

Interagency Transportation, Land Use, and Climate Change Initiative

Central New Mexico Climate Change Scenario Planning Project

*Ben Rasmussen (Volpe) and Aaron Sussman (MRCOG)
August 12, 2015*



Purpose/History

- ❑ Purpose
 - Focus: 50% adaptation and 50% mitigation
 - Uses scenario planning as a framework
 - Integrates into LRTP
 - Involves multiple agencies with different priorities; not just transportation

- ❑ Two locations
 - Coast: pilot project on Cape Cod, Massachusetts (2010-11)
 - Non-coastal: Central New Mexico (2013-15)

- ❑ Key differences
 - Additional modeling software v. existing modeling software
 - State of the practice

Partnerships

- ❑ Federal funding sponsors



- ❑ Supporting federal agencies



- ❑ Regional and local agencies / governments



- ❑ Private and academic entities



Central New Mexico



Climate Change Adaptation Process

- ❑ Identify:
 - Regional climate change impacts
 - The effect of these impacts on transportation, land use, and natural resources
 - The effect of transportation and land use policy choices on climate change impacts
- ❑ Example adaptation strategies:
 - Mixed use/density
 - Buffers

How will these strategies be affected by climate change impacts?

How will these strategies improve or reduce resiliency?

Climate Change Mitigation Process

□ Estimate (for each development scenario):

- Vehicle miles traveled
- GHG emissions

□ Example mitigation strategies:

- Mixed use/density
- Alternative fuels
- Transit
- Nonmotorized investments

Strategy	GHG Mitigation Potential	Analysis Capability
Zoning changes	●●●● L	●●●● U
Infill development	●●●● L	●●●● U
Transit oriented development	●●●● L	●●●● U,C
Building design standards	●●○○ L	●○○○ Q
Urban growth boundaries	●●●● M	●●●● U
Bicycle and pedestrian infrastructure improvements	●●○○ S	●○○○ O,P,Q
Improving public transportation	●●○○ S	●●○○ C
Establishing a complete streets policy	●○○○ L	●○○○ Q
Road pricing (HOT lanes/congestion charging)	●●○○ S	●○○○ C,P
HOV facilities	●○○○ M	●○○○ Q,P
Parking management	●●○○ S	●●○○ C
Car sharing	●○○○ S	●○○○ Q
Bike sharing	●○○○ S	●○○○ Q
Ride sharing	●○○○ S	●●○○ Q,C
Travel demand management-educational	●○○○ S	●○○○ Q
Travel demand management-transit incentives	●●○○ S	●○○○ Q,P
“Wheels” tax (VMT charging)	●●●● S	●●●● C
Traffic signal enhancement	●●○○ S	●●○○ C,P
Incident management	●○○○ S	●○○○ Q
Intersection improvement	●○○○ S	●●○○ P,C
Establishing roadway connectivity standards	●●○○ L	●●○○ C
Electric vehicle infrastructure support	●●○○ M	●○○○ Q,M
Heavy-duty vehicle retrofit	●○○○ M	●●○○ Q,M
Truck-stop electrification technologies	●○○○ S	●●○○ M
Construction activities	●○○○ M	●○○○*
Reduce emissions associated with electricity generation from fossil fuel	●●●● M	●○○○**

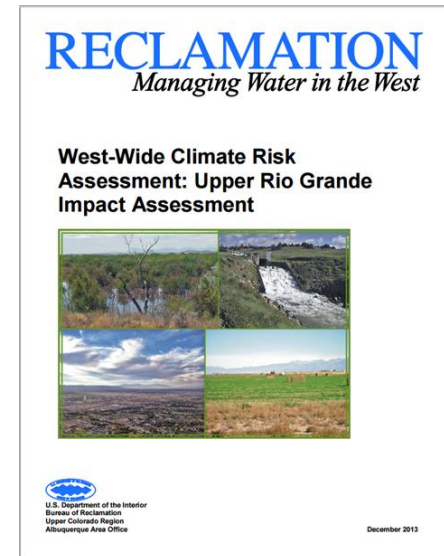
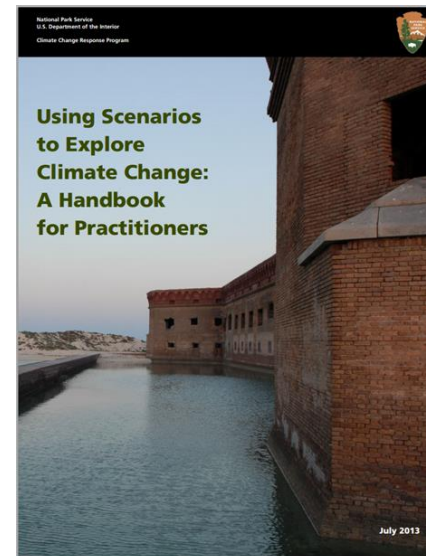
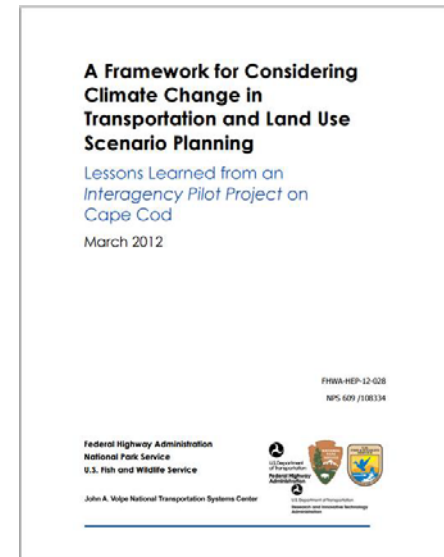
●○○○ → ●●●●
 Low → High

L = long term
 M = medium term
 S = short term

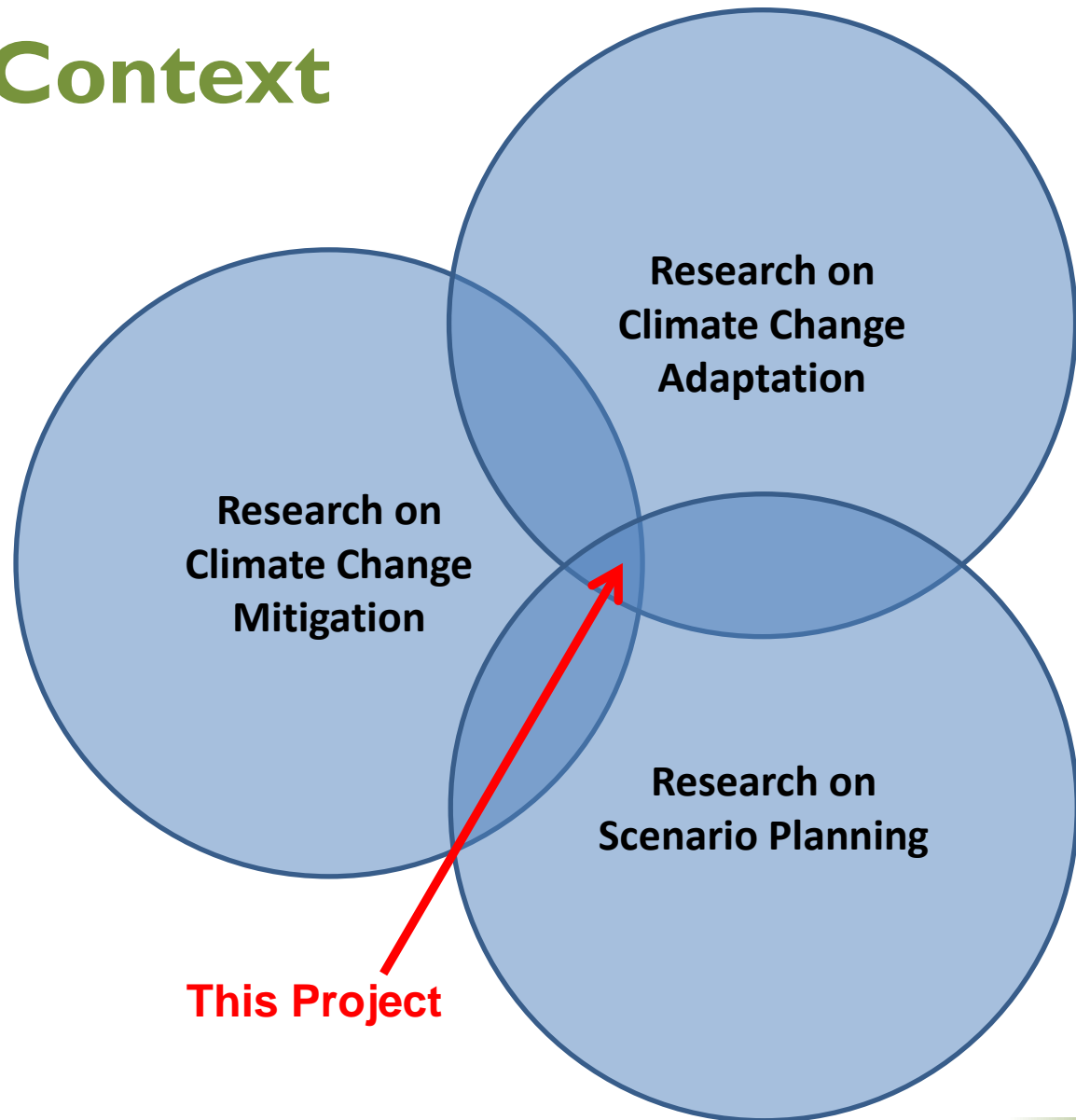
U = UrbanSim, C = CUBE,
 M = MOVES, O = Off Model,
 P = Post Process, Q = Qualitative

Research Context

- ❑ FHWA Adaptation Framework & Climate Resilience Pilots
- ❑ FHWA Scenario Planning Guidebook & Peer Exchanges
- ❑ Cape Cod Pilot Project Guidebook
- ❑ NPS Climate Change Scenario Planning Handbook
- ❑ BoR Climate Change Report
- ❑ Volpe Climate Futures Tool
- ❑ Studies on GHG Emission Reduction Strategies



Research Context



Successful Methodologies

- ❑ Integrated land use and travel demand models
- ❑ Off-model GHG analysis
- ❑ Analysis of the effect of different land use patterns on water consumption using data from the local water utility
- ❑ Integrated climate analysis into the transportation plan
- ❑ Leveraged partnerships and existing studies

Recommendations for Future Research

- ❑ Plan for climate change beyond traditional planning time frames
- ❑ Conduct early exploratory analysis well before formal plans need to be developed
- ❑ Develop a complete picture of climate change impacts specific to the region before developing conceptual land use and transportation scenarios



Integrating Climate Change Analysis into the Metropolitan Transportation Planning Process

Aaron Sussman, AICP
Senior Planner



Mid-Region Council of Governments



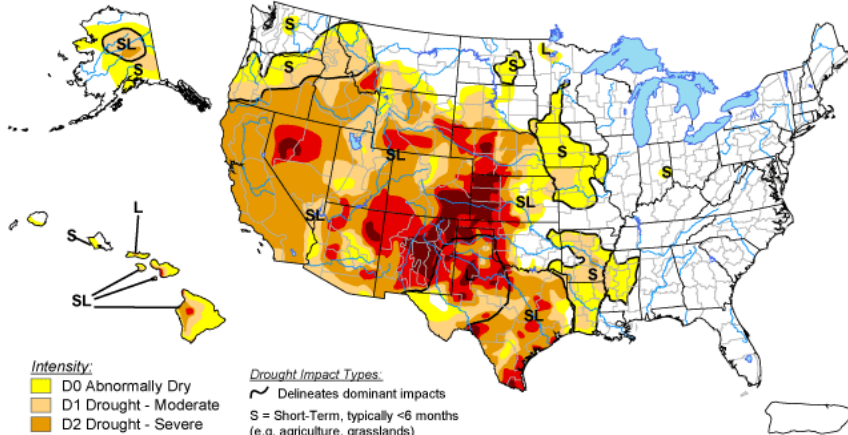
Albuquerque and Central NM

- ◆ Albuquerque population = 555,000
 - ◆ Less than 100,000 in 1950
 - ◆ Metropolitan area = 900,000
(Projected >1.3 million by 2040)
- ◆ City area = 190 mi.² / MSA = 8,400 mi.²
- ◆ Surrounded by mountains to the east; tribal lands to north, south, and west
- ◆ Northern edge of Chihuahuan Desert
- ◆ 9" of rain per year
- ◆ Elevation = 5312'



U.S. Drought Monitor

July 30, 2013
Valid 7 a.m. EDT



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



Released Thursday, August 1, 2013

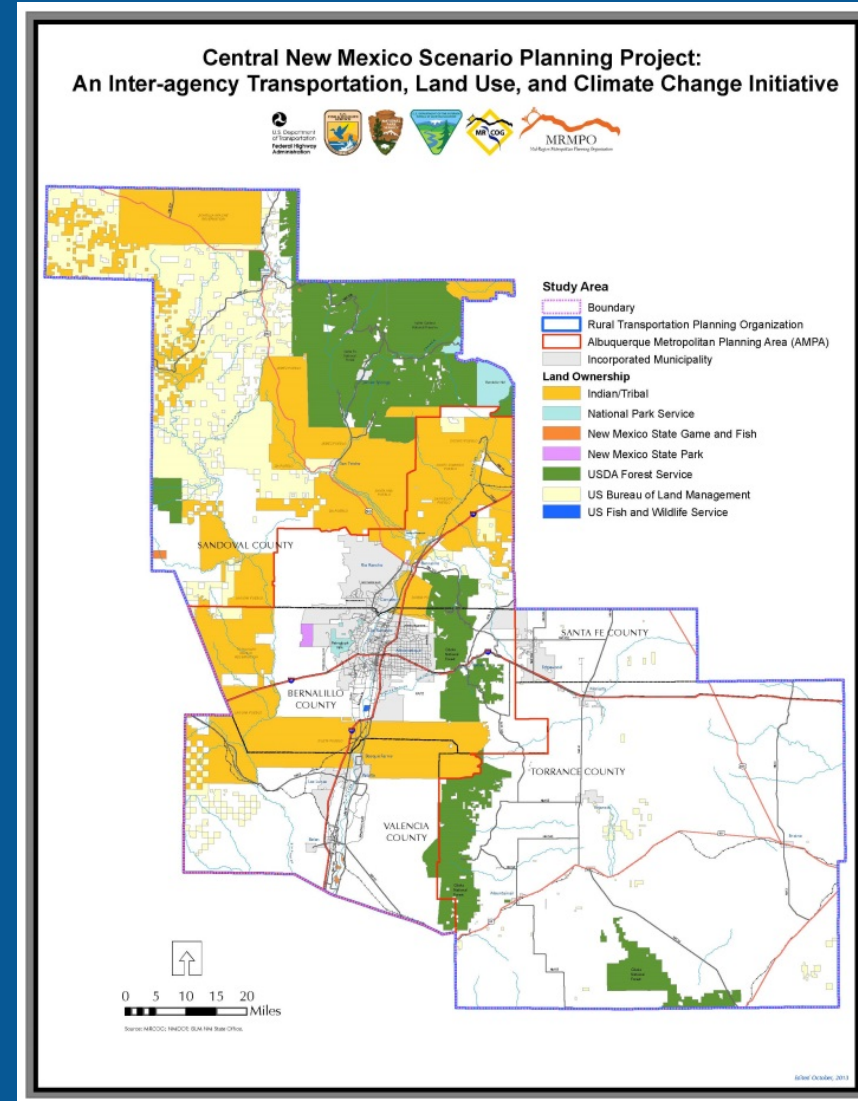
Author: Brian Fuchs, National Drought Mitigation Center

<http://droughtmonitor.unl.edu/>



Central New Mexico Climate Change Scenario Planning Project

- ◆ Partnerships with range of federal agencies, US DOT Volpe Center
- ◆ Understanding of climate trends
 - ◆ Temperature & precipitation levels
- ◆ Climate change impacts on central NM
 - ◆ Droughts
 - ◆ Wildfires
 - ◆ Flooding
 - ◆ Water availability
- ◆ Consider whether development patterns make us more or less resilient to climate impacts



Integration with Futures 2040 Metropolitan Transportation Plan

- ◆ MTP adopted April 17, 2015
- ◆ Expanded scenario planning
- ◆ Climate change as way to frame discussions on future growth
- ◆ MTP performance measures
 - ◆ Transportation conditions
 - ◆ Air quality / emissions
 - ◆ Water consumption
 - ◆ Development locations



Addressing Climate Change through Regional Planning Efforts

Mitigation

Can we grow and invest in ways that *reduce GHG* emissions?

- ◆ Targeted density
- ◆ Mixed-use development
- ◆ Public transit
- ◆ Roadway efficiency improvements

Adaptation

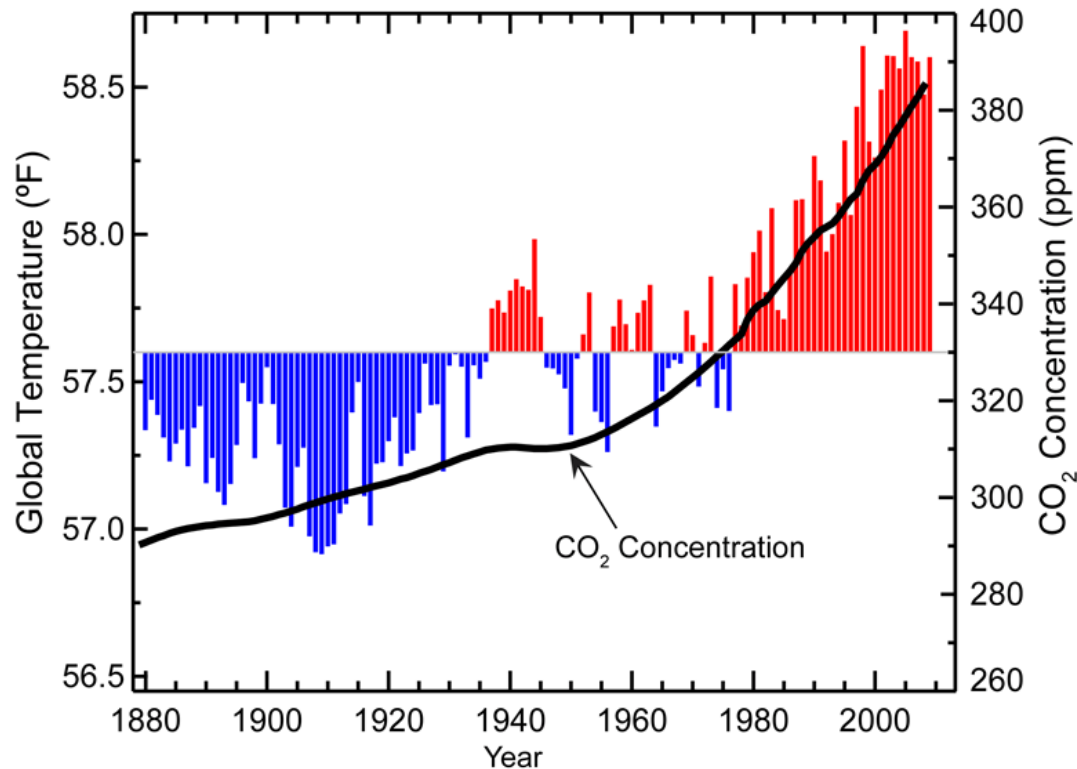
Will our development choices make us *more or less resilient* to the impacts of climate change?

- ◆ Minimizing growth in vulnerable areas
- ◆ Water availability and consumption



Changing Climate Conditions

Global Temperature and Carbon Dioxide



Rio Grande Basin – 1971-2011

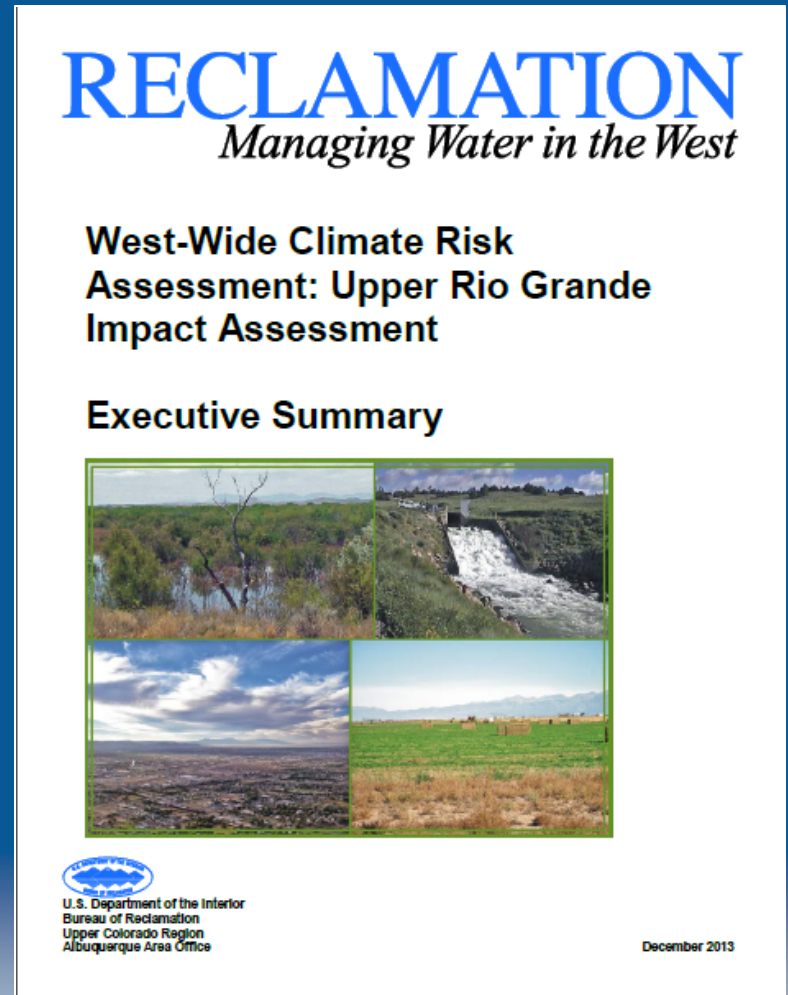
- ◆ Average temperature increased by 0.7°F per decade
- ◆ Twice the global average

Source: NOAA



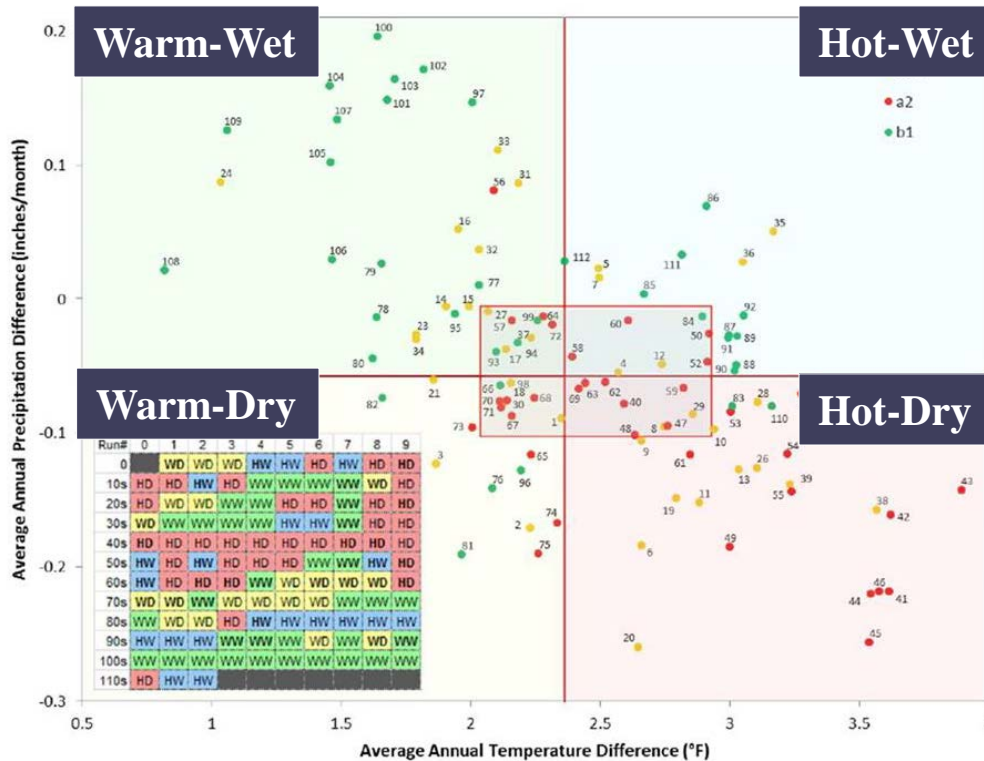
Upper Rio Grande Impact Assessment

- ◆ Study completed December 2013
 - ◆ Bureau of Reclamation
 - ◆ Army Corps of Engineers
 - ◆ Sandia National Labs
- ◆ Evaluated of climate, hydrology, and water operations of the upper Rio Grande basin of Colorado and New Mexico
- ◆ Water availability projections
- ◆ Starting point for assessing climate impacts



Upper Rio Grande Impact Assessment

GCM Simulated Changes in Precipitation and Temperature in Upper Rio Grande:
(Averages for each of 112 simulations for 2040-2069 compared to 1950-1999)



- ◆ All 112 scenarios result in higher temperatures (methodology replicated in tool developed by Volpe Center)
- ◆ Precipitation is highly variable, which may lead to more intense droughts and more extreme events
- ◆ Earlier snowmelt runoff → changes in timing of river flows, affects water availability



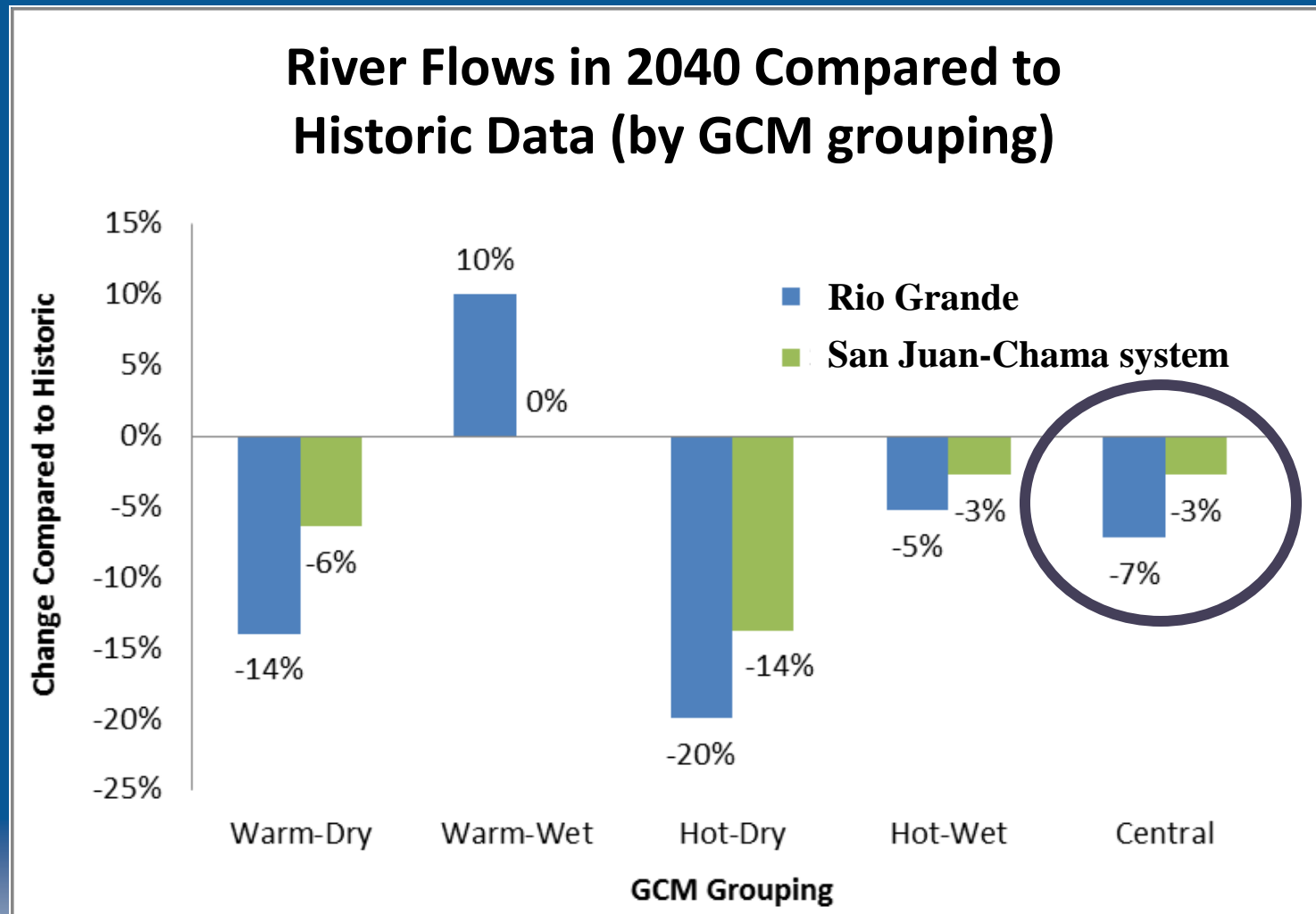
Water Availability in 2100

According to the Upper Rio Grande Impact Assessment:

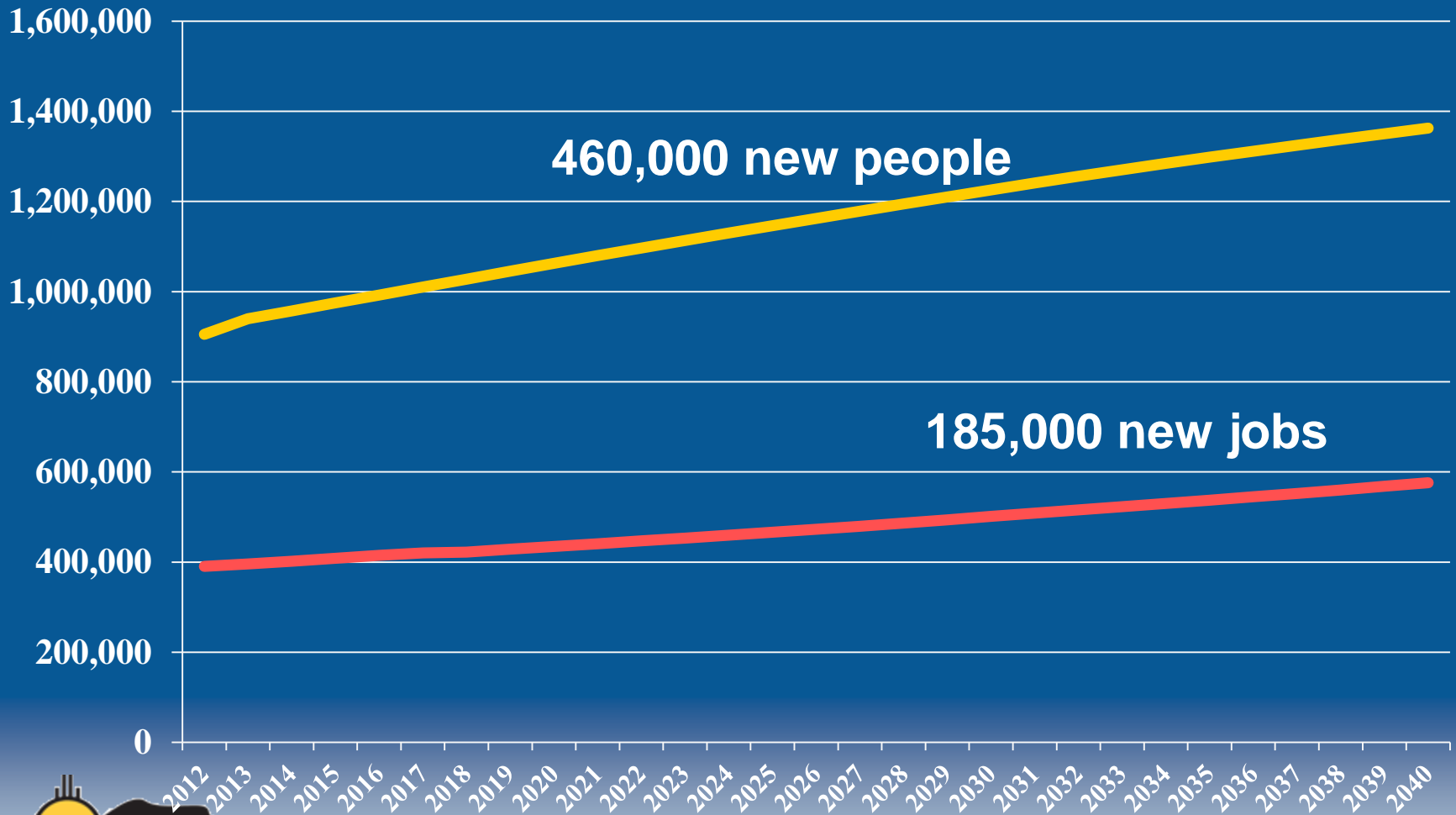
- ◆ Rio Grande flows decrease by 1/3
- ◆ San Juan-Chama flows decrease by 1/4
- ◆ Significant impacts to water supplies for Albuquerque area



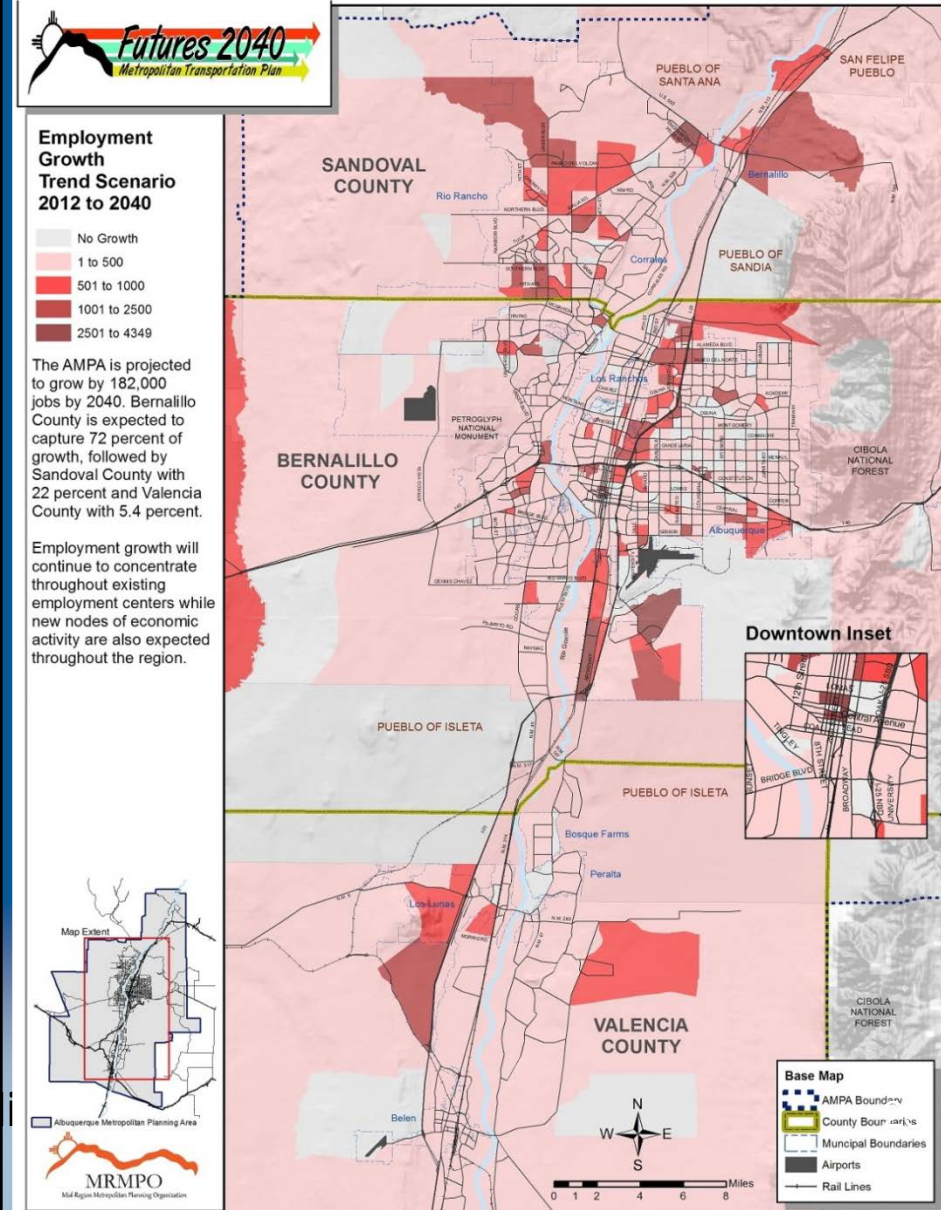
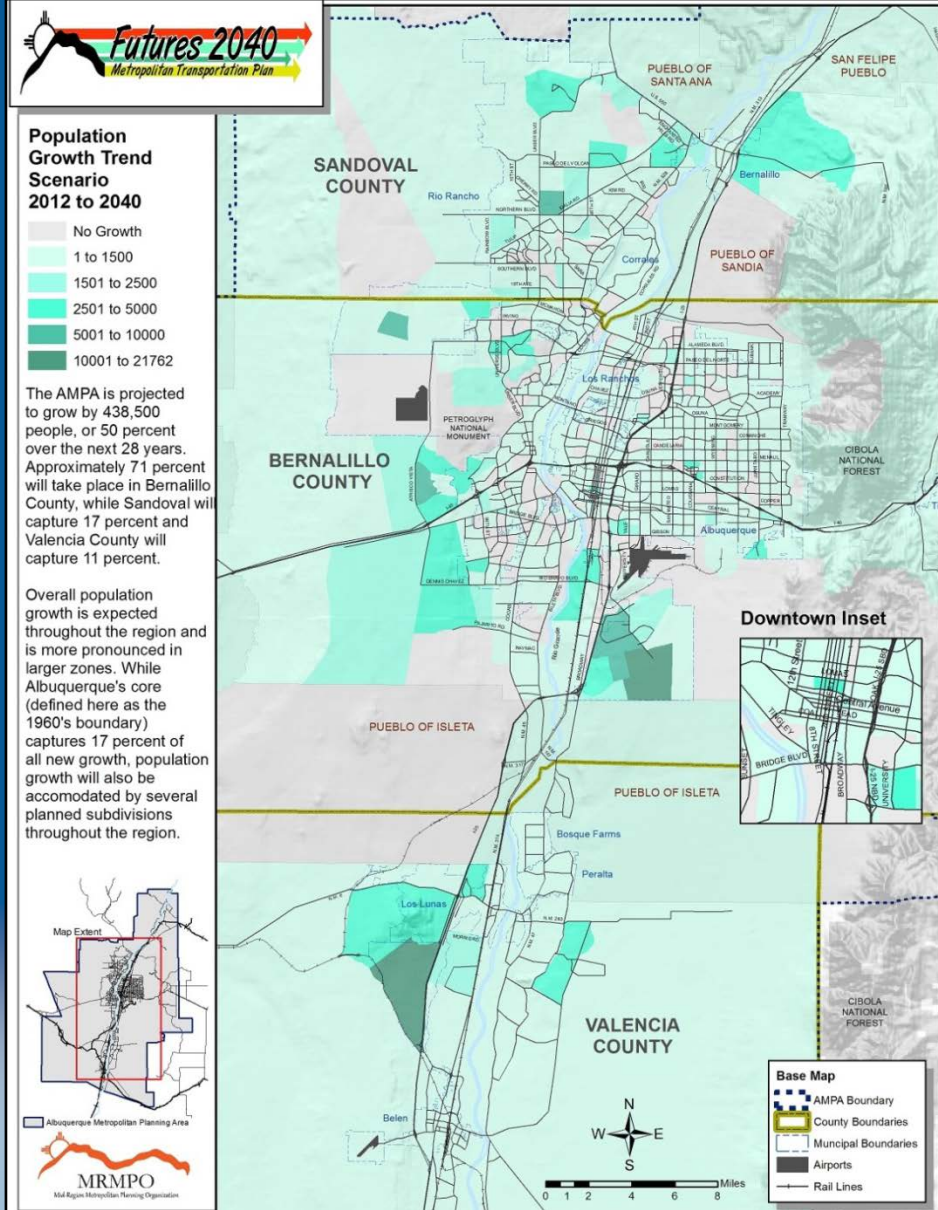
Water Availability in ABQ Area: 2040



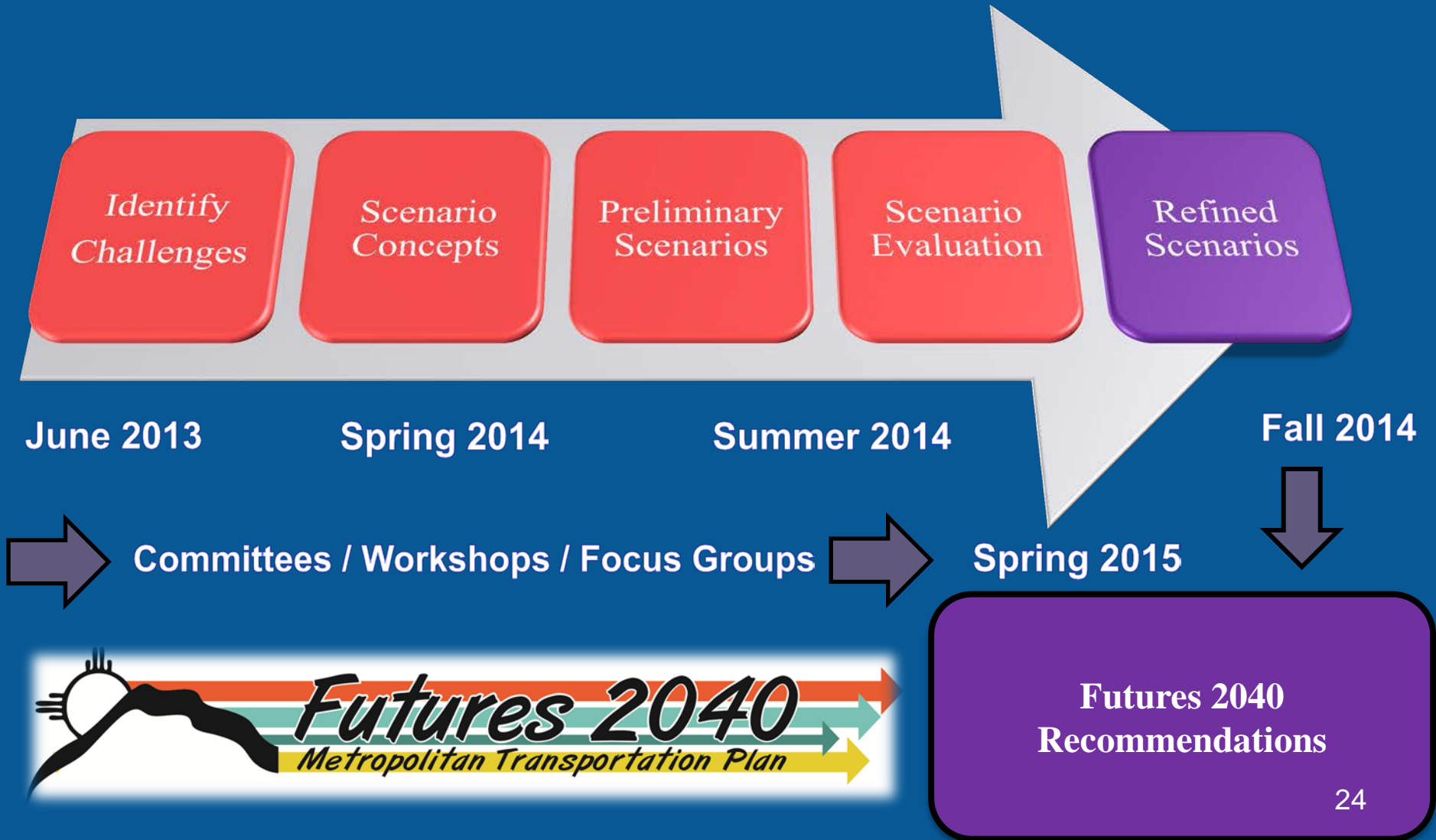
2040 Regional Forecast



Trend Scenario: Population and Employment 2040



Scenario Planning Process



Principles of the Preferred Scenario

- ◆ Link land use and transportation decision-making
- ◆ Concentrated **development in activity centers** and transit nodes
- ◆ **Mix of uses** in activity centers to promote alternative modes and shorten trip lengths
- ◆ Greater range of **housing and transportation choices**, including **transit service expansion**
- ◆ Maximize utility of **existing infrastructure**



Preferred Scenario Components

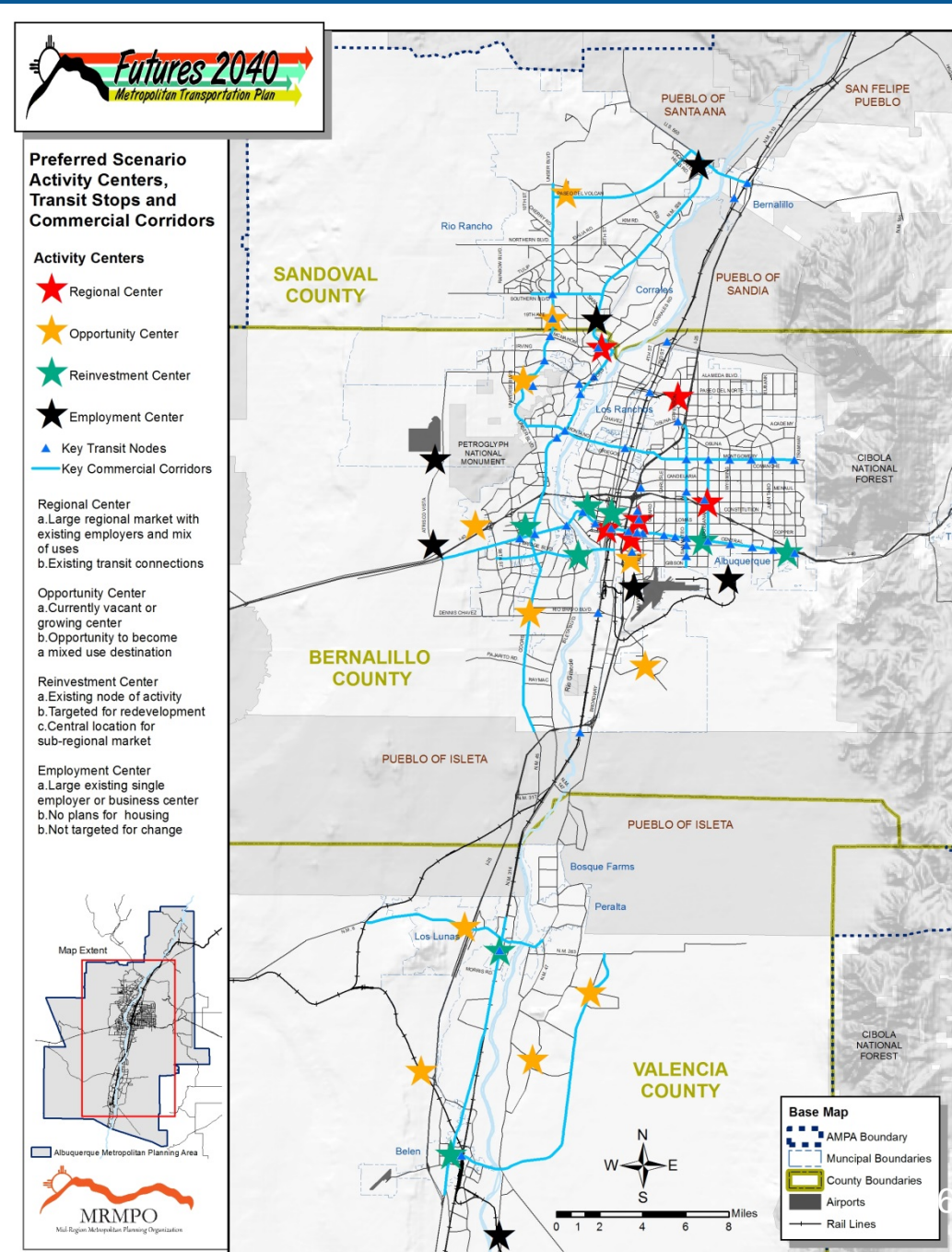
◆ Increase attractiveness:

- ◆ Activity Centers
- ◆ Transit Nodes

◆ Infrastructure differences:

- ◆ Same roadway network
- ◆ Built-out transit network

◆ Same levels of population and employment growth as the Trend Scenario



Scenario Planning Modeling Process

- ◆ UrbanSim – market-based land use forecasting tool
- ◆ Cube – four-step travel demand model
- ◆ Integrated models with feedback loop
 - ◆ 2012 base year, 2025 iteration, 2040 forecast



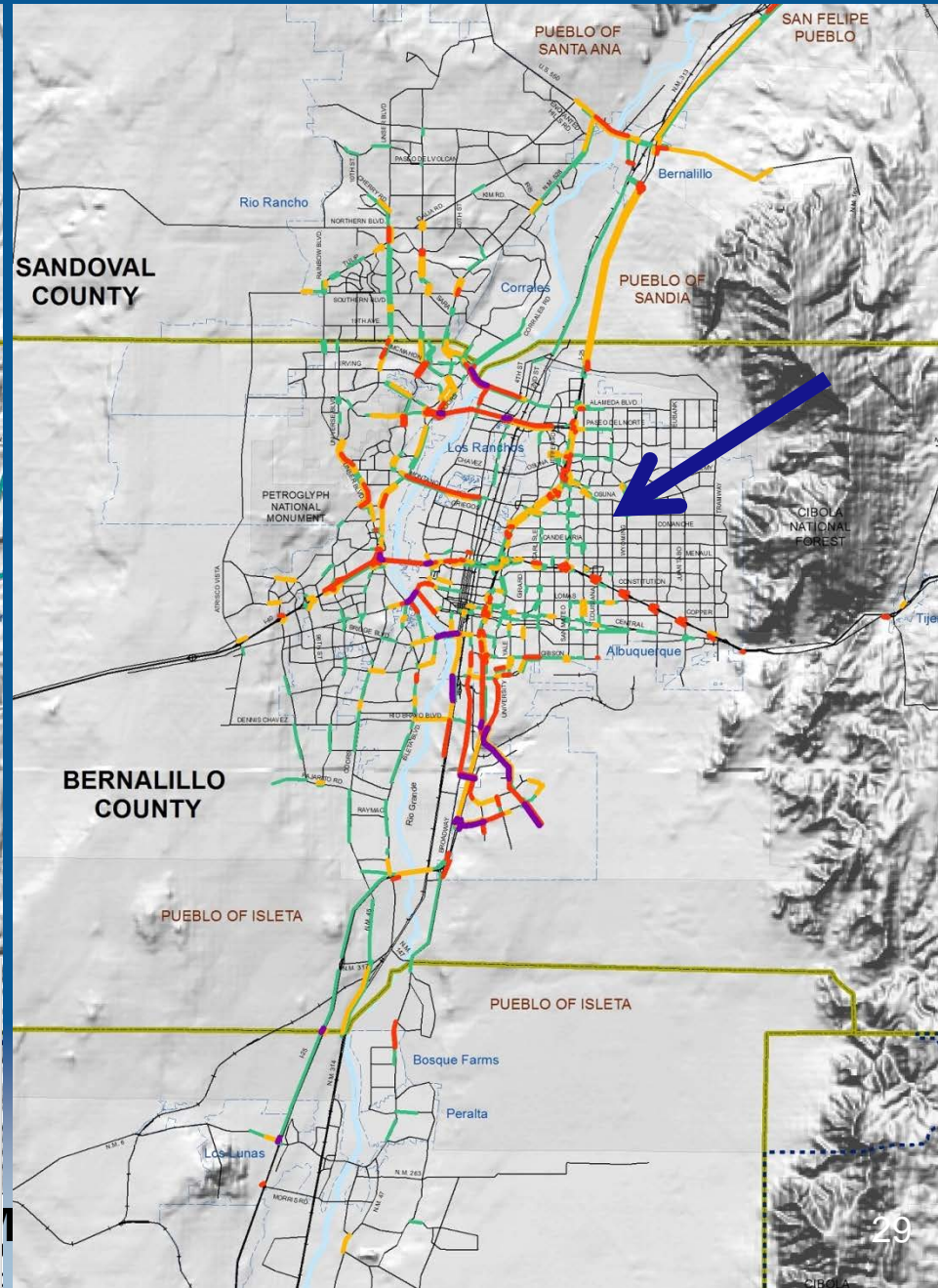
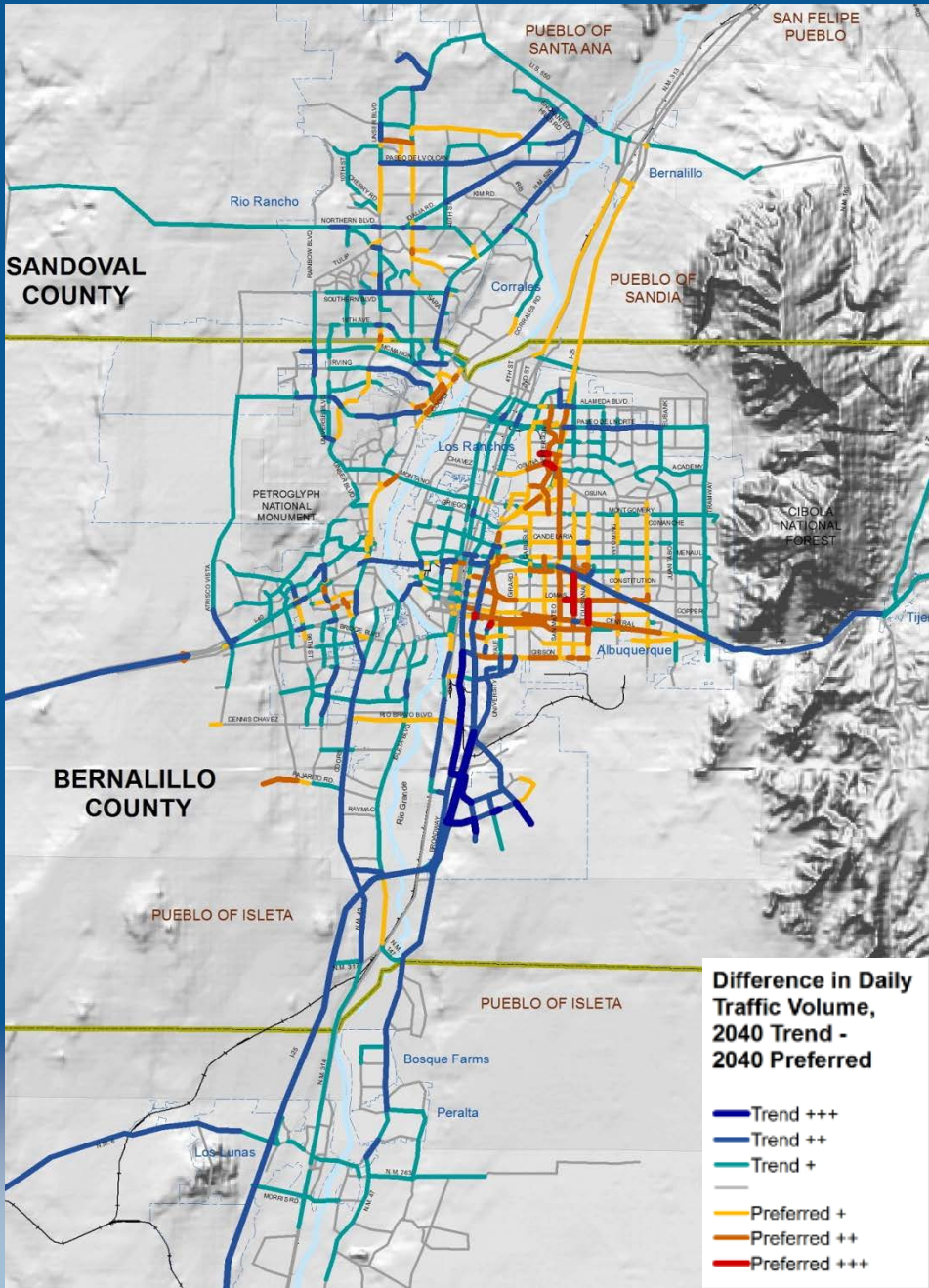
Scenario Planning Modeling Process

- ◆ Carrots rather than sticks approach to future development
 - ◆ Apply “shifters” to incentivize development in certain locations
 - ◆ Growth was not forced or allocated manually
- ◆ **Key question:** Does emphasizing growth in activity centers and near transit reduce development in at-risk locations?
- ◆ Evaluate distribution of growth and resulting transportation conditions

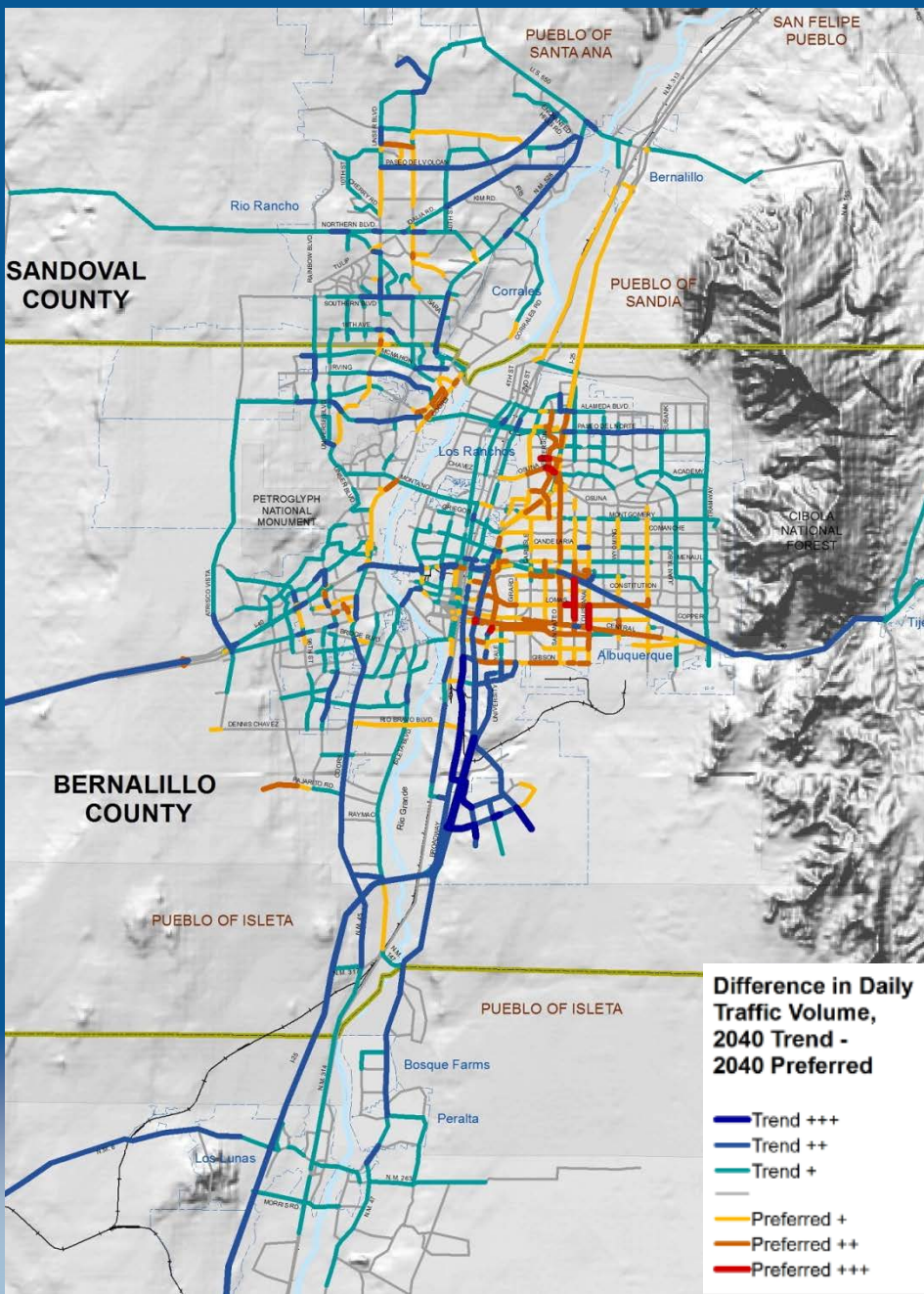


Volume: Trend vs. Preferred

Congestion: 2040 Preferred



Differences: Trend vs. Preferred



◆ Average speeds ↑ **15%**

◆ Commute time ↓ **18%**

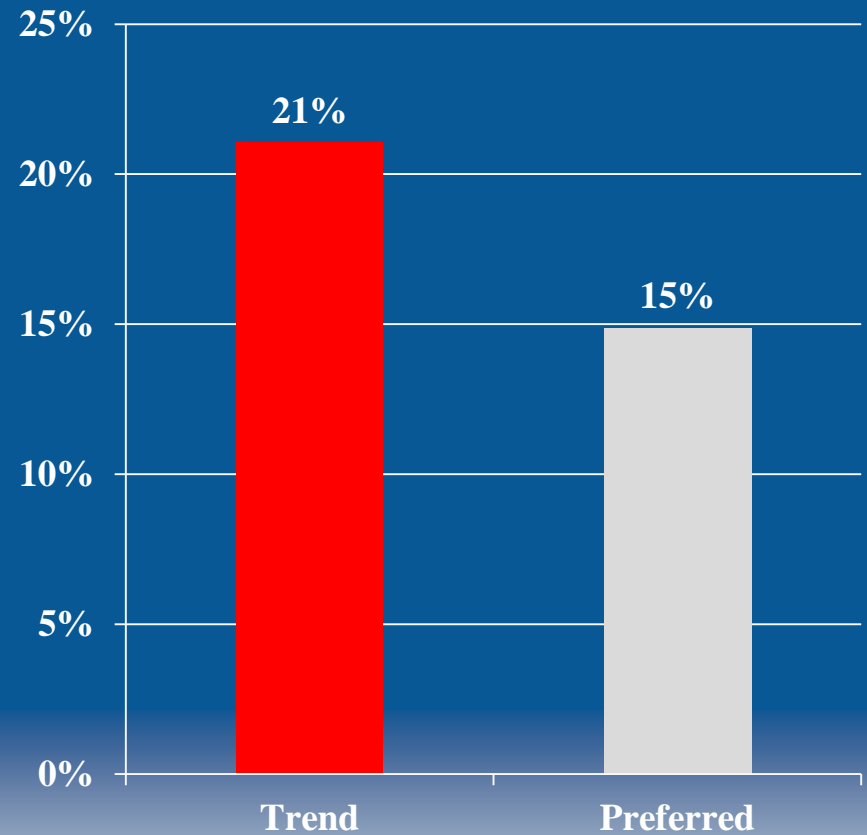
◆ Hours traveled ↓ **17%**

◆ Miles traveled ↓ **4%**

Development Footprint

- ◆ 5% reduction in overall number of acres consumed in 2040 in the Preferred Scenario compared to the Trend Scenario
- ◆ 12,600 fewer acres of residential development

New Land Developed

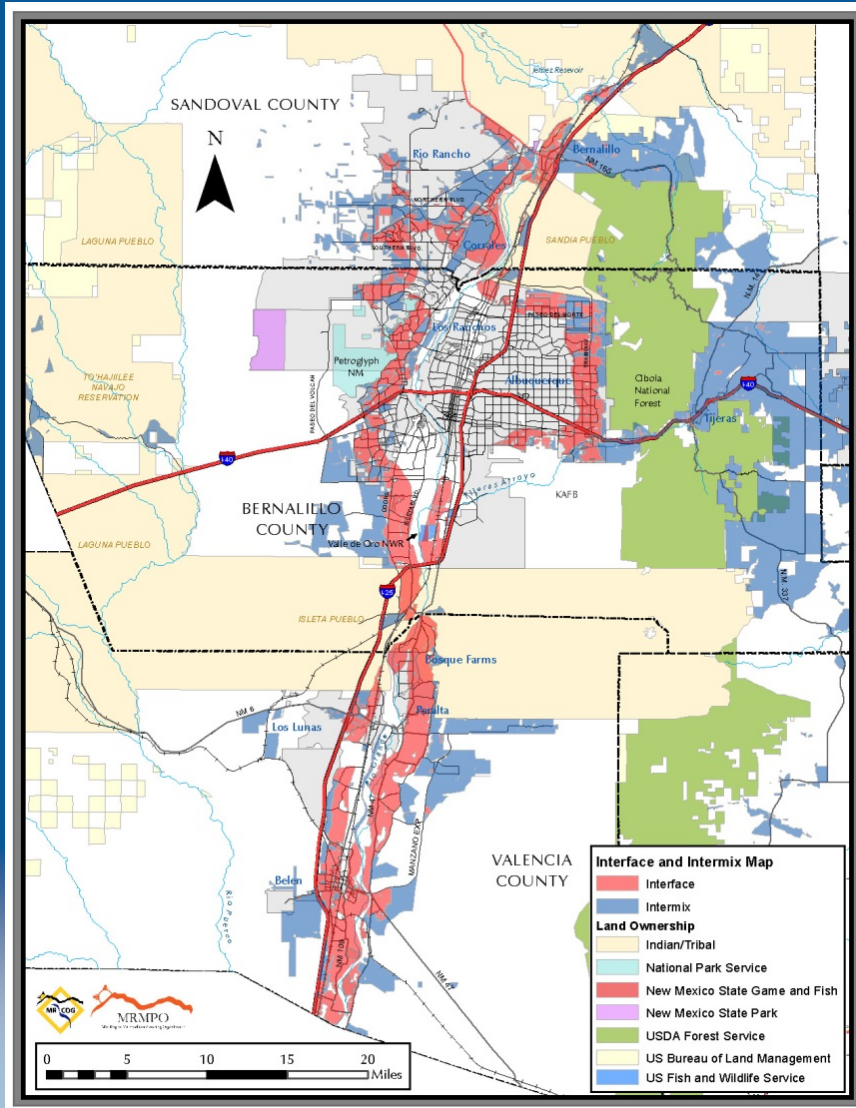


Climate Change-Related Evaluation Measures

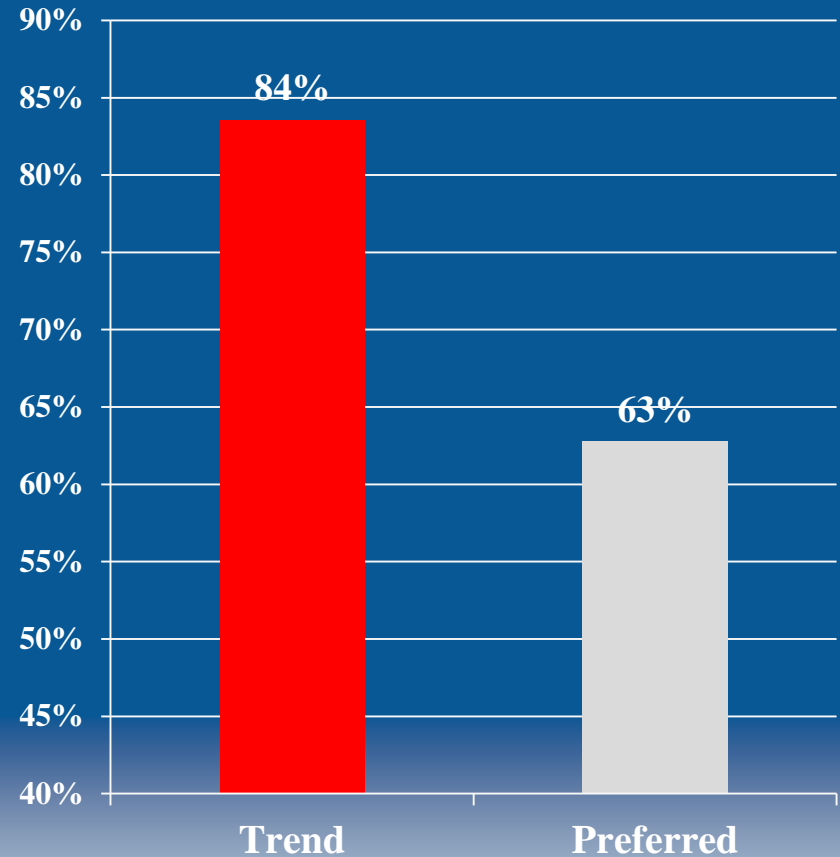
- ◆ Wildland-Urban Interface (wildfire risk area)
- ◆ FEMA-designated 100-year floodplains
- ◆ Crucial Habitat Assessment Tool
- ◆ Water consumption
- ◆ CO₂ emissions



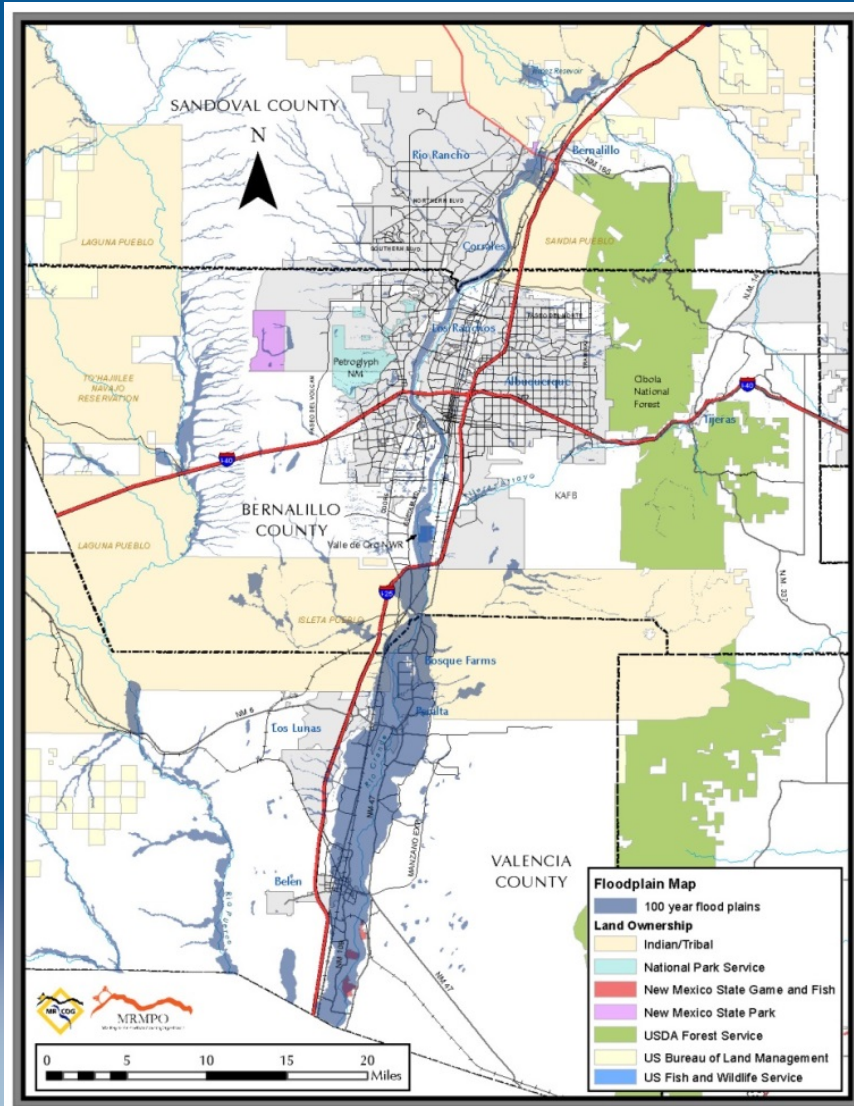
Wildland-Urban Interface



Housing + Employment Growth – Intermix Area Only



100-Year Floodplains



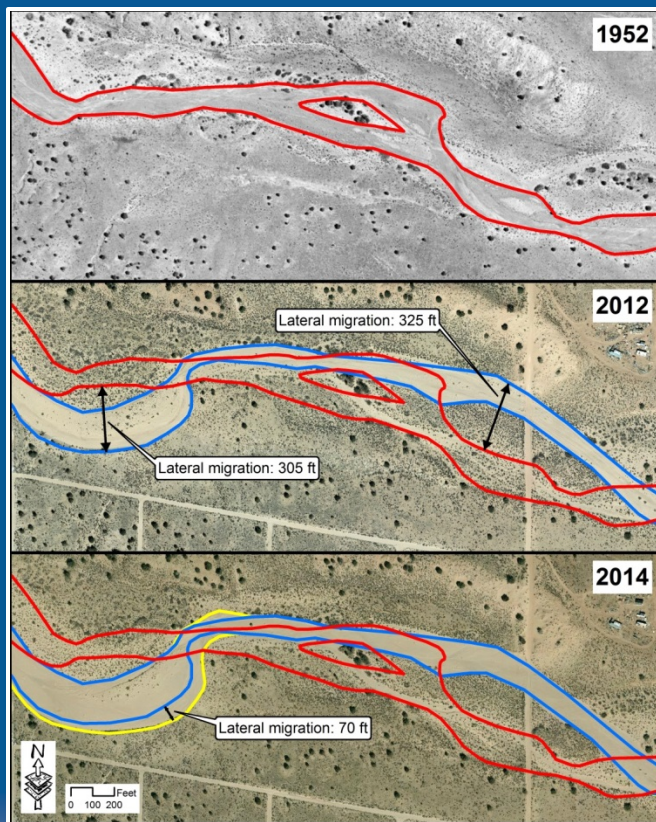
What we hoped to do:

- ◆ Quantify potential increase in flood risks
- ◆ Identify areas that will be at risk as climate conditions change
- ◆ Measure current and future development on new high-risk areas

100-Year Floodplains

What we ended up doing:

- ◆ Case study: potential changes to 100-year 24-hour design storm on Calabacillas Arroyo
 - ◆ 10% increase in precip. → 25% increase in flow
 - ◆ 25% increase in precip. → 75% increase in flow

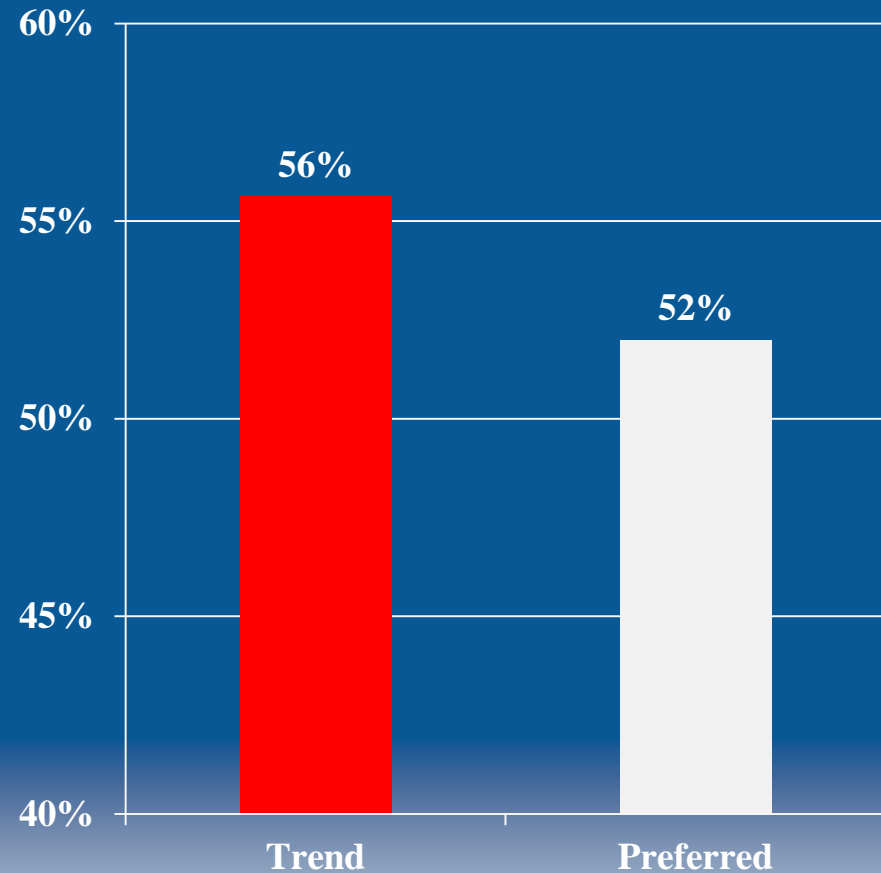


High Flood Risk Area

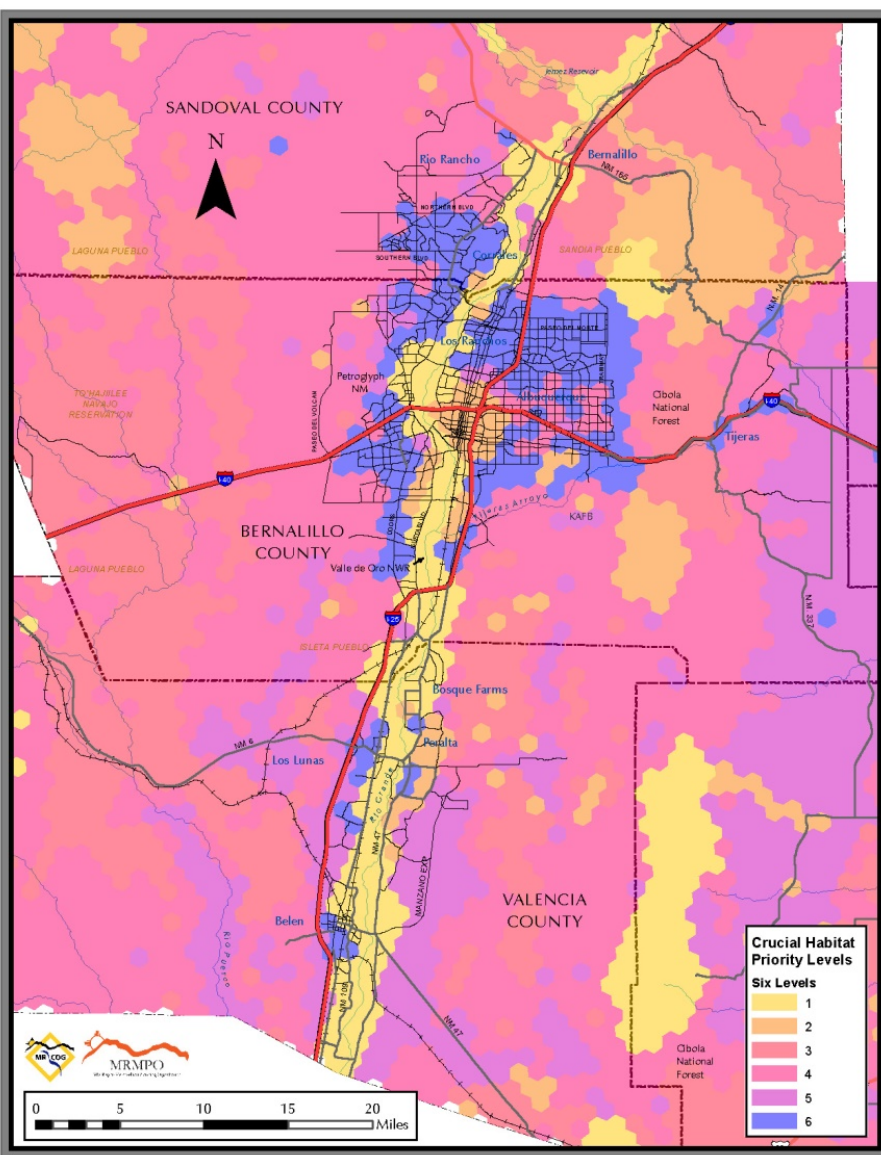
What we ended up doing:

- ◆ Measure current and future development on existing flood plains only
- ◆ Reduce zoning capacity in floodplains by 20% (minimal impact)

Housing + Employment in 100-Year Floodplains



Crucial Habitat Areas

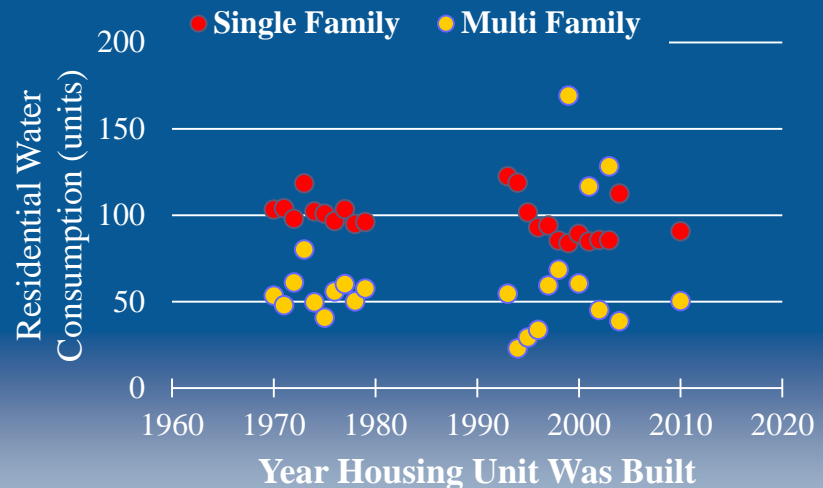
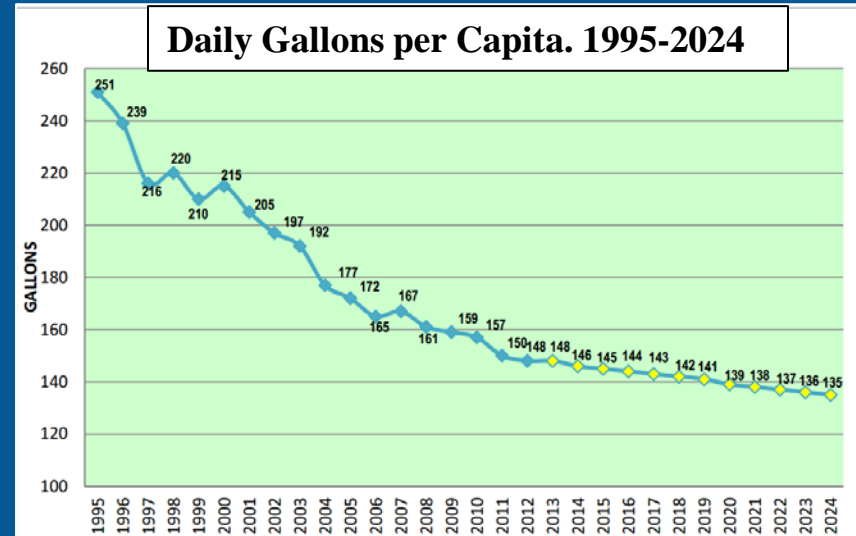


- ◆ Western Governors Association tool – ranking for 1-mi² hexagons
- ◆ Overlay land use with crucial habitat scores
- ◆ Challenges:
 - ◆ Most critical locations are in the urban core - Lowest risk areas also those subject to potential sprawl
- ◆ Not much difference between scenarios
- ◆ Conclusion: Better to develop more intensively in areas where development already exists

Water Consumption

- ◆ How we grow impacts how much water we consume
- ◆ Analyze consumption patterns by land use type and housing mix:
 - ◆ Single-family vs multi-family
 - ◆ Large-lot vs small-lot
- ◆ Daily residential consumption dropping locally and nationally
 - ◆ 1994: 250 gallons per capita
 - ◆ Today: ~135 gallons per capita

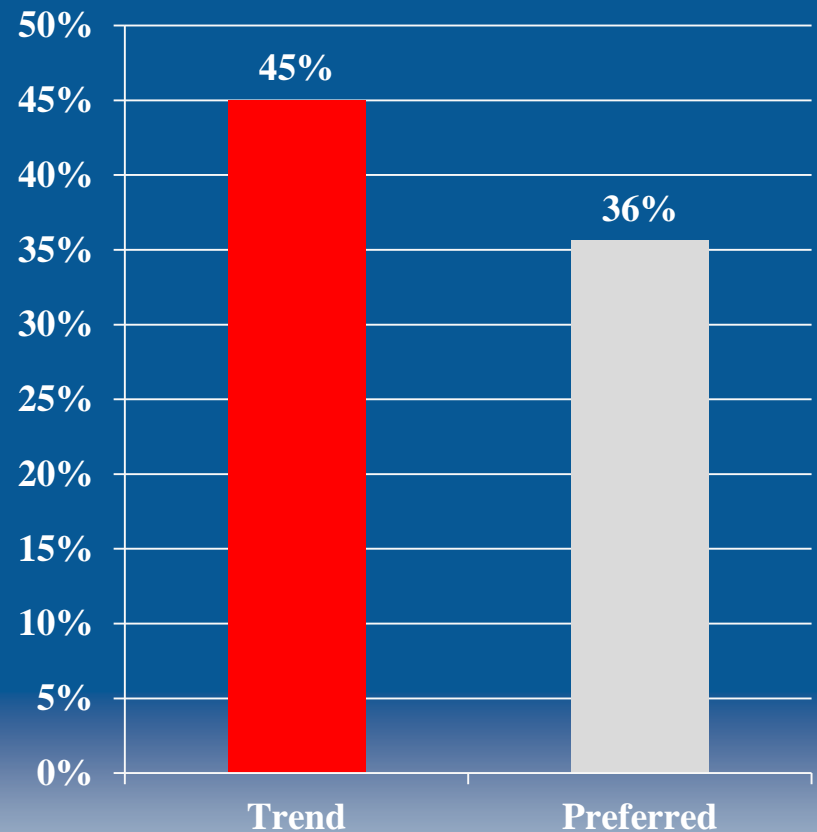
Source: Albuquerque Bernalillo County Water Utility Authority



Water Consumption

- ◆ Multi-family housing units consume less water on a per-capita basis
- ◆ Correlation between lot size and consumption for single-family homes
- ◆ Determine water consumption per acre for different land uses
- ◆ 5.5 billion fewer gallons consumed annually for residential purposes in Preferred Scenario

Residential Water Consumption



Emissions Reduction Strategies

Preferred Scenario

Components:

- ◆ Expanded transit service
- ◆ Transit-oriented development
- ◆ Land use / increased density
 - ◆ Zoning
 - ◆ Infill
 - ◆ Development incentives
- ◆ Many other strategies are discussed in the 2040 MTP but could not be included in modeling environment
- ◆ Additional analysis conducted by project team

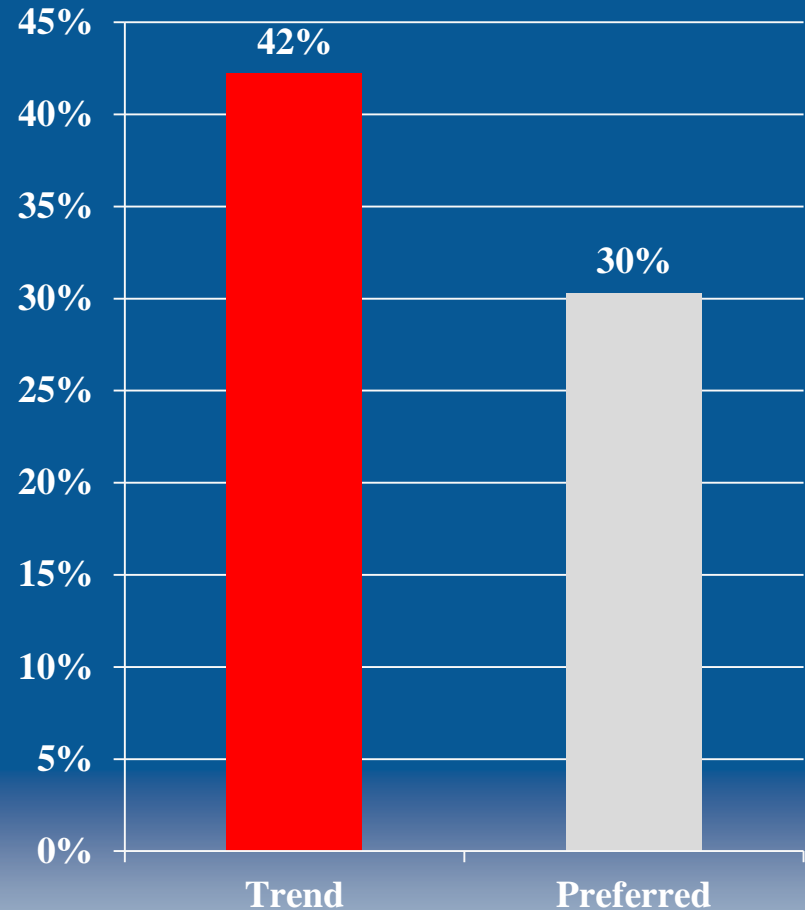


GHG Emissions

Preferred Scenario:

- ◆ Reduction in VMT, VHT, VHD
- ◆ Reduction in river crossing trips
- ◆ Increase in systemwide speed
- ◆ Increase in proximity to jobs, activity centers
- ◆ Increase in transit usage

Mobile-Source CO₂ Emissions



Changes in Preferred Scenario Compared to Trend Scenario

New Land Developed	-5%
Vehicle Miles Traveled	-4%
CO ₂ Emissions	-8%
Residential Water Consumption	-6%
Growth in Flood Risk Areas	-2%
Growth in Fire Risk Areas	-10%
Development in Crucial Habitat Areas	-1%



Lessons Learned

Tying scenario planning to metropolitan transportation planning process has its pros and cons

Pros

- ◆ Structure of MTP (built-in forecasting) ensures scenario planning is linked to policy decisions
- ◆ Market-based modeling tools generated realistic scenarios that were immediately respected

Cons

- ◆ MTP development process is constrained by member agency policies and investment decisions
- ◆ Market-based modeling approach not utilized to diagnose necessary changes in region



Lessons Learned / Discussion

- ◆ Land use and transportation scenarios lend themselves to creative spatial analysis
- ◆ Analysis requires understanding of changing conditions and impacts to natural features (e.g. floodplains, fire risk areas)
- ◆ Creating an inventory of vulnerable infrastructure and at-risk locations is a challenging but critical first step
- ◆ Few agencies are linking climate change impacts with development policies and transportation decision-making, so the MPO has a role to play
- ◆ Should we talk about climate change directly, or co-benefits?



Project Benefits

- ◆ Climate change as framing device for scenario planning and a way to introduce new measures
- ◆ Connection between transportation, land use, and water
- ◆ Create a sense of urgency
- ◆ Agency connections
 - ◆ Project intended to integrate federal-land management areas into MPO planning
 - ◆ New partnerships:
 - Bureau of Reclamation
 - Army Corps of Engineers
 - Water Utility Authority
 - University of New Mexico
 - Sandia National Labs



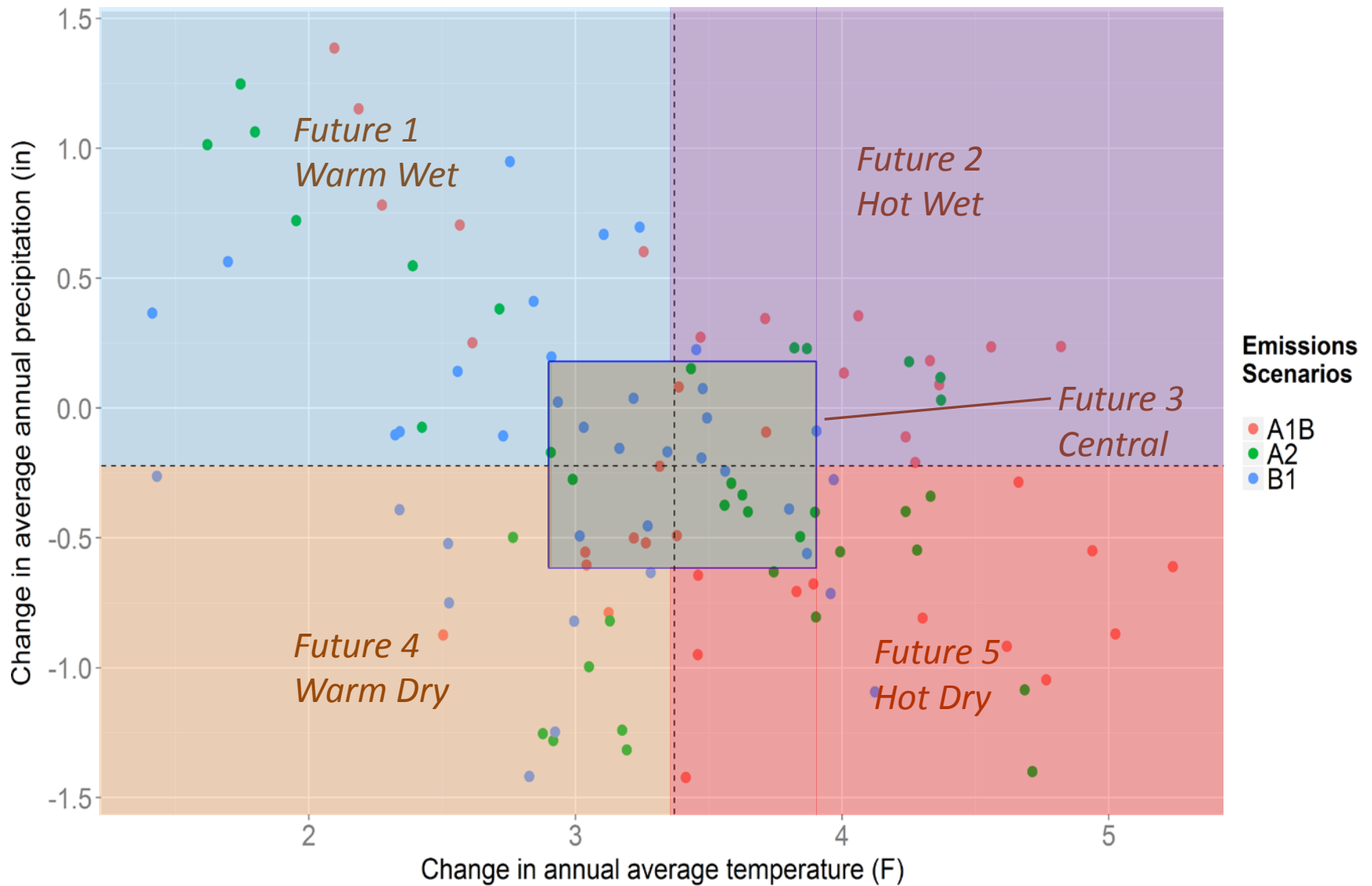
Downscaled Climate Data Processing Tool

Variables
Precipitation (mm/day)
Maximum daily temperature (°C)
Minimum daily temperature (°C)
Average daily temperature (°C)— <i>derived by averaging max & min</i>
Average daily wind speed

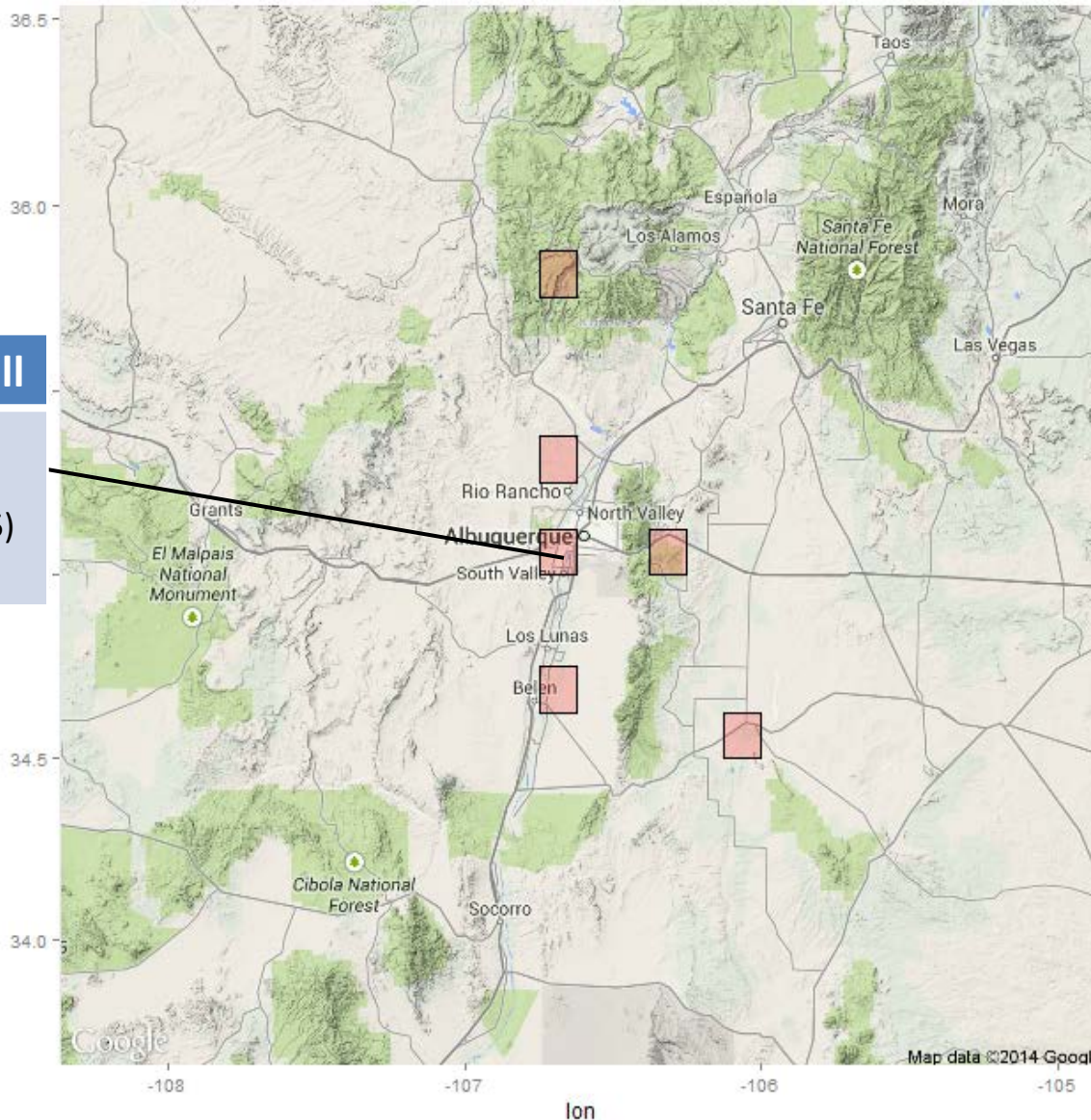
Projections Range
1950-2099

- ❑ Downscaled (fine spatial resolution translations) of CMIP3 climate projections
- ❑ Based on 112 model runs: 9 models, 3 emissions scenarios
- ❑ Supplied by Bureau of Reclamation Technical Services Center
- ❑ Updated CMIP5 projections recently became available (July 2014)

Changes in climate means in 2040, by GCM run

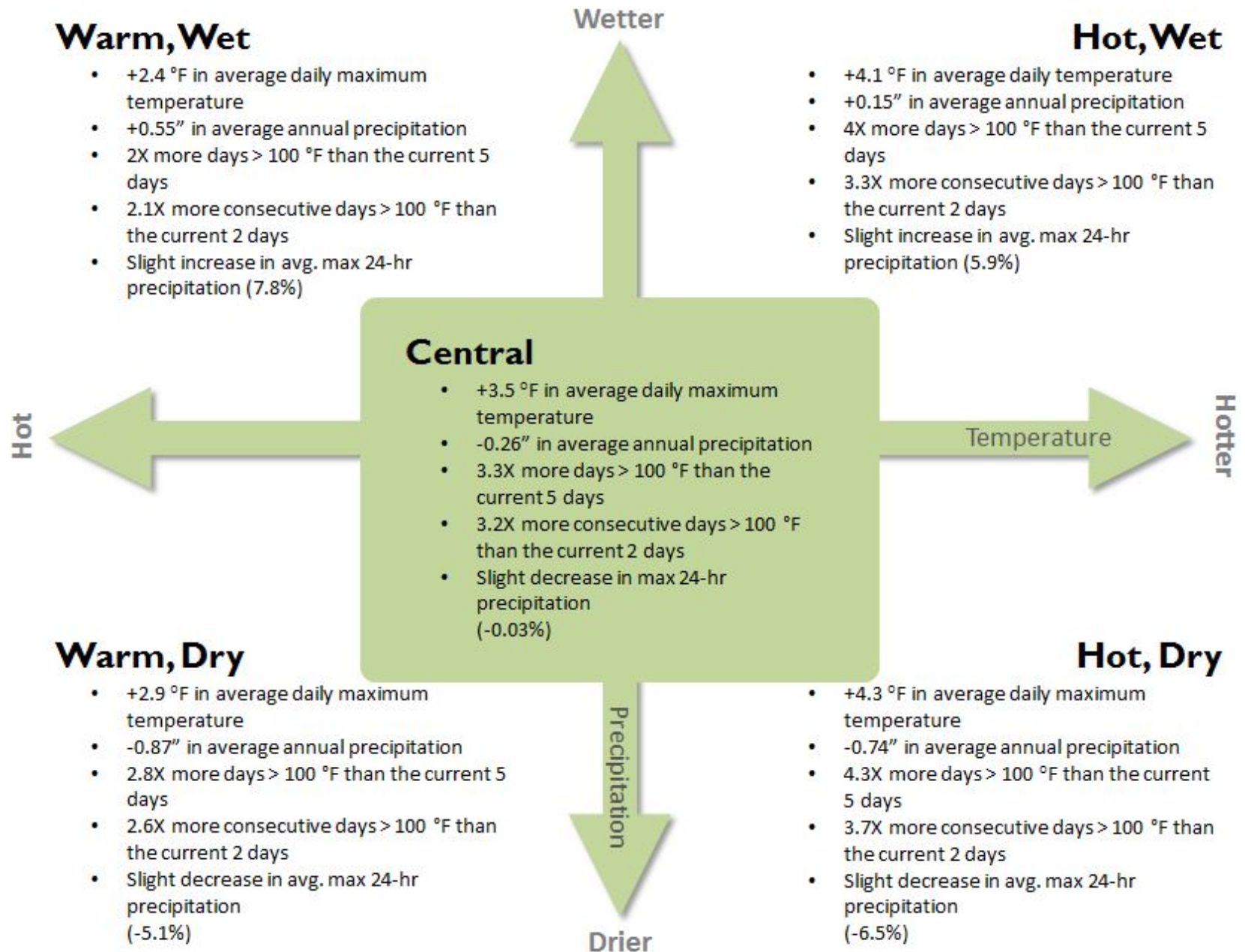


MRCOG-Identified Grid Cells of Interest



Original Grid Cell
SW quadrant of
Albuquerque
(35.0625, -106.6875)
Elevation: 4,940 ft.

Central NM Climate Futures - 2040



MRCOG-Identified Grid Cells of Interest

Grid Cell #1

Rio Rancho area, N of Albuquerque
(35.3125, -106.6875)
Elevation: 5,615 ft.

Grid Cell #5

Santa Fe National Forest, N of Albuquerque
(35.8125, -106.6875)
Elevation: 7,435 ft.

Original Grid Cell

SW quadrant of Albuquerque
(35.0625, -106.6875)
Elevation: 4,940 ft.

Grid Cell #3

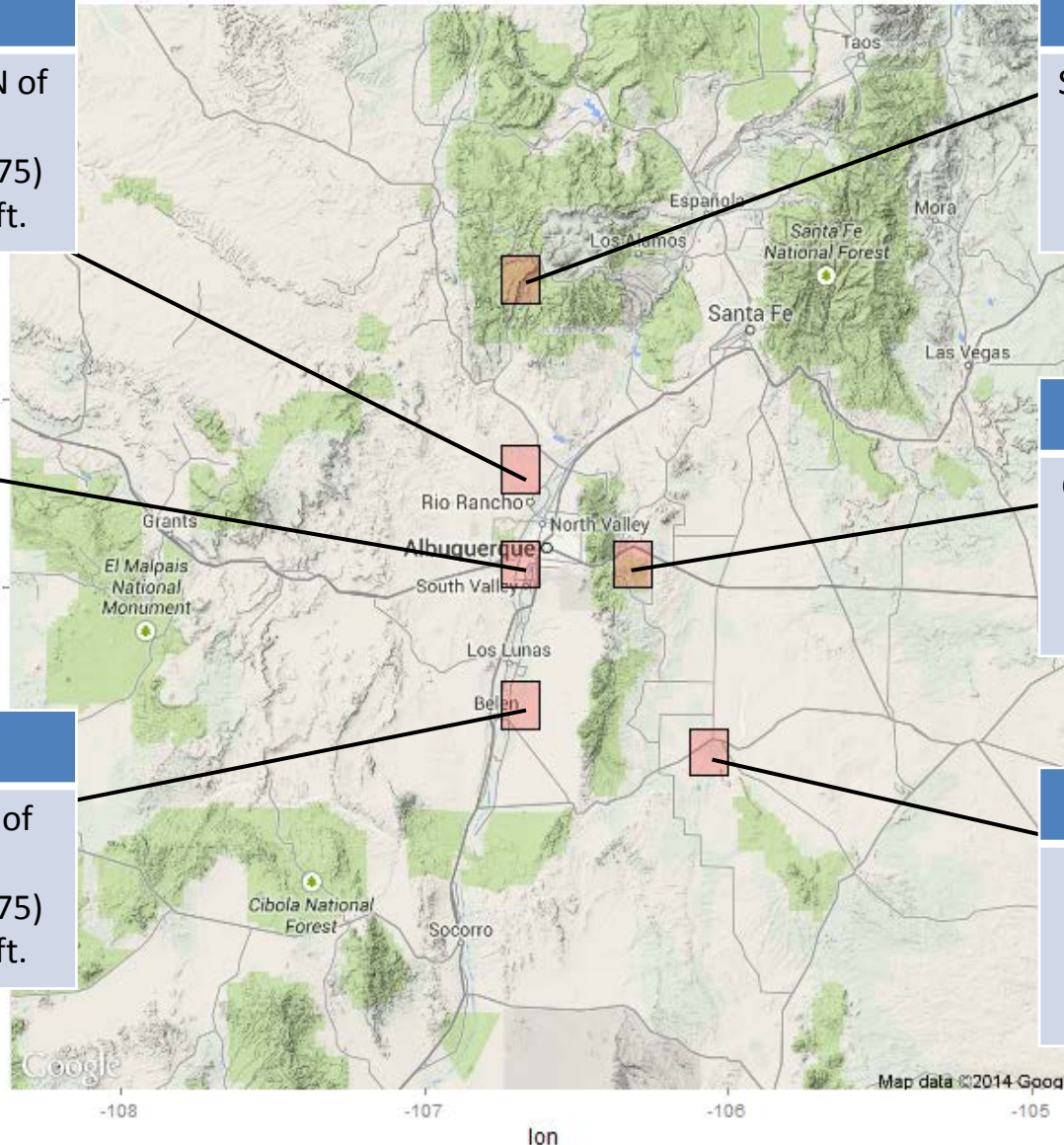
Cibola National Forest, E of Albuquerque
(35.0625, -106.3125)
Elevation: 7,025 ft.

Grid Cell #2

Los Lunas area, S of Albuquerque
(34.6875, -106.6875)
Elevation: 5,005 ft.

Grid Cell #4

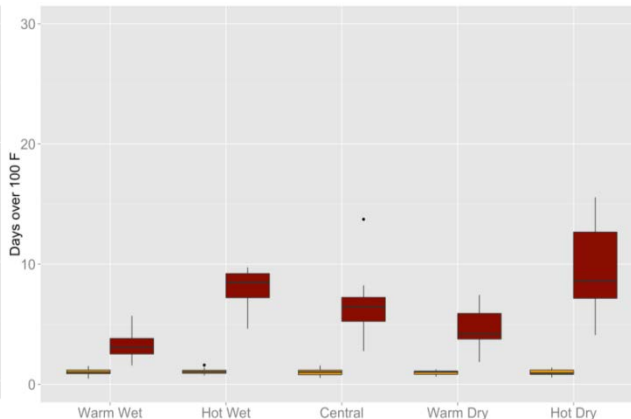
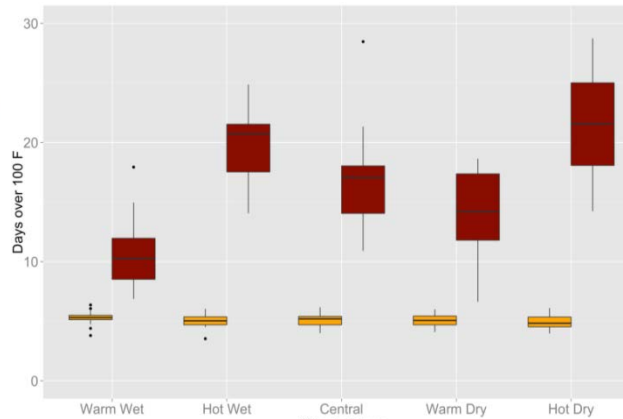
General desert area, SE of Albuquerque
(34.5625, -106.0625)
Elevation: 6,155 ft.



Total Days Over 100°F in Baseline (1950-1999) and 2040 (2025-2055 average)



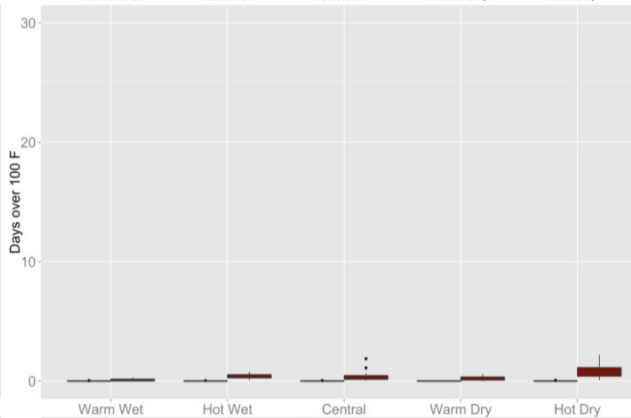
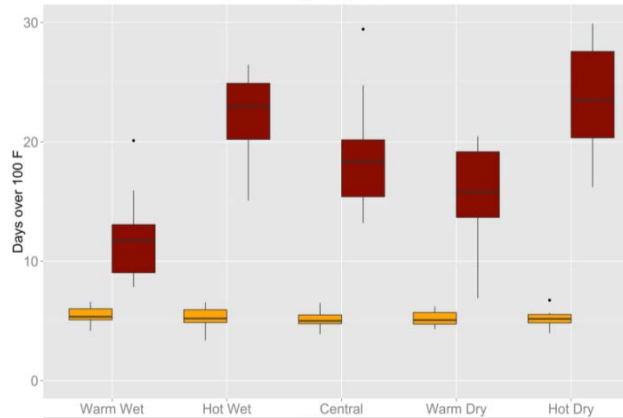
Original Grid Cell



Grid Cell #1



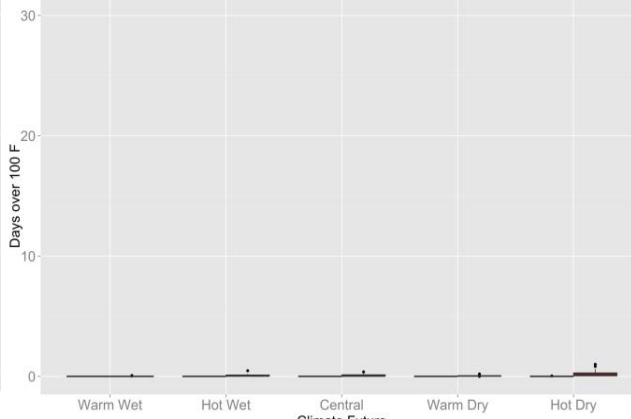
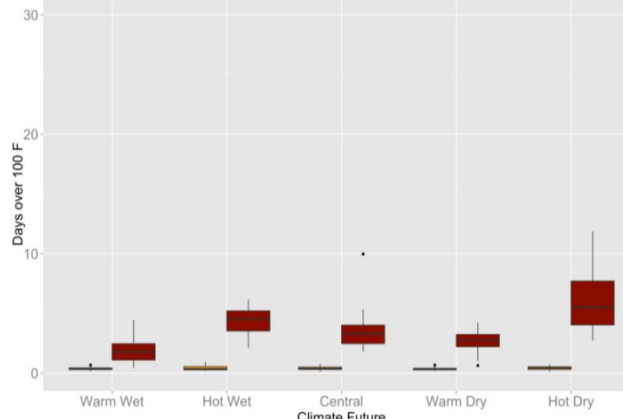
Grid Cell #2



Grid Cell #3



Grid Cell #4



Grid Cell #5

Mitigation Component

- ❑ Greenhouse Gas Mitigation Strategies
 - Analysis Completed During Scenario Planning Workshop Phase
 - Higher Priority Strategies Evaluated Post-Workshop
 - Strategies to be Discussed in Final Report
- ❑ Summary of Work by Department of Civil Engineering at the University of New Mexico
 - Dr. Gregory Rowangould
 - Mohammad Tayarani
 - Amir Poorafakhraei

Strategy	GHG Mitigation Potential	Analysis Capability
Analysis Completed During the Scenario Planning Phase		
Zoning changes	●●●●● L	●●●●● U
Infill development	●●●●○ L	●●●●○ U
Transit oriented development	●●●●○ L	●●●●○ U,C
Improving public transportation	●●●○ S	●●●○ C
Higher Priority Strategies Evaluated		
Urban growth boundaries	●●●●● M	●●●●● U
“Wheels” tax (VMT charging) & Gas Tax	●●●●● S	●●●●○ C
Bicycle and pedestrian infrastructure improvements	●●●○ S	●●○○○ O,P,Q
Incident management	●●○○○ S	●○○○○ Q
Traffic signal enhancement	●●○○○ S	●●○○○ C,P
Establishing roadway connectivity standards	●●○○○ L	●●○○○ C
Lower Priority Strategies to be Discussed in Final Report		
Bike sharing	●○○○○ S	●○○○○ Q
HOV facilities	●○○○○ M	●○○○○ Q,P
Building design standards	●●○○○ L	●○○○○ Q
Establishing a complete streets policy	●●○○○ L	●○○○○ Q
Road pricing (HOT lanes/congestion charging)	●●○○○ S	●○○○○ C,P
Parking management	●●○○○ S	●●○○○ C
Car sharing	●○○○○ S	●○○○○ Q
Ride sharing	●○○○○ S	●●○○○ Q,C
Travel demand management-educational	●○○○○ S	●○○○○ Q
Travel demand management-transit incentives	●●○○○ S	●○○○○ Q,P
Intersection improvement	●○○○○ S	●●●○○ P,C
Electric vehicle infrastructure support	●●○○○ M	●○○○○ Q,M
Heavy-duty vehicle retrofit	●○○○○ M	●●○○○ Q,M

Strategies Evaluated in Scenario Planning Workshops Using Models

- ❑ Zoning Changes
 - Allowable densities/uses
- ❑ Infill Development
 - Increased probability of development through incentives
- ❑ Transit-Oriented Development
 - Increased densities through zoning and incentives
 - Mode shift/access through transit access
- ❑ Improving Public Transportation
 - Mode shift/access through transit access

Other High Priority GHG Mitigation Strategies

- ❑ Urban Growth Boundaries
- ❑ VMT Tax
- ❑ Bicycle Infrastructure
- ❑ Incident Management
- ❑ Traffic Signal Enhancement
- ❑ Roadway Connectivity

Urban Growth Boundary

- ❑ Prohibiting future development outside the existing metropolitan area footprint
- ❑ Travel demand model analysis/EPA MOVES model
- ❑ Comparison to Preferred Scenario:
 - Additional reduction in per capita VMT by 2 percent
 - Additional reduction in GHG emissions by 3.8 percent

VMT Tax

- ❑ Increasing the cost of driving by imposing a per-mile charge to driving
- ❑ The tax rate matters
 - If VMT tax is set to be equal to today's fuel tax, it could increase emissions by reducing incentives to drive fuel-efficient vehicles
 - A VMT tax set to be higher than today's fuel tax reduces driving incentives

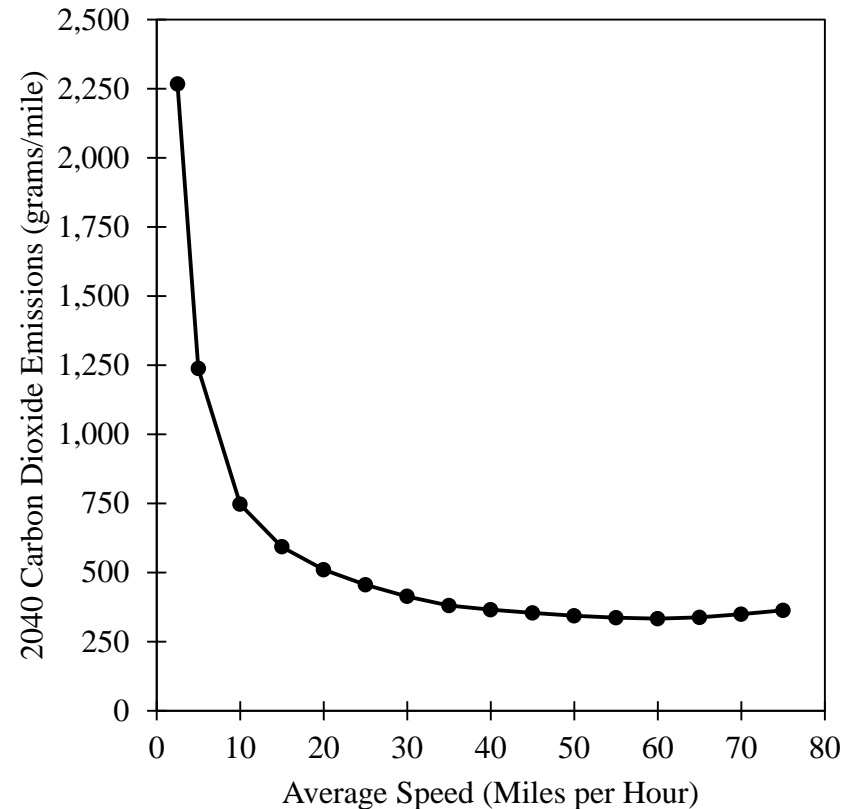
Additional VMT Tax	Equivalent Gas Tax Increase (\$/gallon)	Daily VMT per Capita	CO ₂ -eq (tonne/day)	% Change in CO ₂ -eq
\$0.00	\$0.00	20.0	13,352	0%
\$0.03	\$0.62	19.4	12,572	-6%
\$0.06	\$1.24	18.5	11,959	-10%
\$0.12	\$2.47	17.1	10,968	-18%
\$0.25	\$5.15	15.0	9,616	-28%
\$0.50	\$10.30	12.3	7,955	-40%

Bicycle Infrastructure

- ❑ Travel demand model estimates bike trips based solely on household characteristics and trip distance; it does not factor in presence of bicycle or pedestrian facilities
- ❑ Analysis of full build out of City of Albuquerque's Bicycle Plan
- ❑ Comparison to Preferred Scenario:
 - Additional 0.4 percent decrease in VMT and GHG emissions
 - Cost of providing bike lanes and paths is small

Incident Management

- ❑ Incident management programs should reduce GHG emissions if they reduce delays and increase speed
- ❑ No studies exist that quantify GHG emissions reduction from incident management programs



Traffic Signal Enhancement

- ❑ Adaptive signal control to optimize signal timing along corridor
 - Bernalillo County installed such a system on Alameda Blvd
 - Traffic data was collected before and after showing reduced morning peak travel time by 21 percent and evening peak travel time by 11 percent and reduction of GHG emissions of 5.9 percent
- ❑ Applied a reduction factor to two other congested corridors

Road	CO ₂ -eq (tonnes/day)				
	Before	After	Change	% Change	% of 2040 Total
Alameda	60.8	57.2	-3.6	-5.9%	-0.03%
Montgomery/Montano	288	276	-12.0	-4.2%	-0.09%
Coors	442	426	-15.6	-3.5%	-0.12%

Roadway Connectivity

- ❑ Street grids provide shorter path options for travel than less connected networks with cul-de-sacs and dead ends and provide better bicycle/walk/transit conditions
- ❑ Prior studies indicate a VMT elasticity of -0.12 for both:
 - Intersection density
 - Proportion of four-way intersections
- ❑ Four districts of the metropolitan area were evaluated

Neighborhood	Area (km ²)	Intersections	Intersection Density	% Change in VMT from SW Albuquerque ^a
SW Albuquerque	0.78	51	65.6	0.0%
NW Albuquerque	0.71	50	70.6	-0.9%
University Area	0.67	56	83.9	-3.3%
Downtown Albuquerque	0.45	52	116.8	-9.4%

Conclusions from Additional Analysis

- Additional GHG mitigation strategies will result in lower GHG emissions than what was included in the preferred scenario

	CO2-eq Reduction	
Growth Boundary	512	3.8%
VMT Tax 0.005 per mile ^a	107	0.8%
VMT Tax 0.03 per mile	780	5.8%
VMT Tax 0.12 per mile	2,384	17.9%
Bicycle Infrastructure	49.1	0.4%
Traffic Signal Enhancement	27.6	0.2%

Resources Available

- ❑ Final Report/Guidebook
- ❑ Technical Report
- ❑ Integration Plan
- ❑ Reports for BLM and FWS

U.S. Fish & Wildlife Service
Preparing for a Changing Climate
Valle de Oro National Wildlife Refuge

About the Refuge
 Valle de Oro National Wildlife Refuge is the Department of the Interior's first urban wildlife refuge and the first U.S. Fish and Wildlife Service unit developed in accordance with the Standards of Excellence for Urban Refuges, a guiding strategy for engaging urban communities in wildlife conservation. This location serves as an essential ecological, educational, and recreational resource for the greater Albuquerque metropolitan area.

Upon the refuge's inception in 2012, FWS issued a solicitation for proposals to develop and implement a 20-year conservation plan by addressing urban citizens in the national wild. FWS collaborated with other federal and regional entities to accomplish this mission and, since the refuge's dedication, has sustained these partnerships to resolve other challenges. Together, the partners have designed important flood mitigation infrastructure, developed and issued funding for alternative transportation routes, and assessed climate change to advise and fund sound plans for the region's future.

Preparing for Climate Change in Central New Mexico
 Across the United States, communities are increasingly responding to a changing climate with a variety of natural and man-made infrastructure where they live, work, and play. Climate change has the potential to dramatically alter which plants and animals live in a region, as well as sea level rise, drought, and other adverse conditions that may risk infrastructure, health, livelihood, or food.

The U.S. Fish and Wildlife Service's (FWS) mission is to conserve, protect, and enhance fish, wildlife, and plants

and their habitats for the continuing benefit of the American people. As such, FWS is dedicated to preparing for and mitigating the impact of climate change to protect natural habitats and the benefits that healthy ecosystems provide for communities.

In the Albuquerque region, FWS is addressing climate change by:

- Participating in research to better understand how climate change may affect Central New Mexico
- Developing a new urban refuge, Valle de Oro National Wildlife Refuge (NWRL), which helps FWS assess and reduce natural habitat, provides flood protection for surrounding communities, and provides opportunities for local residents to experience and learn about the natural environment.
- Providing a transferable model that FWS will use around the U.S. to help other communities.

New Mexico Climate Change Adaptation Plan
 FWS partnered with federal and regional partners to conduct research through the Climate Change Scenario Planning Project (CCSP), which studied potential temperature and precipitation changes, and projected associated impacts on area wildlife, in order to inform planning for the region's future.

According to the CCSP's findings, by 2040, the Central New Mexico region will experience a 2.4°F to 3.9°F increase in annual average temperature and between a 30% decrease in 10% increase in average annual precipitation. Temperature changes are projected to be more pronounced in the summer and there will be more drought regardless of precipitation change due to increased evaporation from higher temperatures.

Based on sophisticated modeling, climatologists also expect more and longer heat waves, less snowfall and more rain and more extreme, variable precipitation. This means that although there may be more drought in the future there may also be more heavy rain events and floods.

Temperature and precipitation strongly influence the number and distribution of species. These changes have profound implications for natural resources and habitat both on the refuge and region-wide. The potential effects of climate change on species and ecosystems include:

- Declines in species populations and shifts in distribution
- Changes to plant and animal life cycles
- Increased invasion by exotic species
- Spread of pathogens and pests
- Further fragmentation of habitat and wildlife corridors

Integrating Climate Change in Transportation and Land Use Scenario Planning
 An Example from Central New Mexico

3/4/2015

Central New Mexico Climate Change Scenario Planning Project
 Final Report

April 2015
 DOT-VNTSC-FHWA-15-10

Prepared for:
 Federal Highway Administration
 U.S. Fish and Wildlife Service
 Bureau of Land Management

U.S. Department of Transportation
 2014 A Vision National Transportation Systems Center

Integration Plan for the Mid-Region Council of Governments: Central New Mexico Climate Change Scenario Planning Project
 June 30, 2015

Introduction
 The Central New Mexico Climate Change Scenario Planning Project (CCSP) is a multi-agency collaboration to research the potential impacts of climate change on the Central New Mexico region's land use development and transportation system to inform regional planning. As part of the CCSP, the project team analyzed strategies that the region could take to adapt to climate change, increase its resiliency, and mitigate greenhouse gas (GHG) emissions. As part of the CCSP, the Mid-Region Council of Governments (MRCOG), the metropolitan planning organization for the Albuquerque Metropolitan Planning Area, used the CCSP team's analysis of potential future climate change impacts to evaluate the relative resiliency of its land use and transportation planning scenarios for its metropolitan transportation plan (MTP), the Future 2040 MTP.

The purpose of this Integration Plan is to provide useful information on strategies that MRCOG and its partners can pursue over the next five years to adapt regional policies, programs, and data collection procedures to further the goals of environmental protection, climate change mitigation, climate change adaptation, and resiliency. These strategies will help MRCOG further integrate these goals into its next MTP.

This Integration Plan explores potential implementation strategies for the following policy focus areas. For each focus area, the Plan provides examples of similar policies and programs in other regions, as well as recommendations for the role that MRCOG could play in supporting these implementation strategies.

- **Transportation Climate Change Adaptation Assessment:** Identifies strategies to fill existing data gaps to better understand present and potential future flood, heat, and wildlife vulnerability for the region's transportation assets.
- **Mitigating GHG Emissions from Electronics Generation:** Identifies two primary strategies for reducing GHG emissions from transportation facilities - retrofitting streets/lights to light-emitting diode (LED) technology and installing renewable energy generation facilities in transportation rights-of-way.
- **Nonmotorized, Transit-Oriented Activity Centers:** Analyzes land use and transportation strategies to support the development of "activity centers" with concentrated development near transit.
- **Regional Support for Travel Demand Management:** Analyzes potential regional strategies the region could adopt to use travel demand management (TDM) to incentivize reductions in vehicle miles traveled.
- **Open Space Preservation Programs and Policies:** Identifies several potential strategies for preserving regional open space to increase resiliency to flooding and wildfires and protect critical habitat areas.

<https://www.volpe.dot.gov/transportation-planning/valle-de-oro-national-wildlife-refuge-climate-change-scenario-planning-report>
 Mid-Region Council of Governments, 2014, Draft 2040 MTP Released - Accepting Public Comments, <http://www.mrcog.com/assets/new7133-crafb-2040-mtp-crafb.pdf>

Potential Climate Change Impacts and the BLM Rio Puerco Field Office's Transportation System: A Technical Report
 Prepared for the Bureau of Land Management's Rio Puerco Field Office, New Mexico

Erica Simmons, Paige Colton, Alexander Eppelt, Benjamin Rasmussen

March 2015
 DOT-VNTSC-BLM-15-01

Prepared for:
 Bureau of Land Management
 Rio Puerco Field Office
 Albuquerque, New Mexico

U.S. Department of Transportation
 2014 A Vision National Transportation Systems Center

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