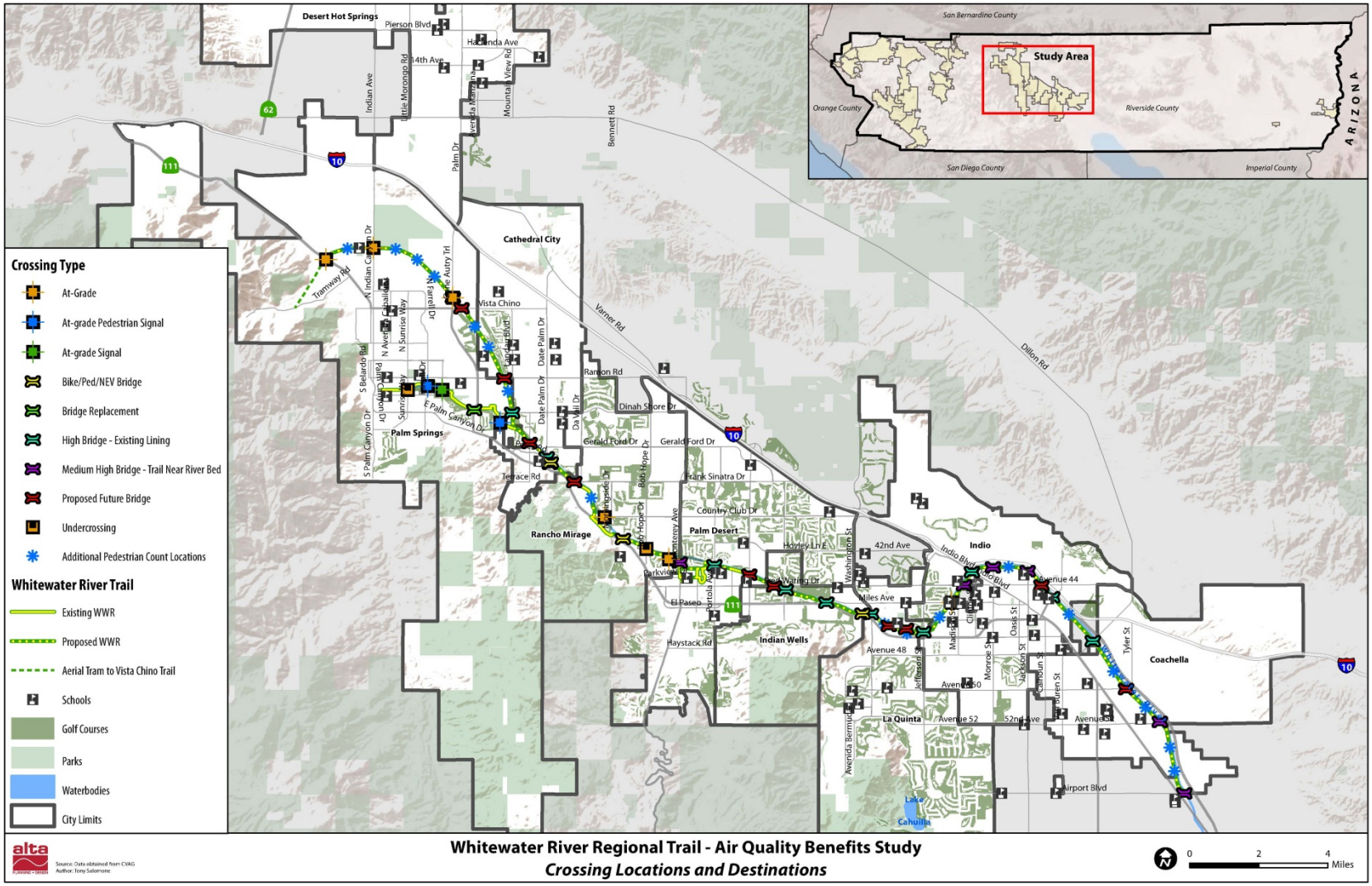

Figure 3: Parkway Crossing Locations and Destinations

Seamless Travel Demand – Pedestrian Activity on Parkway 1e11

This portion of the model considers population density, employment density and includes a binary value for the presence of commercial/manufacturing land uses. Population and employment density is calculated per quarter and half mile radii (respectively) around count locations by dividing total population and employment by the acreage of their respective buffers. Half mile buffers are assigned a value of "1" if there are commercial/manufacturing land uses present.

The buffers are used to create a geometric intersection of demographic values. As the buffers do not intersect census blocks along exact block boundaries, it was necessary to apportion demographic values to the buffers. For instance, if 25% of a census block falls within a buffer, then 25% of the values are assigned to that buffer. The resulting summary statistics are then used to estimate pedestrian activity.

The baseline pedestrian demand analysis was conducted using 2010 employment, population and land use data. This analysis provided a look at current estimated usage. The future analyses included 2010 land use data (because 2035 land use data are unavailable), as well as 2035 employment and population data.

Seamless Travel Demand – Bicycle Activity on Parkway 1e11

As Seamless predicts demand at points along a trail, the crossing locations identified by CVAG (see Figure 3) were used as the geographic basis for demand for both bicycle and pedestrian models and augmented with additional points when necessary. Bicycle activity is estimated by calculating employment density and the total length of multi-use trails within a quarter mile radius of count locations. Quarter mile buffers are drawn around each count location and are used to create a geometric intersection of census blocks containing total employment values. As the buffers do not intersect census blocks along exact block boundaries, it was necessary to apportion total employment to the intersecting buffers. For instance, if 25% of a census block fell within a buffer, then 25% of the total employment values were assigned to that buffer. Employment density is determined by dividing total employees per census block within the buffer by the acreage of the buffer. Length of multi-use trails was assessed in a similar way. By intersecting the trails with the buffers, the total length of all multi-use trails within a quarter mile radius can be summed and assigned to each crossing location. The bike model and pedestrian models are then applied separately.

A baseline bicycle demand analysis was conducted using 2010 employment data, existing Parkway and Tahquitz Trail segments and other existing multi-use trails adjacent to the Parkway. This analysis provided a look at current estimated usage.[4] An additional analysis included the same 2010 employment data and existing trail network and integrated the proposed Parkway segments. This

[4] As most current population and employment data are available for 2010, the 2012 trail estimates are based on this model year, and adjusted for growth.

analysis provided a look at how many more users could be expected if the proposed segments are incorporated into the rest of the existing network.

To better plan for future trail usage, CVAG's projected employment data for 2035 was incorporated into the bicycle model. The same methodology of integrating existing and proposed multi-use trails with 2035 employment projections was utilized to provide a look at future trail usage.

Below is a summary of the scenarios that were used to extrapolate expected bicycling activity along the Parkway:

1) Existing Parkway 1e11 and other existing multi-use trail facilities with 2010 employment density
2) Existing Parkway 1e11 and other existing multi-use trail facilities with 2035 projected employment density
3) Existing Parkway 1e11, proposed Parkway 1e11 and other existing multi-use trail facilities with 2010 employment density
4) Existing Parkway 1e11, proposed Parkway 1e11 and other existing multi-use trail facilities with 2035 projected employment density

ESRI's Model Builder was utilized is used to automate the processes described above. Sample work flows are shown below.

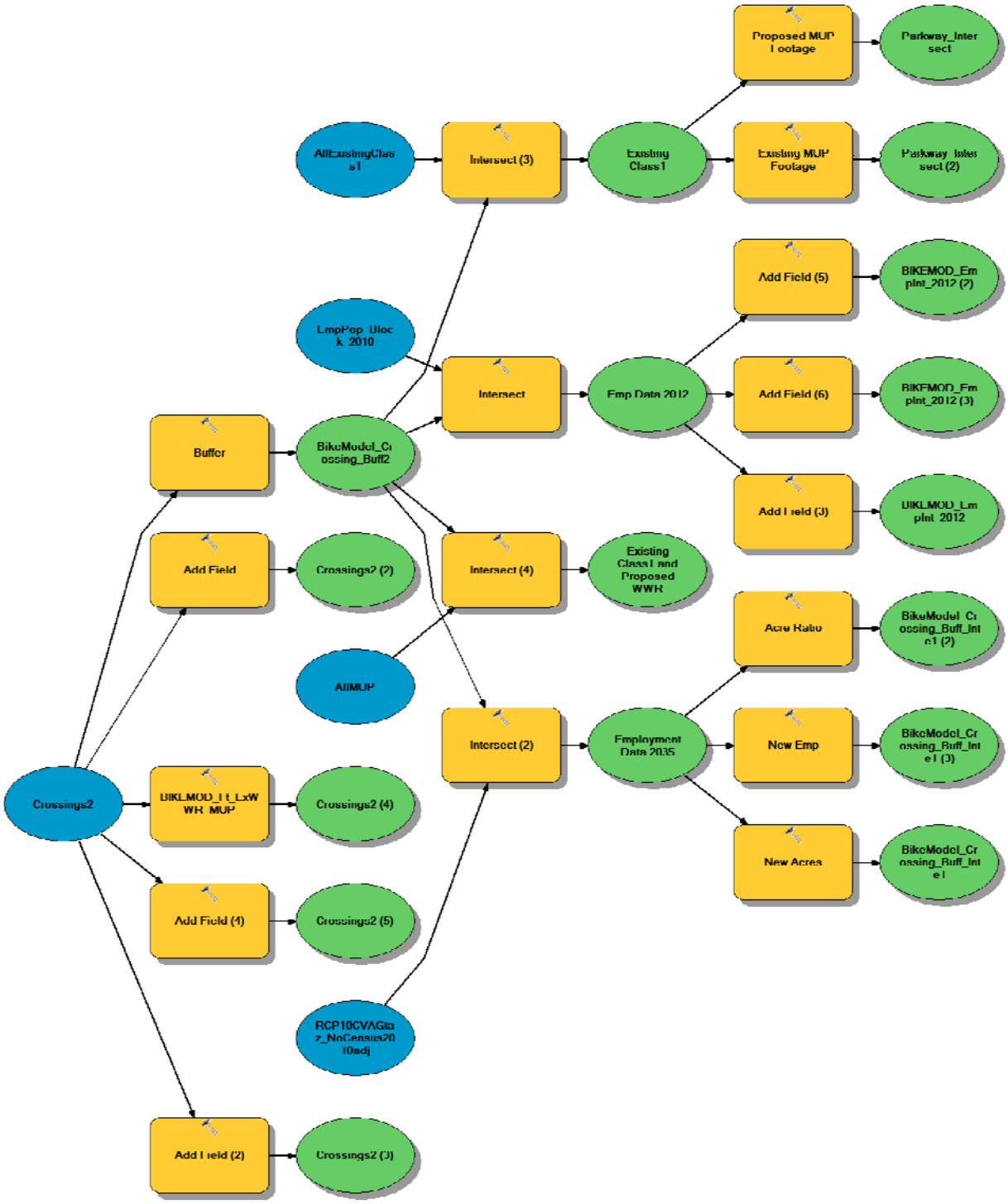

Figure 4: Bike Demand Model: Automation of capturing trail segments, 2010 and 2035 employment data within ¼ mile of crossing locations

Figure 5: Pedestrian Demand Model: Automation of capturing 2010 and 2035 population and employment data within ¼ mile and ½ mile of crossing locations

Estimating Bicycle and Pedestrian Trip Making from Parkway Activity

When comparing levels of use among regional trail systems, annual usage is the most commonly available number and most easily understood measure for a variety of audiences. Because the Seamless Model produces peak morning activity as its primary output, it is necessary to apply several levels of adjustment in order to arrive at the annual estimate. Annual Parkway activity was developed using adjustment formulas developed as a part of the National Bicycle and Pedestrian Documentation Project (NBPD), an annual count and survey effort sponsored by the Institute of Transportation Engineers (ITE). The adjustment figures enable extrapolation from the Seamless AM peak estimates by accounting for daily, weekly, and seasonal variation.

Adjustment Factors

The Seamless Travel Demand Model estimates peak hour activity. This estimate is then extrapolated to provide a snapshot of daily, weekly, monthly and annual travel based on a model created from the analysis of continuous automatic counter data (24 hours/day, 365 days/year) from trail locations in areas with similar weather patterns to the Coachella Valley.

The total local demand estimates show both the person trips made annually by residents for all trip purposes and the accumulated number of trips as construction phases come on line, until 2035. These numbers represent local travel and do not estimate tourism demand. In order to account for the seasonal population increase experienced in the valley, the total households within one mile of the trail were divided by the number of households classified as "seasonal" by Riverside County's transportation model. This ratio was then applied to the annual pedestrian and bike counts.

The extrapolation process utilizes a series of assumptions which are calibrated to reflect the local conditions of the Coachella Valley, including climate (very hot summer, mild winter) and trail type (regional multi-use trail).

Converting Counts to Trips

The Seamless output provides predicted activity at specific points along the proposed Parkway and Tahquitz Trail. This activity level is best described as the number of people expected to pass that point while traveling on the trail, also known as a screenline count. The count locations shown on Figure 6 were selected based on the 2012 Whitewater River/ Parkway 1e11 NEV/Bike/Pedestrian Corridor Preliminary Study Report authored by Alta Planning + Design, LSA Associates and RBF Architects showing recommended crossing improvements and augmented as necessary to provide suitable spacing between count locations. A subset of these locations were used to develop bike counts. Data from the 2009 National Household Travel Survey (NHTS) were used to calculate an average one-way pedestrian and bicycle trip length (0.7 miles and 2.6 mile respectively). By dividing the trail into segments that corresponded to these lengths, counts within each segment can be averaged (if multiple points are present within a single segment) to generate an estimate of the

number of unique users expected to be on the trail at that location. The total expected activity on each segment was added to obtain an estimate of annual pedestrian or bicycle usage expected for each phase of Parkway construction.

Seamless model scenarios were run under the conditions described above to understand existing and future pedestrian and bicycle use along the corridor.

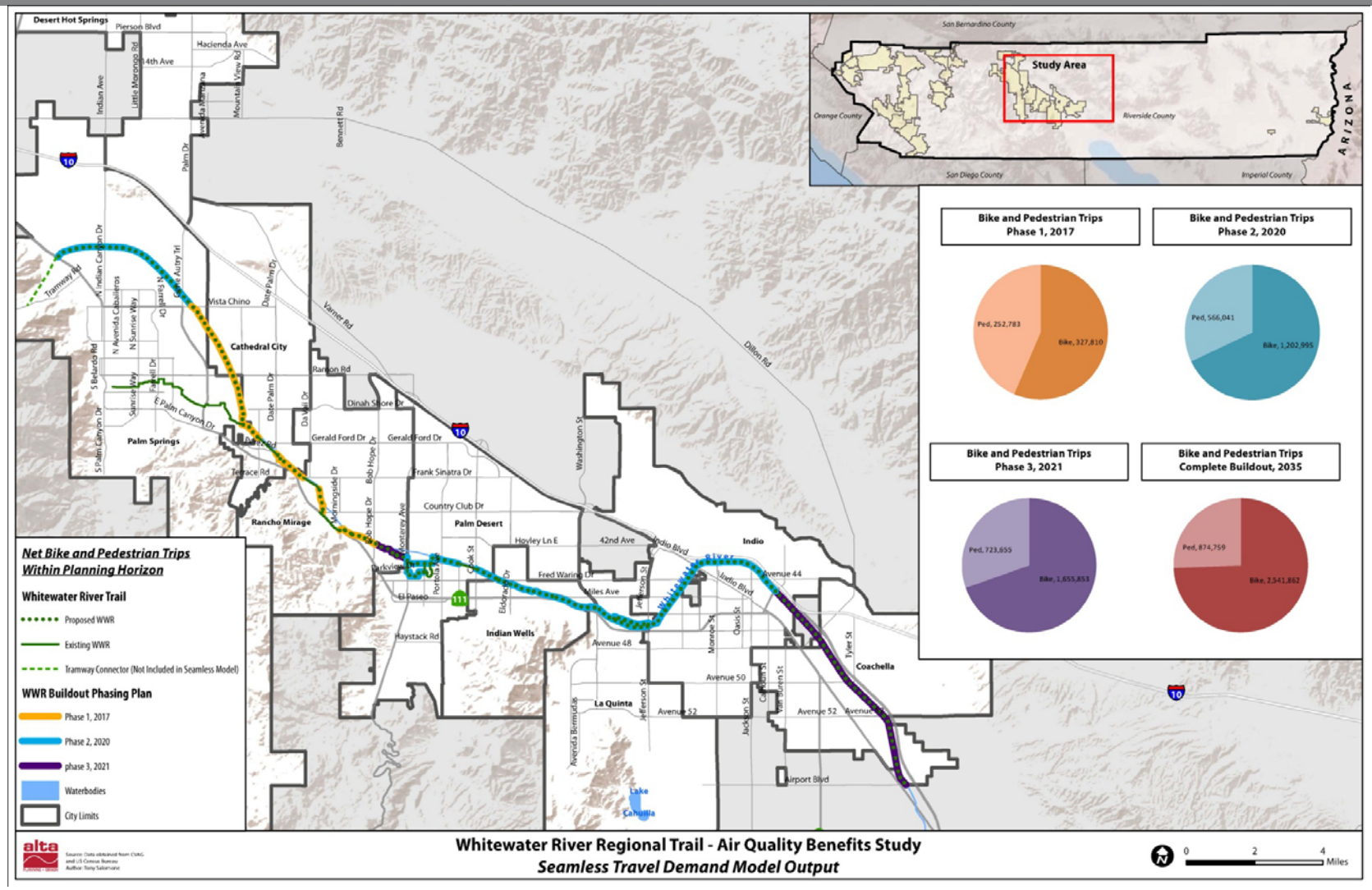

Figure 6: Pedestrian and Bicycle Trip-Making by Phase

Results - Replacement of Vehicle Miles Traveled and Air Quality Benefits due to Walking and Bicycling Use of Parkway 1e11

Vehicle Miles Traveled Saved by Construction Phase

Trips per year per mode are described below in sample years, representative of the second year after a new phase comes on line. New pedestrian and bicycle activity is associated with activity on the new trail segments. In other words: 2017 reflects activity associated with the projects constructed in Project Years 4&5 (Tahquitz Creek to Bob Hope Drive, Tahquitz Creek Trail Connector Retrofit, Vista Chino to Tahquitz Creek); 2020 reflects activity associated with the projects constructed in Project Years 6 & 7 (Aerial Tram to Vista Clinic and Monterey Ave to Washington Street); and 2021 reflects activity associated with the projects constructed in Project Years 8 & 9 (Bob Hope Drive to Monterey Ave. and Golf Center Parkway to Avenue 56).

Table 6 shows a snapshot of annual savings, while Table 7 shows the cumulative benefits over the planning horizon ending in 2035.

Table 6: Annual Vehicle Miles Reduced
Due to Increased Pedestrian and Bicycle Activity

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
Pedestrian Trips				
Annual Pedestrian Trips	327,810	1,202,995	1,655,853	2,541,862
Reduced Motor Vehicle Trips	157,349	601,498	861,044	1,372,605
Reduced Motor Vehicle Miles	220,289	842,097	1,205,461	1,921,647
Bicycle Trips				
Annual Bicycle Trips	252,783	566,041	723,655	874,759
Reduced Motor Vehicle Trips	96,057	237,737	332,881	437,380
Reduced Motor Vehicle Miles	499,498	1,236,235	1,730,983	2,274,374
Annual Reduced Motor Vehicle Miles by Walking and Bicycling	**719,787**	**2,078,332**	**2,936,444**	**4,196,021**

Table 7: Cumulative Vehicle Miles Reduced
Due to Increased Pedestrian and Bicycle Activity Through 2035

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
Pedestrian Trips				
Accumulated Pedestrian Trips	327,810	2,678,910	4,823,046	34,207,050
Reduced Motor Vehicle Trips	157,349	1,327,982	2,424,887	8,452,193
Reduced Motor Vehicle Miles	220,289	1,859,174	3,394,842	25,284,602
Bicycle Trips				
Accumulated Bicycle Trips	252,783	1,432,942	2,400,215	13,589,114
Reduced Motor Vehicle Trips	96,057	584,141	1,012,105	6,403,931
Reduced Motor Vehicle Miles	499,498	3,037,533	5,262,946	33,300,444
Total Reduced Motor Vehicle Miles	**719,787**	**4,896,707**	**8,657,788**	**58,585,046**

Air Quality Benefits by Construction Phase

The Parkway air quality benefits estimate assumes a baseline of January, 2012, for the purposes of using census and other locally available data that are relatively current today. The horizon year of 2035 is chosen due to its selection as a future modeling year for local travel forecasting and air pollution modeling. New trip making, resulting in the net change in trips due to the new phases, is accounted for in the estimation of new trips, and is shown below. Average one way trip distances of 2.6 miles for bicycling and 0.7 miles for walking are used to estimate the vehicle miles traveled saved and the resulting air quality savings.

Using the emissions reduction factors described in Table 3, VMT reduction is converted to air quality benefits. The emission factors were selected based on their suitability for the region during the planning horizon for this project.

The Table 8 shows a snapshot of annual savings, while Table 9 shows the accumulation of benefits over the planning horizon ending in 2035.

Table 8: Annual Air Quality Benefits
Due to Increased Pedestrian and Bicycling Activity

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
AIR QUALITY BENEFITS - Pedestrians				
Reduced Hydrocarbons (pounds)	661	1,594	3,071	4,691
Reduced Particulate Matter PM10 (pounds)	108	260	501	765
Reduced Particulate Matter PM2.5 (pounds)	25	60	115	176
Nitrous Oxides (pounds)	92	221	427	651
Carbon Monoxide (pounds)	993	2,394	4,613	7,046
Carbon Dioxide (pounds)	179,207	432,130	832,854	1,271,967
AIR QUALITY BENEFITS - Bicycles				
Reduced Hydrocarbons (pounds)	1,498	2,604	4,451	6,008
Reduced Particulate Matter PM10 (pounds)	244	425	726	980
Reduced Particulate Matter PM2.5 (pounds)	56	98	167	225
Nitrous Oxides (pounds)	208	362	618	834
Carbon Monoxide (pounds)	2,251	3,911	6,686	9,025
Carbon Dioxide (pounds)	406,347	706,018	1,206,931	1,629,199
AIR QUALITY BENEFITS - TOTAL				
Reduced Hydrocarbons (pounds)	2,159	4,197	7,522	10,699
Reduced Particulate Matter PM10 (pounds)	352	685	1,227	1,745
Reduced Particulate Matter PM2.5 (pounds)	81	157	282	401
Nitrous Oxides (pounds)	300	583	1,045	1,486
Carbon Monoxide (pounds)	3,244	6,305	11,299	16,070
Carbon Dioxide (pounds)	585,554	1,138,149	2,039,785	2,901,166

Table 9: Cumulative Air Quality Benefits
Due to Increased Pedestrian and Bicycling Activity through 2035

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
AIR QUALITY BENEFITS - Pedestrians				
Reduced Hydrocarbons (pounds)	661	5,578	10,185	75,854
Reduced Particulate Matter PM10 (pounds)	108	910	1,662	12,375
Reduced Particulate Matter PM2.5 (pounds)	25	209	382	2,843
Nitrous Oxides (pounds)	92	775	1,415	10,535
Carbon Monoxide (pounds)	993	8,378	15,298	113,939
Carbon Dioxide (pounds)	179,207	1,512,457	2,761,738	20,569,277
AIR QUALITY BENEFITS - Bicycles				
Reduced Hydrocarbons (pounds)	1,498	9,113	15,789	99,901
Reduced Particulate Matter PM10 (pounds)	244	1,487	2,576	16,298
Reduced Particulate Matter PM2.5 (pounds)	56	342	592	3,744
Nitrous Oxides (pounds)	208	1,266	2,193	13,875
Carbon Monoxide (pounds)	2,251	13,688	23,716	150,060
Carbon Dioxide (pounds)	406,347	2,471,063	4,281,459	27,090,244
AIR QUALITY BENEFITS - TOTAL				
Reduced Hydrocarbons (pounds)	2,159	14,690	25,973	175,755
Reduced Particulate Matter PM10 (pounds)	352	2,397	4,237	28,673
Reduced Particulate Matter PM2.5 (pounds)	81	551	973	6,587
Nitrous Oxides (pounds)	300	2,040	3,607	24,411
Carbon Monoxide (pounds)	3,244	22,066	39,014	263,999
Carbon Dioxide (pounds)	585,554	3,983,520	7,043,197	47,659,521

Table 10: Sources for Walking and Bicycling Methodology

Factor	Factor Value	Use	Source
Existing trail facilities	N/A	Used to develop baseline (2012) trail activity	CVAG Non-Motorized Trail Study 2010
Future Whitewater Parkway alignment and phasing plan	See Data Collection Appendix	Used to develop estimates of trail use over time	CVAG Non-Motorized Trail Study 2010, LSA Associates
2010 Residential Population	Within · mile of count locations = 15,931	Used to develop trail use estimates	2010 US Census
2010 Employment Information	Within · of count locations = 9,083 Within · mile of count locations = 31,854	Used to develop trail use estimates	2007 US Economic census
2035 Residential Population	Within · mile of count locations = 36,910	Used to develop trail use estimates	2010 Riverside County Demographic Study
2035 Employment Population	Within · of count locations = 24,624 Within · mile of count locations = 96,125	Used to develop trail use estimates	2010 Riverside County Demographic Study
Current land use data	N/A	Used to develop trail use estimates	Southern California Association of Governments
Count locations	See Figure 6	Used to develop trail use estimates	2012 Whitewater River/ Parkway 1e11 NEV/Bike/Pedestrian Corridor Preliminary Study Report crossing locations augmented by additional sampling locations added by Alta Planning + Design
Average one way bicycle /	2.6 mi. / .7 mi.	Used to develop trail use	Based on 2009 National Household Travel Survey, and Non-Motorized Transportation

Factor	Factor Value	Use	Source
pedestrian trip length		estimates	Pilot Project.
Existing (2010) bicycle and pedestrian trail use estimates	Calculated	Used to estimate baseline bicycle and pedestrian trips	Alta - Seamless travel demand model
Future (2035) bicycle and pedestrian trail use estimates	Calculated	Used to estimate future bicycle and pedestrian trail use	Alta - Seamless travel demand model

Neighborhood Electric Vehicle Methodology

The methodology for estimating Parkway 1e11 use by long term and seasonal residents is based on interviews with knowledge experts and review of the literature. Assuming average current and future trip making distances from the Riverside County Forecast model, a conservative forecast of increasing of NEV ownership is used to estimate VMT and air pollution savings due to the Parkway.

NEV Background Research

A subclass of the Low Speed Electric Vehicle, the Neighborhood Electric Vehicle (NEV) has a 25 mph speed limit and is legal on streets with speed limits of 35 mph or less. They are also legal on multi-purpose paths and separated lanes on streets with higher speed limits. NEVs are required to have a California license plate to operate on public roads. Unlike golf-carts, NEVs are motor vehicles and therefore subject to the State Motor Vehicle Code.

NEVs are designed for low-speed local trips in neighborhoods and urban areas, to run errands, and for commuting or making local deliveries. The use of these vehicles eliminates the air pollution generated from the "cold start" plus the per mile benefit of replacing internal combustion engines with electric. NEV use is best supported in communities where land use and street patterns support trips of short distances.

The Whitewater River Parkway provides opportunities to increase connectivity to key destinations. NEV owners living in close proximity to the parkway (one mile or less) are likely to use the facility. Enhancements to the community, such as including NEVs as a mobility choice in local Circulation Elements, developing and implementing a route signage and way-finding plan, and allowing use of NEVs on bike lanes, could increase NEV use and increase the impact this mode can have in reducing vehicle miles traveled by vehicles using internal combustion.

For this study, a literature review of NEV planning and research documents was conducted to understand the expected dissemination of NEVs into the Coachella Valley and the potential of this vehicle type to reduce automobile trips.

Expected Fuel Economy

The California Energy Commission 2002 study (California Energy Commission, 2002) followed the use of NEVs in four California Communities, including Palm Springs. During the NEV Demonstration Program, quantitative data in the form of trip mileages and number of days/trips were collected by the host sites. To obtain a rough estimate of NEV "fuel economy", energy meters were placed at host sites. Mileage and associated charge data were generated by the participants, which allowed the calculation of an approximate NEV "fuel economy" of 0.223 kwh/mile. Average fuel economy for conventional vehicles based on the CAFÉ standard for passenger cars is 27.5 mpg.

NEV Usage Characteristics

Various published resources were reviewed to understand the characteristics of NEV travel. Although they closely resemble golf carts, which are represented in the National Household Travel Survey, they are not electable as a mode choice in and of themselves in the survey, so it is not possible to secure national data on their use for commuting or other types of trips. Consistent across the literature is the finding that more than 90% of all NEV trips are under five miles in length. NEVs have been reported to replace between 12% and 22% of the vehicle miles traveled by car. Due to range and speed constraints, they are unlikely to replace personal automobiles as a primary vehicle, but in the Coachella Valley golf cart culture, it is very probably that their growth will continue.

Table 11. NEV Research Summary

	South Bay Cities Council of Governments, NEVs in Mature Suburbs	Green Car Institute, Study of NEV Users in California	Vision Los Angeles (CAPCOA)	Lincoln Trans-portation Plan Review	Various Sources
Average Trip Length	1.13 (trip leg or segment) 5 miles, RT			4.5 miles	
Percentage of All Trips	22% of household VMT		12.7% (citing Lincoln) average 3500 miles per year/estimated VMT/HH		
Expected Market Penetration	60% of secondary vehicles – potential to completely replace second and third vehicles		.04 – 1 vehicles per HH (based on Lincoln City)		1.3 % of all vehicles sold between 1996 and 2010 (CARB); 25,000 of all US Vehicles in 2017 (Pike Research Group)
Percentage of household trips that otherwise would have been made by personal or company car		73.4%			
Percent of trips for journey to work	17%	10%			
Percentage of household trips less than 5 miles	99%	91%		96% (LT 6)	

Air Quality Benefits

NEVs operate using grid power, and generate 0 tailpipe emissions. Because of the wide range of emissions benefits to society, the City of Lincoln's NEV Transportation Plan argues that is it reasonable to claim that their grid power comes from hydroelectric or other environmentally benign sources, so the emissions costs of the household energy required to power the NEVs is not included in this analysis.

A Changing Regulatory Climate

The California Air Research Board (CARB) has developed the Advanced Clean Cars program to address air quality needs through mobile sources. The program combines the control of smog, soot causing pollutants, and greenhouse gas emissions into a package of requirements for model years 2015 through 2025. The Zero Emissions Vehicle EV program is a focus of this effort, requiring increased production of ZEVs and plug in hybrids during these model years.

CARB estimates that between 1996 and 2010, 28,800 NEV have been placed in California. This number represents 1.3% of overall vehicle replacement.[5] However, according to staff at CARB, this trend is unlikely to project into the future because of regulatory changes described below.[6]

CARB regulatory requirements for 2018 and subsequent years will increase the ZEV and plug in market to 15.4% of new sales by 2025. However, future credits for NEVs have been reduced and capped, in order to focus on the full function passenger cars. It can be expected that of the 1.5 million ZEVs (Fuel Cell, BEV and Plug-in) on the market in 2025, NEVs will play a much smaller role than today. Representatives from the Air Quality Management District confirmed that they are not using NEVs as part of a development of baseline vehicle use in the region and they have not being tracked by the organization. There is little evidence to support an assumption that past growth trends will be reflected in future growth. However, the changing regulations are expected to have little impact in the Coachella Valley, which has a golf car culture and some nearly ideal demographic, climatic and land use conditions. Therefore, unique market penetration estimates are developed for the area, due to its likely insensitivity to CARB regulations and incentives.

The Benefits of Separated Paths for NEV Users

An evaluation of Lincoln's NEV Transportation Plan study illustrated that although more than 80% of respondents perceive a separated path to be very safe, only 50% would be willing to travel out of

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5 Energy Commission Grant Prepares Coachella Valley for Electric Vehicles CARB Advanced Clean Cars Program, http://www.arb.ca.gov/msprog/clean_cars/acc%20summary-final.pdf
6 DriveClean.ca.gov, and personal communication on 5/3/2012, with Lisa Chiladakis: 916.327.2932

direction to drive on one.[7] NEV facilities that provide direct access to destinations equivalent to that of traditional automobiles, will be most successful. As a suitable alternative to SR-111, the Parkway is just such a facility. Therefore, it is estimated that 50% of the NEV future trip making in the travelshed of the Whitewater Trail will include use of the Parkway.

Market Penetration

Estimates of market penetration vary widely. Personal communication with local salespeople and NEV advocacy representatives indicate that approximately 1000 NEVs are in the area surrounding the Parkway (approximately 700-800 in Palm Desert and 200 in Palm Springs). The Parkway is considered to be an incentive to motivate sales into a range of 2,000 to 3,000 annually, with particular interest to tourists[8].

A review of available information, at the time of this report, provided the following understanding of NEV market penetration into the US and Coachella Valley markets:

- In 2011, 14,737 NEVs were sold in the United States. Pike Research Group estimates that by 2017, approximately 25,000 vehicles will be sold per year in the US, assuming a compound annual growth rate of 6.6% during this period[9]. It is not clear whether this estimate accounts for the decreasing role of NEVs in the marketplace as a result of changing clean air regulations.
- Opportunities that will support increasing penetration include rising gas prices, the aging population, and the increase in master planning for NEV use and community density.
- Local communities can increase penetration through supportive local policies and a strong NEV network, including on-street and off-street paths and wayfinding. Other effective local strategies include government incentives including parking, Class 2 bike lanes, consumer education, and NEV retailing.
- NEV market has the potential to completely replace the second and third vehicles in household use[10].

CVAG was recently awarded a planning grant to develop a regional readiness plan for Plug In Electric Vehicles, including NEVs. Task 3 of this work is to develop a projection of the size of the electric

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7 City of Lincoln and City of Rocklin (January 1, 2011) Joint Report to the California State Legislature, as required by Assembly Bill 2963, (Chapter 422, Section 1. Chapter 7, Neighborhood Electric Vehicle Transportation Plan Evaluation Ray Leftwich, P.E., Construction Manager, City of Lincoln,Justin Nartker, Public Works Operations Supervisor, City of Rocklin

8 All Custom Golf Carts, NEV dealer. Conversation 5/3/2012, Malcolm Gochioco: 760 340-1575.

9 Hurst, Wheelock (2011) Executive Summary: Neighborhood Electric Vehicles Low-Speed Electric Vehicles for Consumer and Fleet Markets: Demand Drivers and Barriers, Technology Issues, Key Industry Players and Market Forecasts. Accessed April 23, 2012

10 South Bay Council of Cities (July 2011) Neighborhood Electric Vehicles in Mature Suburbs Demonstration and Preliminary Evaluation. Walter Siembab and David MagarianAccessed Aprl 23, 2012.

vehicle market, including the long term market penetration anticipated subsequent to the anticipated rapid deployment beginning in 2014 and rising to 20% by 2020.

Travel and other potential benefits associated with NEV use (and foregone travel by other modes) is an area in need of future research (Lincoln City, 2008). However, local strategies and use of NEVs support a conclusion that NEV trip making will be increase in the immediate future.

Research Summary

For the purpose of estimating future VMT reduction benefits accruing to the Parkway based on the replacement of personal vehicles with NEVs, the following conclusions were drawn from the research available to date:

- With an estimated 1,000 NEVs in the Coachella Valley at present, current rate of ownership in the valley (by seasonal and year round residents) is 0.0047 NEVs/HH
- Ownership will increase over time to a rate of ownership similar to the City of Lincoln
- 95% of motor vehicle trips made in an NEV owning household within 1 mile of the trail will be replaced with an NEV.[11]
- 40% of NEV trips within 1 mile of the trail will utilize the facility.[12]
- Of the average 6 mile round trip[13] made by NEV, · of the trip will occur on the trail.[14]
- The average number of NEV trips per household is 3.89. (2003 Green Cities Study).

11 It is assumed that 95% of NEV trips replace motor vehicle trips based on current Coachella Valley mode split.
12 Because the Parkway is planned to provide access along a Northwest-to-Southeast corridor within the Coachella Valley, it will likely be the most convenient route for several kinds of trips.
13 South Bay Council of Cities (July 2011) Neighborhood Electric Vehicles in Mature Suburbs Demonstration and Preliminary Evaluation. Walter Siembab and David Magarian
14 Based on average trip length of NEVs nationally and average Coachella Valley vehicle trip length

Methodology – Estimating Baseline and Future (2035) NEV Trips by Trip Purpose and Trip Length

Based on the literature, NEV owning households that live within one mile of the trail are most likely to use it. However, not all NEV owning households are likely to live within this buffer. Therefore, NEV ownership is distributed evenly throughout the Coachella Valley area for both seasonal and long term residents. Assuming average current and future trip making distances from the Riverside County Forecast model, a current, conservative forecast that projects increasing of NEV ownership is used to estimate VMT and air pollution savings.

First, using existing NEV household ownership rates, ESRI ArcGIS is used to identify potential NEV trail users by distributing the NEVs within a 1 mile buffer from the proposed Parkway. Existing and future populations, corresponding with the phased construction, [15] are used to derive a NEV ownership growth curve that results in a future estimate of NEVs per household corresponding with the opening of each trail phase, to a rate of 0.039 vehicles per household by 2035.

Second, the number of trips that will use the Parkway is calculated. This is done through the following assumptions: 3.89 NEV trips are made per day per household; households that own an NEV and live within one mile of the Parkway will make 95% of the trips they would have made in a motor vehicle with their NEV[16]; and 40% of NEV trips made by households within 1 mile of the trail will be on the facility[17]

Third, trip making estimates are converted to vehicle miles saved using an average trip length of 6 miles round trip[18] and an assumption that · of each trip will occur on the trail. Using emissions factors identified in Table 3, the emissions benefits are calculated.

Results – Replacement of Vehicle Miles Traveled and Air Quality Benefits due to NEV Use of Parkway 1e11

Vehicle Miles Traveled Reduced by Construction Phase

Trips per year per mode are described below in sample years, representative of the second year after a new phase comes on line. New NEV activity is associated with activity on the new trail segments. In other words: 2017 reflects activity associated with the projects constructed in Project Years 4 & 5 (Tahquitz Creek to Bob Hope Drive, Tahquitz Creek Trail Connector Retrofit, Vista Chino to Tahquitz

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15 Using linear growth estimate.
16 Assuming 95% of NEV trips replace motor vehicles with an internal combustion engine based on current Coachella Valley mode split.
17 Because the Parkway is planned to provide access along a Northwest-to-Southeast corridor within the Coachella Valley, it will likely be the most convenient route for several kinds of trips. Based on conversations with staff.
18 Based on average trip length of NEVs nationally and average Coachella Valley vehicle trip length

Creek); 2020 reflects activity associated with the projects constructed in Project Years 6 & 7 (Aerial Tram to Vista Clinic and Monterey Ave to Washington Street); 2021 reflects activity associated with the projects constructed in Project Years 8 & 9 (Bob Hope Drive to Monterey Ave. and Golf Center Parkway to Avenue 56).

Table 12 shows a snapshot of annual savings, while Table 13 shows the cumulative benefits over the planning horizon ending in 2035.

Table 12: Annual Vehicle Miles Reduced by Construction Phase through Increased NEV Activity

	Construction			
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
NEV Trips				
Annual NEV Trips	122,690	550,993	1,181,542	2,772,163
Reduced Motor Vehicle Trips	116,555	523,443	1,122,465	2,633,555
Total Reduced Motor Vehicle Miles	349,666	1,570,329	3,367,396	7,900,664

Table 13: Cumulative Vehicle Miles Reduced Due to Increased NEV Activity Through 2035

	Construction			
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
NEV Trips				
Accumulated NEV Trips	122,690	1,178,944	2,478,346	30,154,282
Reduced Motor Vehicle Trips	116,555	1,119,997	2,354,428	28,646,568
Total Reduced Motor Vehicle Miles	349,666	3,359,992	7,063,285	85,939,704

Air Quality Benefits by Construction Phase

The estimates of new trip making due to the trail, are used to estimate the vehicle miles traveled saved and the resulting air quality savings. Table 14 shows a snapshot of annual air quality benefits, while Table 15 shows the accumulation of benefits over the planning horizon ending in 2035.

Table 14: Annual Air Quality Benefits Due to Increased NEV Activity

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
AIR QUALITY BENEFITS - NEVs				
Reduced Hydrocarbons (pounds)	1,049	10,080	7,407	16,902
Reduced Particulate Matter PM10 (pounds)	171	1,644	1,208	2,757
Reduced Particulate Matter PM2.5 (pounds)	39	378	278	633
Nitrous Oxides (pounds)	146	1,400	1,029	2,348
Carbon Monoxide (pounds)	1,576	15,141	11,125	25,388
Carbon Dioxide (pounds)	284,457	2,733,387	2,008,444	4,583,340

Table 15: Cumulative Air Quality Benefits
Due to Increased NEV Activity through 2035

Construction				
	Phase 1	Phase 2	Phase 3	
	2017	2020	2021	2035
AIR QUALITY BENEFITS - NEVs				
Reduced Hydrocarbons (pounds)	1,049	10,080	21,190	257,819
Reduced Particulate Matter PM10 (pounds)	171	1,644	3,457	42,061
Reduced Particulate Matter PM2.5 (pounds)	39	378	794	9,663
Nitrous Oxides (pounds)	146	1,400	2,943	35,809
Carbon Monoxide (pounds)	1,576	15,141	31,829	387,266
Carbon Dioxide (pounds)	284,457	2,733,387	5,746,053	69,912,809

Table 16: Sources for NEV Methodology

Factor	Factor Value	Use	Source
Estimate of 2012 NEV use/ownership in the Coachella Valley	1,000	Baseline ownership estimate	Malcolm Gochioco, Partner All Custom Golf Carts
Estimated household ownership of the Coachella Valley's NEV fleet in 2035 or estimated number of NEVs in use within 1 mile of the trail in 2035	0.039 NEV/Household	Used to understand growth rate and number of NEV's in use in 2035	Based on conservative estimate of NEV ownership and extrapolated over time to match city of Lincoln
Average distance of NEV trips	6 miles	Used to estimate calculate the VMT savings by trip type	Based on average trip length of NEVs nationally and average CV vehicle trip length
Proportion of NEV trips expected to replace motor vehicle trips	95%	Used to estimate trip replacement rate	It is assumed that 95% of NEV trips replace motor vehicle trips based on current CV mode split.

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