Integrating Water into City Planning and Modeling Residential Urban Water Demand

Brandon Ruiz
Program Associate, Sonoran Institute
bruiz@sonoraninstitute.org

Matt Mulica
Policy Analyst, Keystone Policy Center
mmulica@keystone.org

Stu Feinglas
Senior Water Resources Analyst, City of Westminster
sfeingla@cityofwestminster.us

Kevin Reidy
State Water Conservation Technical Specialist
kevin.reidy@state.co.us

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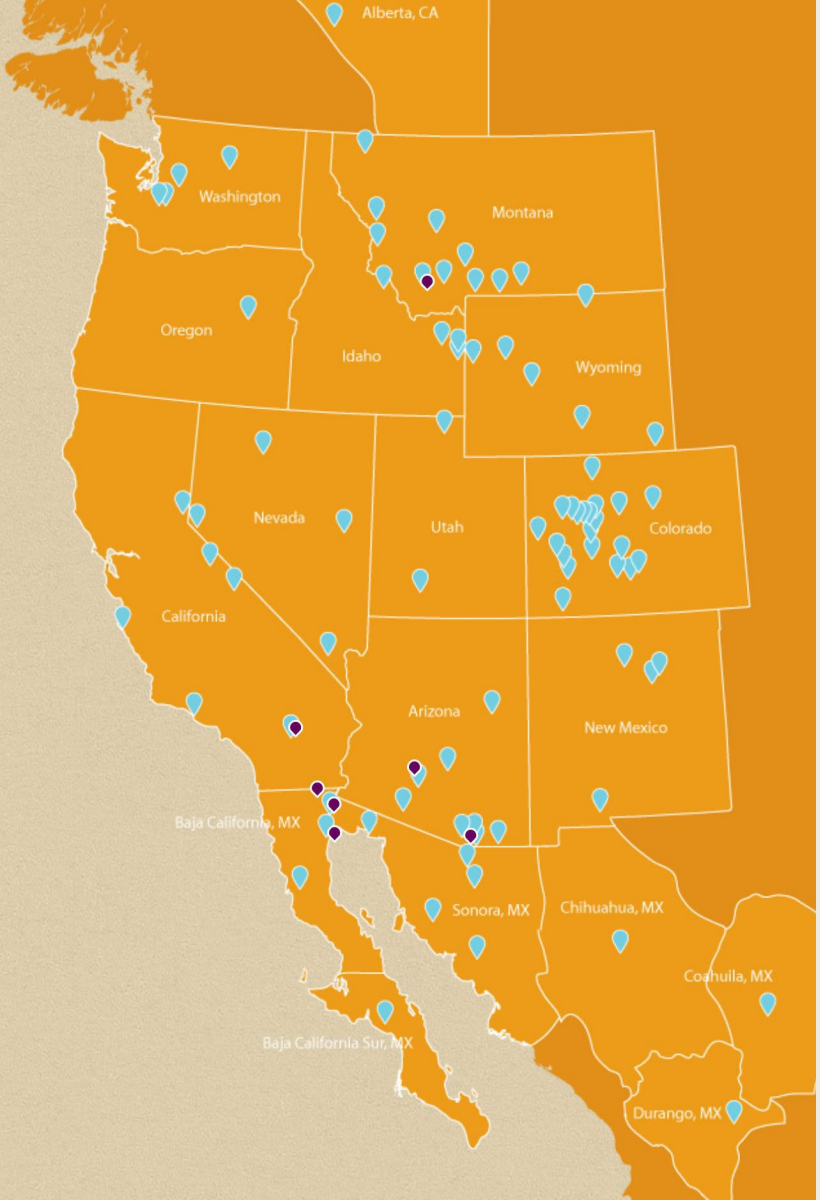

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Mission

Connect people/communities and natural resources

Nexus of **community, commerce, and conservation**

Civil dialogue and collaboration

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Resilient Communities and Watersheds

Tools, Training and Technical Assistance

Resilient Communities Starter Kit

- Adapting to Climate Change

Growing Water Smart

- Integrating water and land use planning

Exploratory Scenario Planning

- Preparing for an uncertain future

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Housekeeping

- 1 APA CM Hour
- Chat Box
- ResilientWest.org

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How we build matters

City of Westminster, CO

Colorado Water and Growth Dialogue

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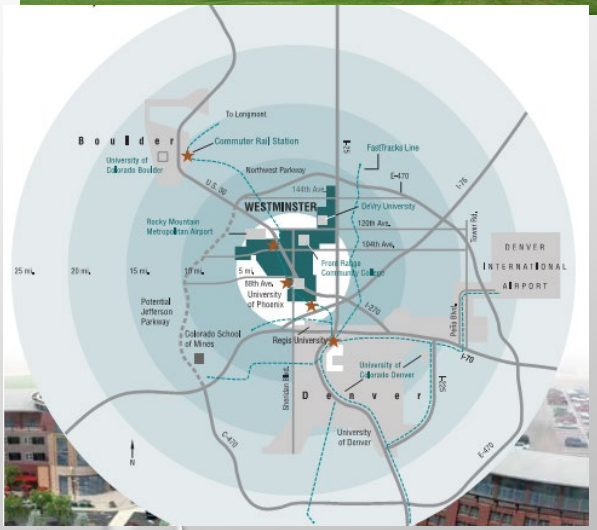
GETTING STARTED
INTEGRATING WATER & DEVELOPMENT

STU FEINGLAS – SENIOR ANALYST

WESTMINSTER

WHO IS WESTMINSTER?

- 115,520 POPULATION (2017 ESRI ANALYST)
- 134,193 WATER SERVICE POPULATION
- 32,500 WATER CUSTOMERS
- 34 SQUARE MILES
- BETWEEN DENVER AND BOULDER ON US HWY 36 CORRIDOR



HISTORIC GROWTH OF WESTMINSTER

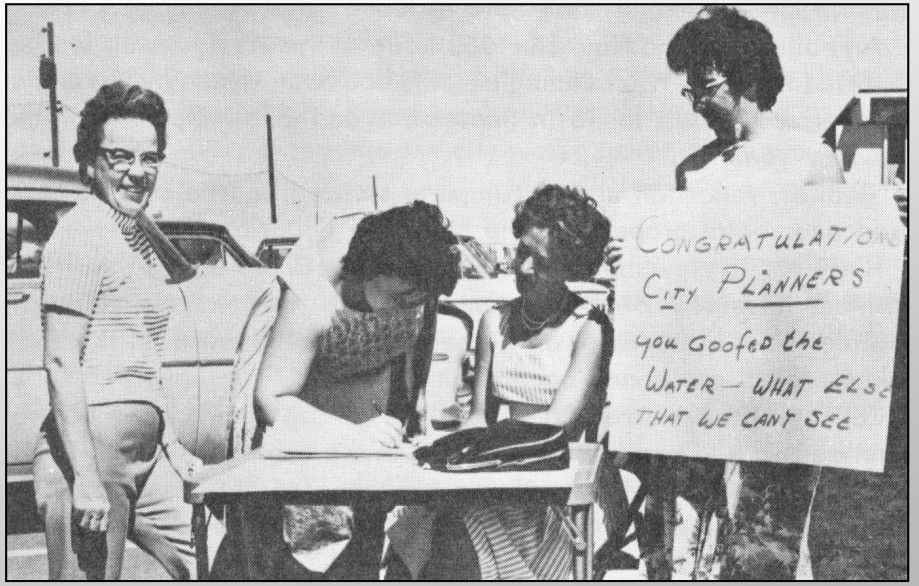
Year	Population
1920	235
1930	436
1940	534
1950	1,686
1960	13,850
1970	19,512
1980	50,211
1990	74,625
2000	100,940
2010	106,144
2017	115,520

- GROWTH SPIKED IN THE 1950S POST-ERA OF DEVELOPMENT – INFLUX OF RESIDENTIAL LENDING AND FHA PROGRAMS AFTER WWII AND ESTABLISHMENT OF BOULDER TURNPIKE IN 1952
- 1962 "MOTHERS MARCH" ON CITY HALL PROTESTING POOR WATER QUALITY, SPURRED THE CITY TO DEVELOP WATER SOURCES AND A NEW TREATMENT PLANT
- 1970-1971 MUNICIPAL LAND AREA INCREASED FROM 4.5 SQUARE MILES TO 28 SQUARE MILES THROUGH ANNEXATION
- 1970 TO 1980 WESTMINSTER POPULATION GREW 157% FROM 19,512 TO 50,211
- GROWTH OUTPACED AVAILABLE WATER SUPPLY
- CITY PURSUED PURCHASE OF WATER RIGHTS AND CONSERVATION PROGRAM
- GROWTH MANAGEMENT PROGRAM ESTABLISHED IN 1978 TO PACE DEVELOPMENT TO AVAILABLE SERVICES

THE LONG, HOT SUMMER OF ‘62

- WATER SHORTAGES REQUIRE CITY TO USE LOW QUALITY WATER
- POOR QUALITY WATER LEADS TO “MOTHERS’ MARCH”
- CITIZENS COMMITTEE ON WATER FORMED

- Stop building permits
- Ban lawn sprinkling
- Stop using Clear Creek water



COOPERATION IS OFTEN BORN OF ADVERSITY AND NEED

- WATER SUPPLY
- CURRENT CUSTOMERS
- GROWTH
- ECONOMY
- ENVIRONMENT

WHERE DID WE START?

- **VISION**
- A VISION FOR THE AREA MUST BE DEVELOPED BY DECISION MAKERS (CITY COUNCIL, COUNTY COMMISSIONERS, WATER PROVIDERS)

- **VALUE**
- THE REAL VALUE AND COST OF WATER AND INFRASTRUCTURE MUST BE BUILT INTO COSTS
- TEAMWORK DEVELOPS INTERDEPARTMENTAL VALUE

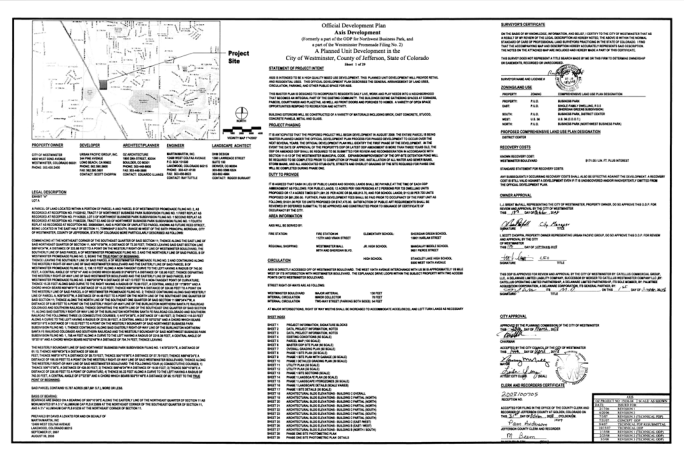
- **VARIABLE**
- THINGS CHANGE

STAKEHOLDERS

- WATER PROVIDER - PWU/WATER RESOURCES STAFF
- COMMUNITY DEVELOPMENT STAFF
- CITY COUNCIL
- DEVELOPMENT COMMUNITY
- PROPERTY OWNERS
- CITIZENS/CUSTOMERS
- …

DEVELOPED VS. DEVELOPED

- COMMUNITY DEVELOPMENT
  - APPROVED ACTIVE ODP

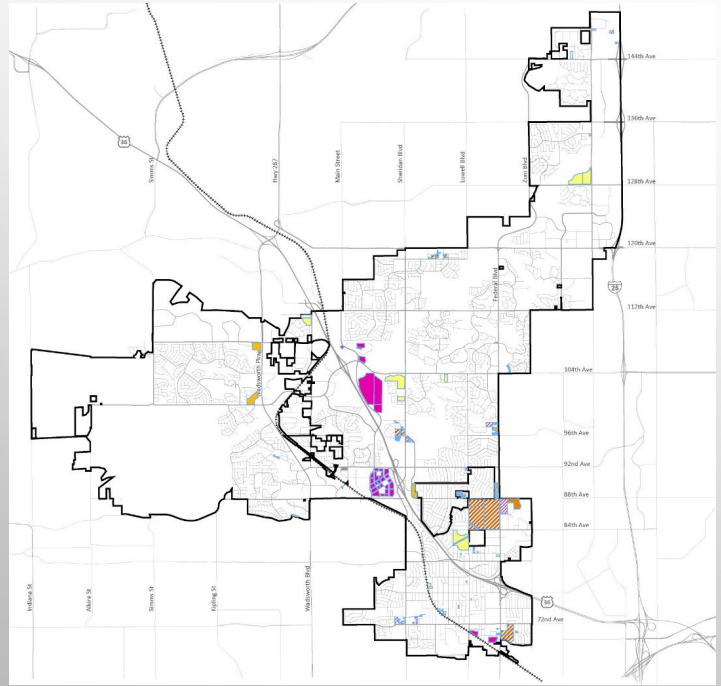


Official Development Plan
Aaks Development
(Formerly a part of the ODP for Northwest Business Park, and
a part of the Westminster Promenade Filing No. 2)
A Planned Unit Development in the
City of Westminster, County of Jefferson, State of Colorado

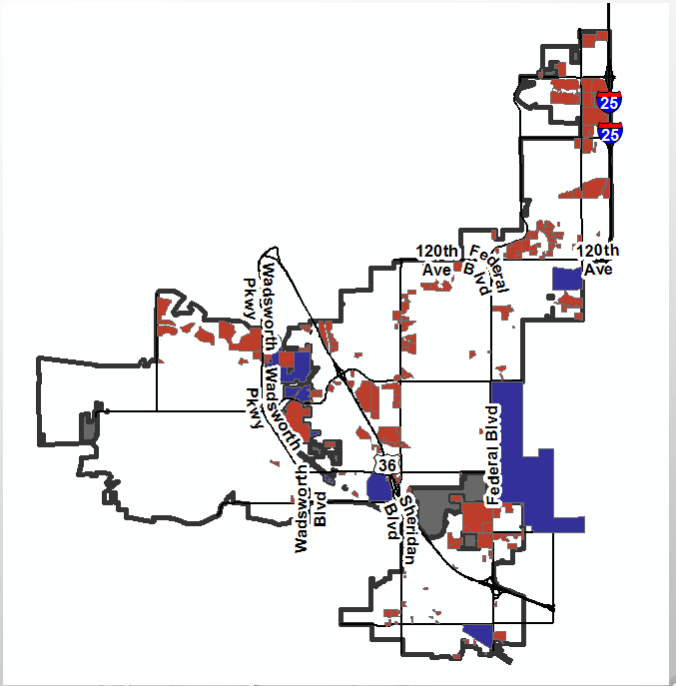
- PUBLIC WORKS & UTILITIES
  - BUILT AND FULLY OCCUPIED
  - 2 – YEARS FULL WATER USE

DEVELOPING A COMMON LANGUAGE

Community Development
Vacant Residential Land



Public Works & Utilities
Undeveloped Land



WESTMINSTER'S TIMELINE

- SERVICE COMMITMENT COMPETITION 1980'S
- IMPLEMENT NEW TAP FEE PROCESS - *COORDINATION*
  - TAP SIZE
  - ESTIMATED WATER RESOURCES REQUIRED TO SERVE THE PROJECT
  - IRRIGATION TAP FEES BASED ON AREA AND LANDSCAPE TYPE
- WATER RESOURCES BEGINS CALCULATING TAP FEES IN COORDINATION WITH BUILDING – *COORDINATION*
- 2002 DROUGHT – INCREASED PROMINENCE OF WATER SUPPLY PLANNING AND CONSERVATION.

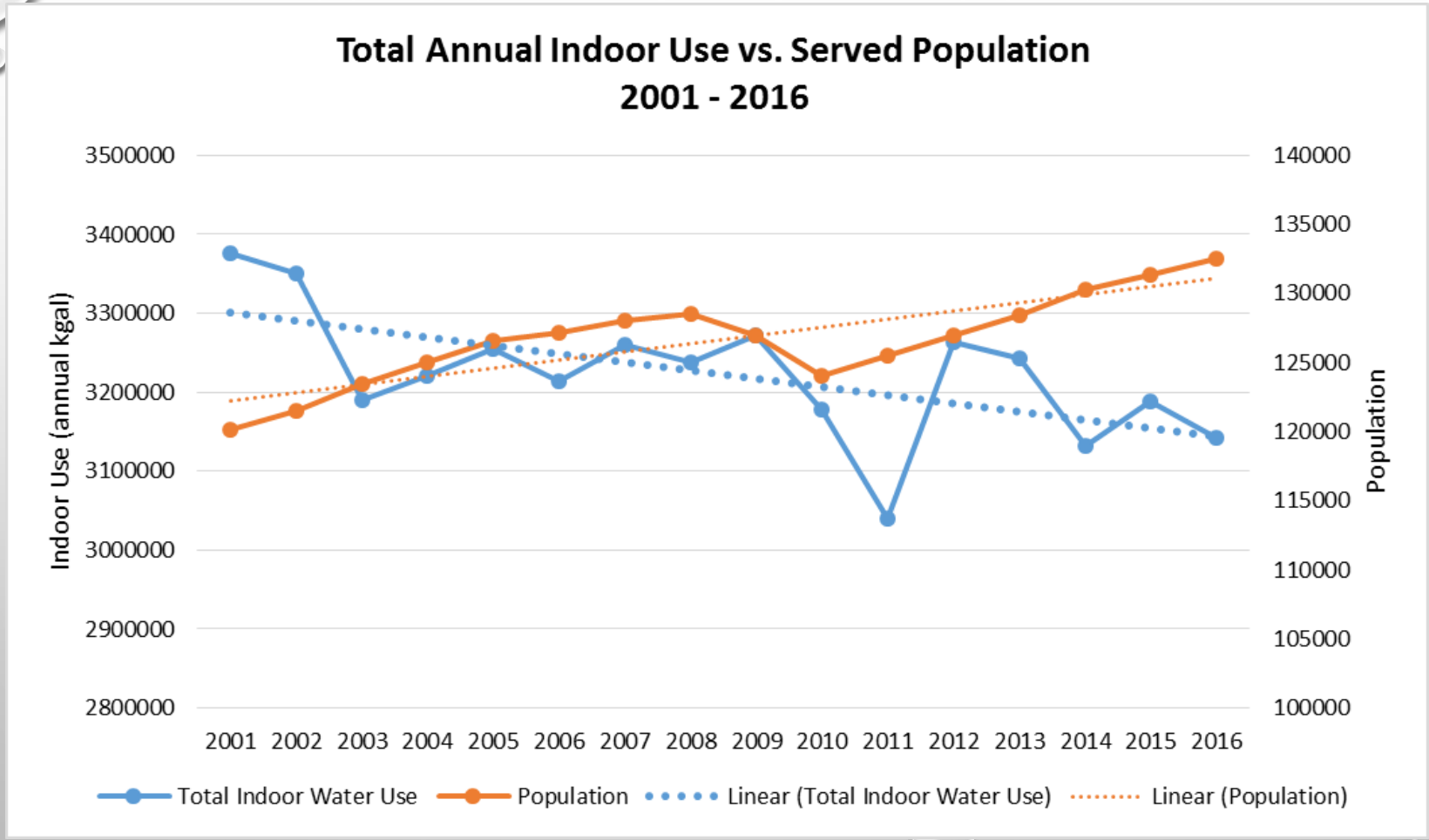
WATER RESOURCES BENCHMARKS

- BASED ON BUSINESS TYPE
- CHARGED PER "SERVICE COMMITMENT" 140,000 ANNUAL GALLONS
- $13,963 BASED ON $32,500/AF 2018

Category Name	Units	Unit Use * (gal/unit/yr)
Auto Service & Repair	sf	21.7
Car Wash	bay	2,100,000 (15 SC)
Childcare	sf	60
Church	sf	31.5
Clubhouse/Pool	unit	140000 (1 SC)
Grocery Store	sf	38.5
Gas Station no Car Wash	sf	242
Hospital	sf	59.97
Hotel/Motel	room	23566
Medical Office	sf	35.7
Multi-family	unit	69925
Office	sf	8
Recreation w/ pool	sf	148.8
Recreation w/o pool	sf	55
Restaurant	sf	200
Retail	sf	29
School	sf	12.4
Senior Housing includes irrigation	unit	0
Warehouse/Industrial	sf	7

POST DROUGHT

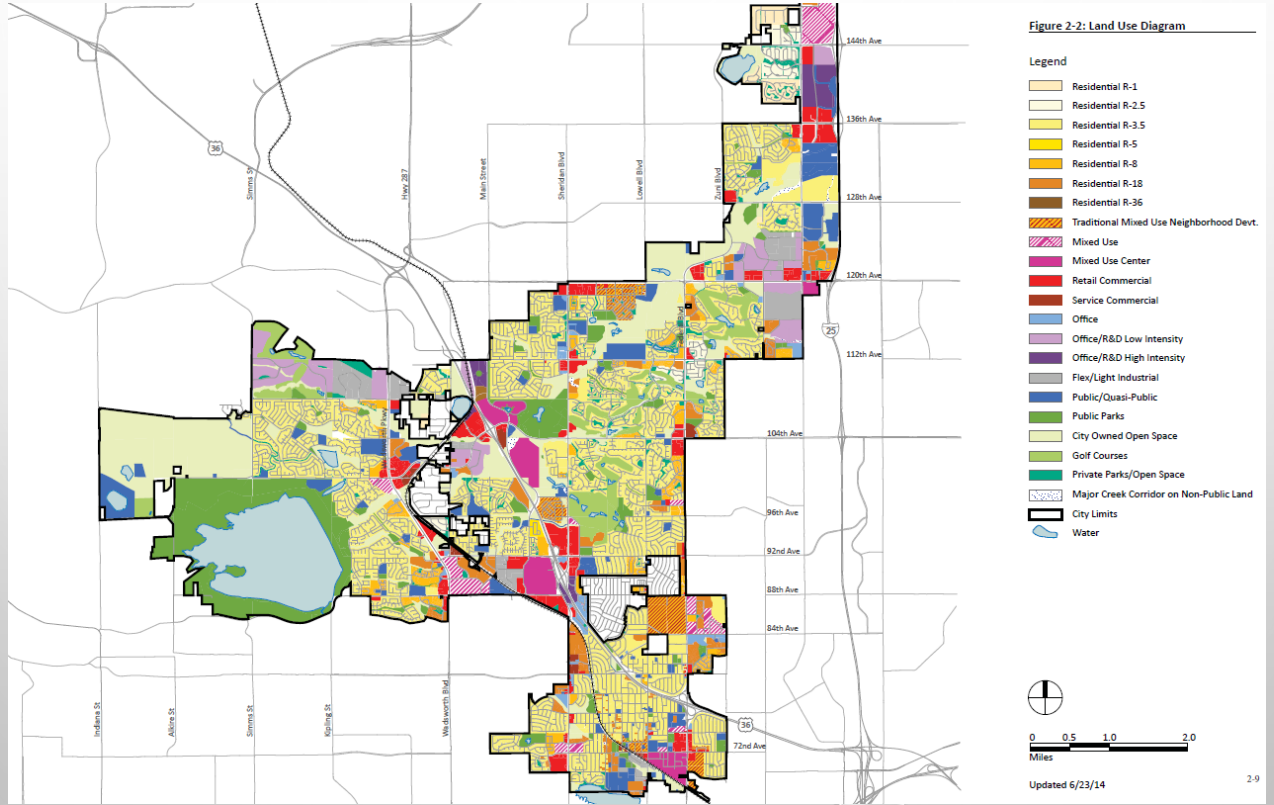
- 2004 LANDSCAPE REGULATIONS- *COORDINATION*
  - LANDSCAPING AND IRRIGATION STANDARDS – *COORDINATION*
  - 2 NEW POSITIONS PAID BY PWU
- PLANNERS IDENTIFIED FUTURE DEVELOPMENT PATTERNS - *COORDINATION*
- 2004 WESTMINSTER COMPREHENSIVE LAND USE PLAN LINKED TO COMPREHENSIVE WATER SUPPLY PLAN- *COORDINATION*
- EDUCATION OF STAFF AND ELECTED OFFICIALS- *COORDINATION*


Total Annual Indoor Use vs. Served Population
2001 - 2016
Indoor Use (annual kgal)
Population
3500000
3400000
3300000
3200000
3100000
3000000
2900000
2800000
140000
135000
130000
125000
120000
115000
110000
105000
100000
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
Total Indoor Water Use
Population
Linear (Total Indoor Water Use)
Linear (Population)

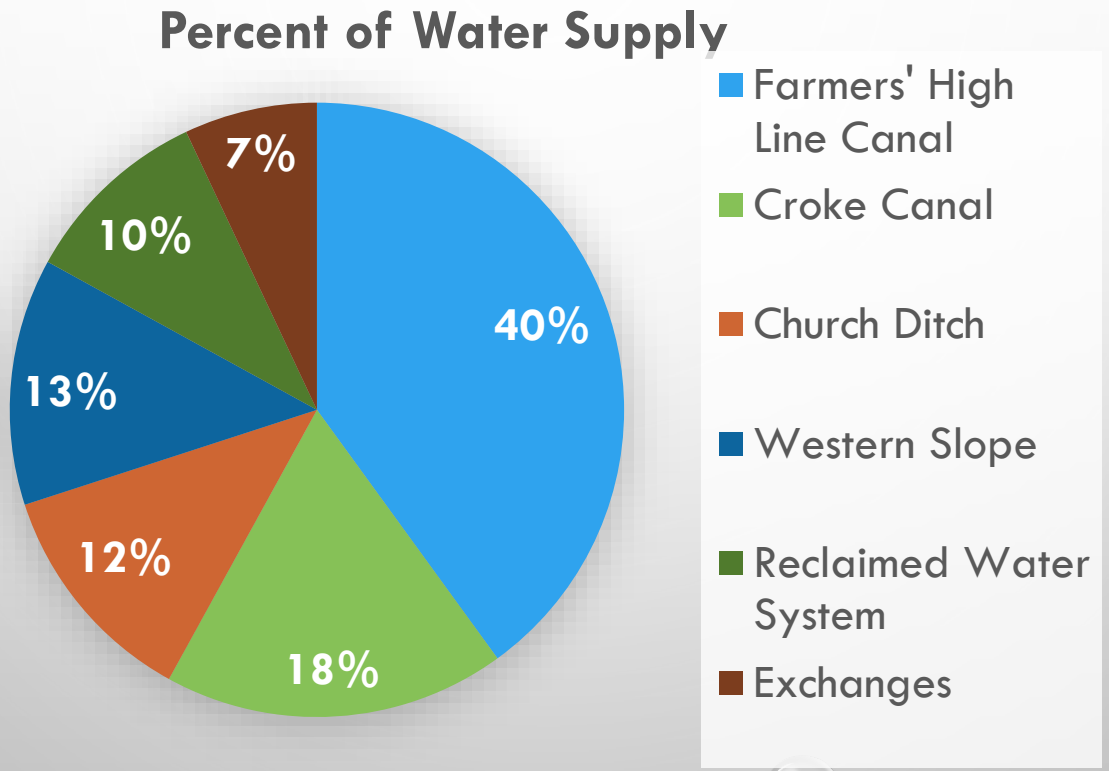
2006-2013

- INCREASED DIALOGUE WITH CITY COUNCIL - *COORDINATION*
  - SUPPLY GAP
  - COSTS TO CLOSE GAP
  - DEMAND PROJECTIONS
- 2013 COMPREHENSIVE AND WATER SUPPLY/DEMAND PLANS- *COORDINATION*
  - WATER SUPPLY IMPACT EVALUATION WITH EACH LAND USE AMENDMENT
  - NEW LAND USE CATEGORIES WERE ESTABLISHED, SUCH AS MIXED USE, AND MODELING WAS ADJUSTED.
  - CLOSING WATER SUPPLY GAP DETERMINED TO BE ACHIEVABLE.

COMPREHENSIVE PLAN



WATER SUPPLY PLAN



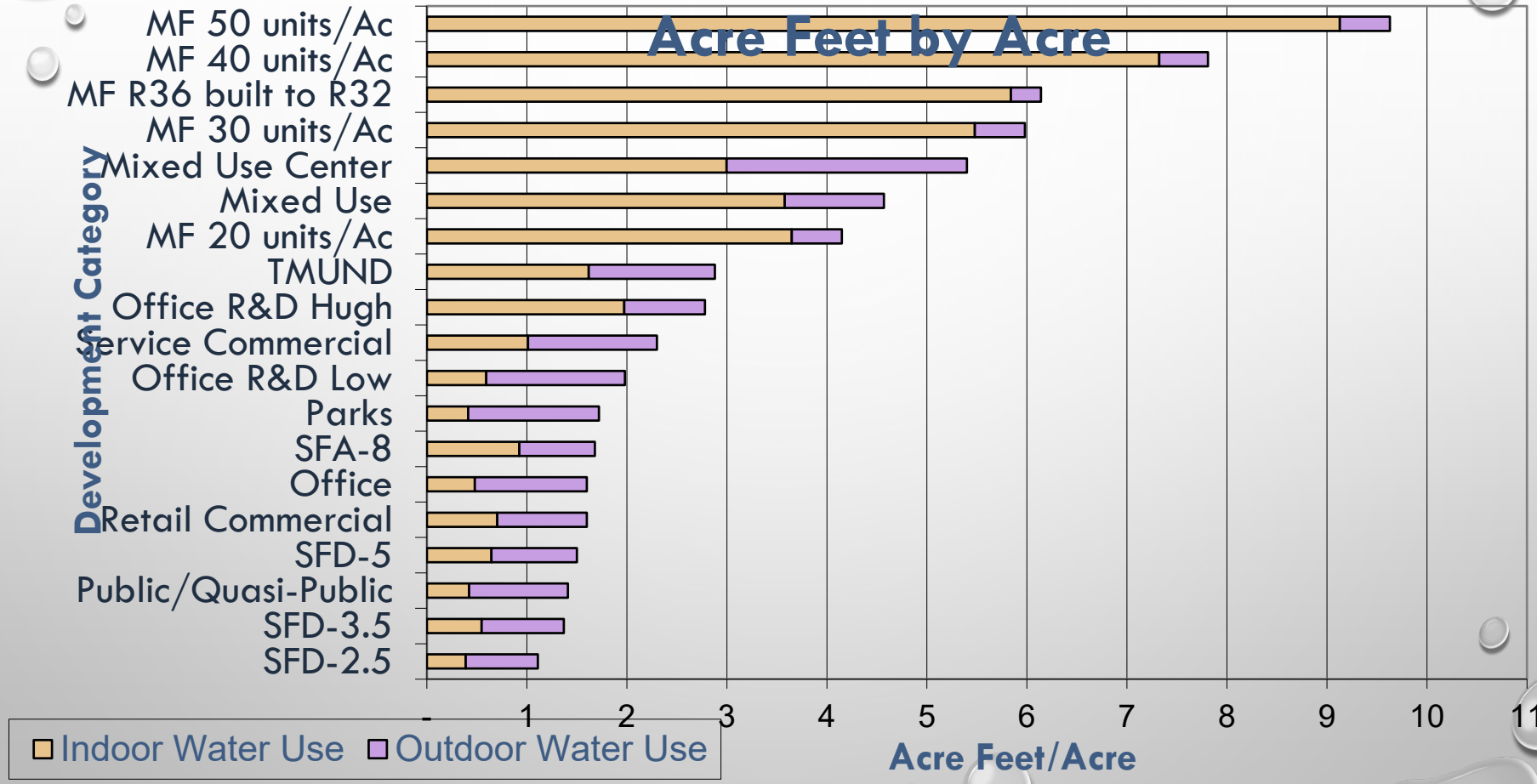
WATER DEMAND METHODOLOGY

- CUSTOMER CONSUMPTION DATA FROM UTILITY BILLING SYSTEM
- MULTI YEAR
- ADJUST FOR WEATHER, WATER LOSS, REVITALIZATION, CONSERVATION, ETC.
- INDOOR VS OUTDOOR
- GIS LAYER
- ADJUST CURRENT CONSUMPTION
  - WEATHER
  - VACANCY
  - UNDERUSED TAPS

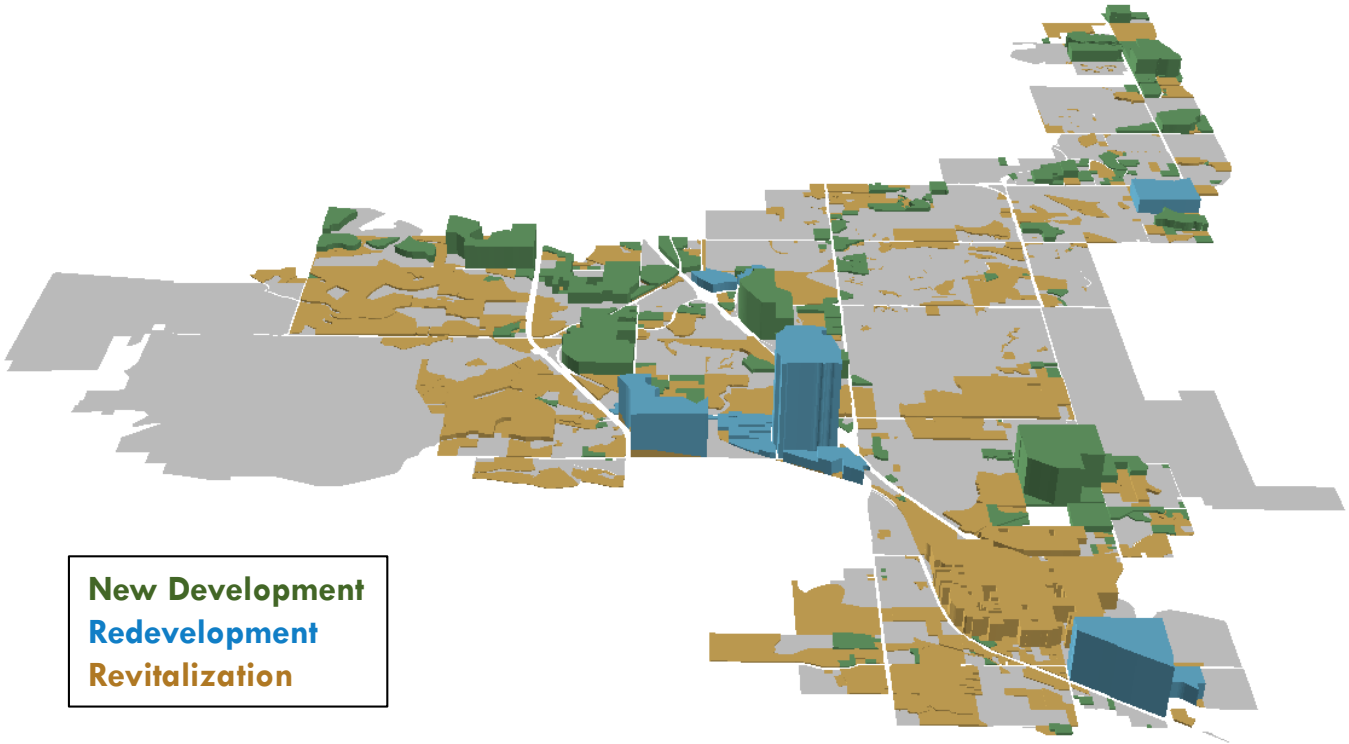
WATER DEMAND METHODOLOGY

- WATER LOSS
- REVITALIZATION
- ADD DEMAND FOR UNDEVELOPED OR TO BE REDEVELOPED LANDS
  - BASED ON PROJECTED WATER USE BY LAND USE TYPE
  - REMOVE CURRENT CONSUMPTION
- ADD DEMAND FOR SPECIAL PROJECTS
- WHOLESALE WATER
- FUTURE CONSERVATION

2013 CLUP Water Use By Development Type



COMPREHENSIVE & WATER SUPPLY PLAN



2014-2017

- NEW STAFF
- FORMAL PRE-APPLICATION MEETINGS TO LAY OUT TAP FEE PROCESS AND DISCUSS PROJECTED WATER USE- *COORDINATION*
- COUNCIL REQUESTS ANNUAL WATER/DEVELOPMENT BALANCE REPORT- *COORDINATION*
- COMPREHENSIVE PLAN AMENDMENTS IMPACTS REPORTED ANNUALLY

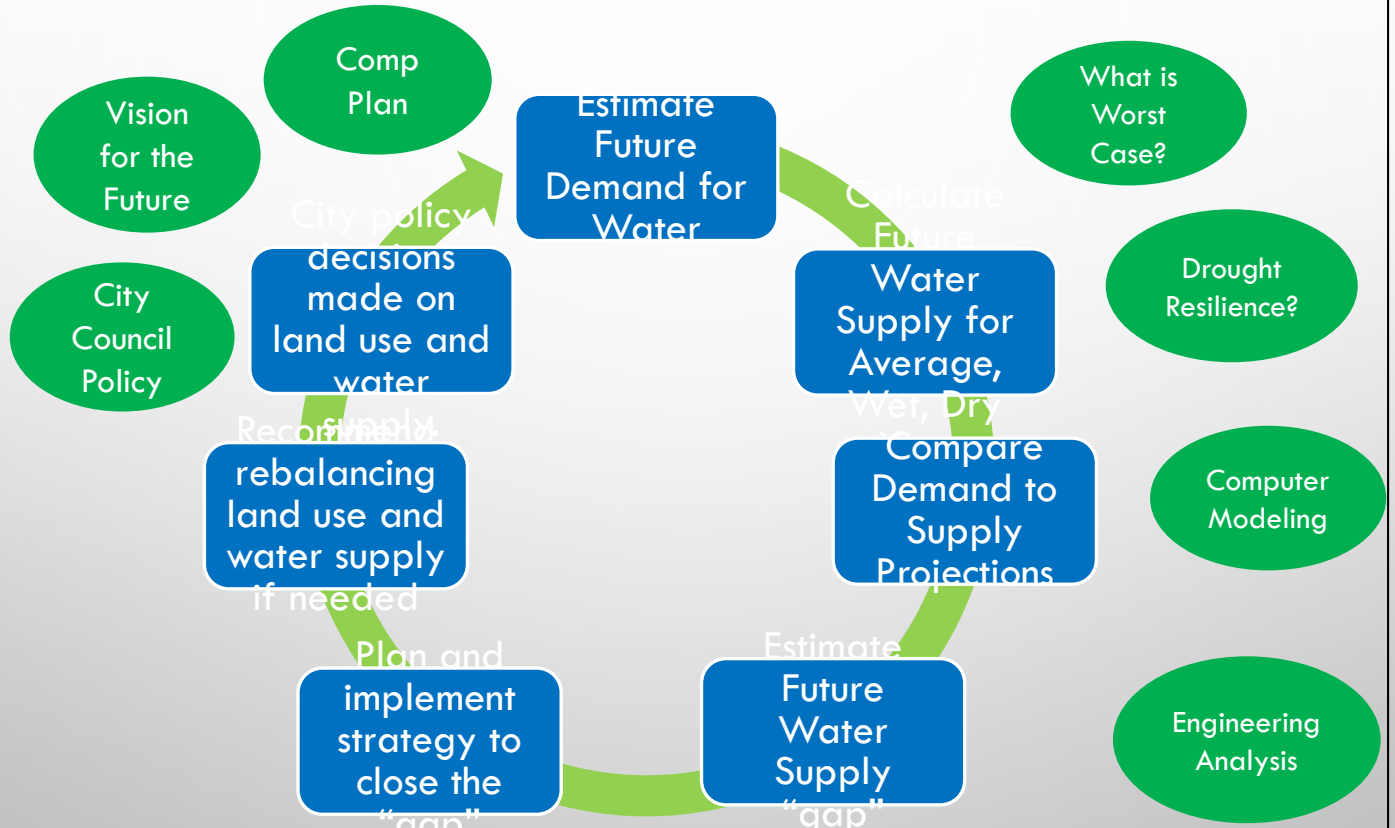
2018-

- NEW VISION FOR THE CITY
  - THE NEXT URBAN CENTER OF THE COLORADO FRONT RANGE
- UPDATE COMP PLAN/WATER SUPPLY PLAN
- MORE REQUESTS FOR COMP PLAN AMENDMENTS
- SPECIFIC WATER BUDGET PER PROPERTY
  - AVERAGE OR WORST CASE
- RATE AND FEE STUDY
  - UNCOLLECTED TAP FEES BUILT INTO RATES (SURCHARGE RATE)
  - SCALABLE RESIDENTIAL TAP FEES

ISSUES

- ACCEPTANCE OF NEW LANDSCAPES
  - CITIZEN IMPLEMENTATION FASTER THAN CITY PLANNING
- PER CAPITA VS LAND USE BASED PROJECTIONS
- LAND USE CATEGORIES
  - INCREASE WATER USE AT DEVELOPED SITES
  - NEW DENSITIES
  - MIXED USE
  - AVERAGE OR MAXIMUM OF DENSITY AND WATER USE
- DEVELOPMENT COSTS WITH FULL COST FEES
- WATER COURT
- CLIMATE CHANGE
- CHANGES IN VISION

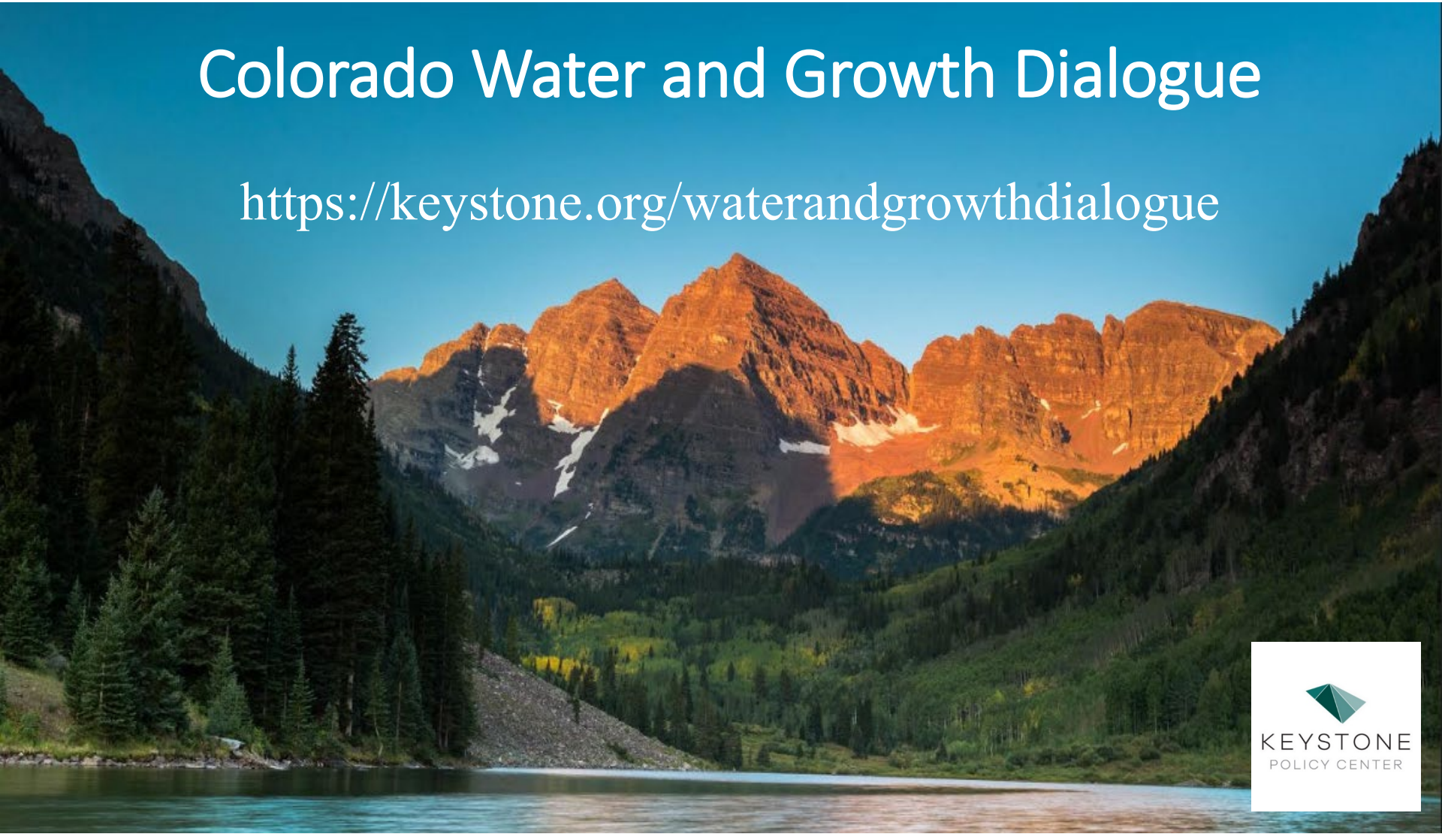
MUNICIPAL WATER SUPPLY PLANNING



THANK YOU

Colorado Water and Growth Dialogue

https://keystone.org/waterandgrowthdialogue



KEYSTONE
POLICY CENTER

Outline

- Collaborators
- Goals of the project
- Clarion Report
- Residential Density Impacts on Water Demand
- Residential Land Use and Water Demand Tool
- Strategic levers

Collaborators

Funders

Colorado Water Conservation Board

Denver Water

Gates Family Foundation

Lincoln Institute of Land Policy

National Science Foundation

Walton Family Foundation

Steering Committee

Greg Fisher – Denver Water

Tom Gougeon – Gates Family Foundation

Peter Pollock – Lincoln Institute of Land Policy

Ray Quay – Arizona State University, Decision Center for a Desert City

Flo Raitano – Denver Regional Council of Governments

Kevin Reidy – Colorado Water Conservation Board

Marc Waage – Denver Water

Lyle Whitney – City of Aurora

Matthew Mulica (facilitator) – Keystone Policy Center

Technical support:

Don Elliott – Clarion Associates

Mitch Horrie - Denver Water

Daniel Jerrett - DRCOG

Ralph Marra - SW Water Resources Consulting

Justin Martinez - DRCOG

David Sampson - DCDC ASU

Jeremy Stapleton - Sonoran Institute

Summer Waters - Sonoran Institute

Working Group:

Clark Anderson - Community Builders

Drew Beckwith - Western Resources Advocates

Susan Daggett - Rocky Mountain Land Use Institute

Tom Cech - One World One Water Center

Mizraim Cordero - Denver Metro Chamber of Commerce

Barry Gore - Adams County Economic Development

Working Group (con't):

Steve Gordon - City of Denver

Peter Grosshuesch - Town of Breckenridge

Karen Hancock - City of Aurora

Julio Iturreria - Arapahoe County

Peter Kenney - Civic Results/Metro Mayors' Caucus

Mara MacKillop - Colorado Water Conservation Board

Becky Mitchell - Colorado Water Conservation Board

Gene Myers - New Town Builders

Chuck Perry - Perry Rose, LLC

Greg Peterson - Colorado Ag Water Alliance

Ben Rubertis - Genus Architecture

Jeff Tejral - Denver Water

Chris Treese - Colorado River District

Heidi Williams - City of Thornton

Susan Wood - Denver Regional Transportation District/CO APA

A Growing Opportunity

- By 2050, Colorado's population is projected to double, greatly increasing the demand for water.
- Colorado is already a water short state.
- By 2050, most people will live in buildings that are yet to be built.
- To date, there has been little integration of land and water planning

The Colorado Water and Growth Dialogue

"If we grow the next 5 million people like we grew the first, there won't be enough water"

"Before we spend the political capital required to reduce landscaping and increase density, we need to know whether these things will move the needle"

Goals:

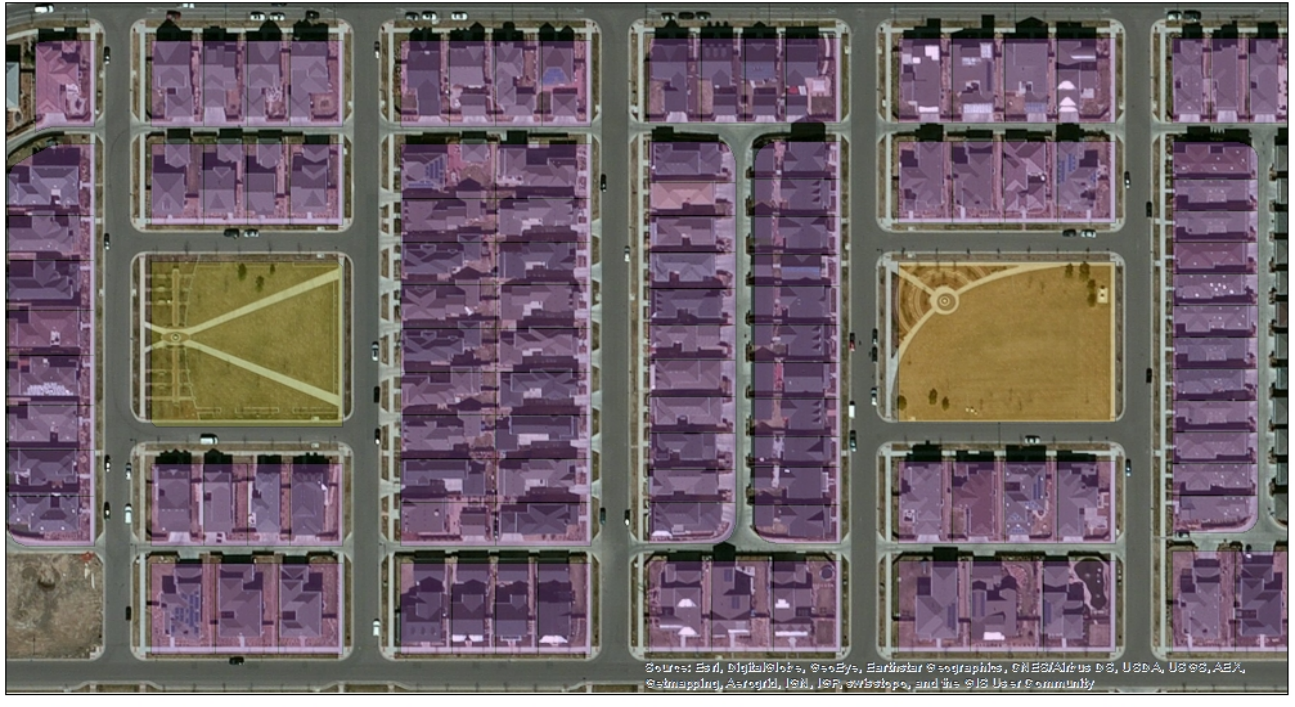
- Demonstrate how much water can be saved through the integration of water and land use planning;
- Develop a consensus-based set of recommended strategies;
- Provide local communities with data, information and a tool box of strategies so that they may make better informed decisions

Clarion Report

- Clarion Associates developed a report that identified existing studies linking land use planning and water demand reduction, and suggested land use forms that might further that goal.

- The following 4 recommended land use pattern changes helped the dialogue focus on what to examine:
  - Land use patterns that are recommended for further examination
    - Build smaller single-family parcels
    - Changing from single-family to multifamily
    - Build denser multifamily
    - Enact landscape restrictions

Smaller Single Family Lots



Legend

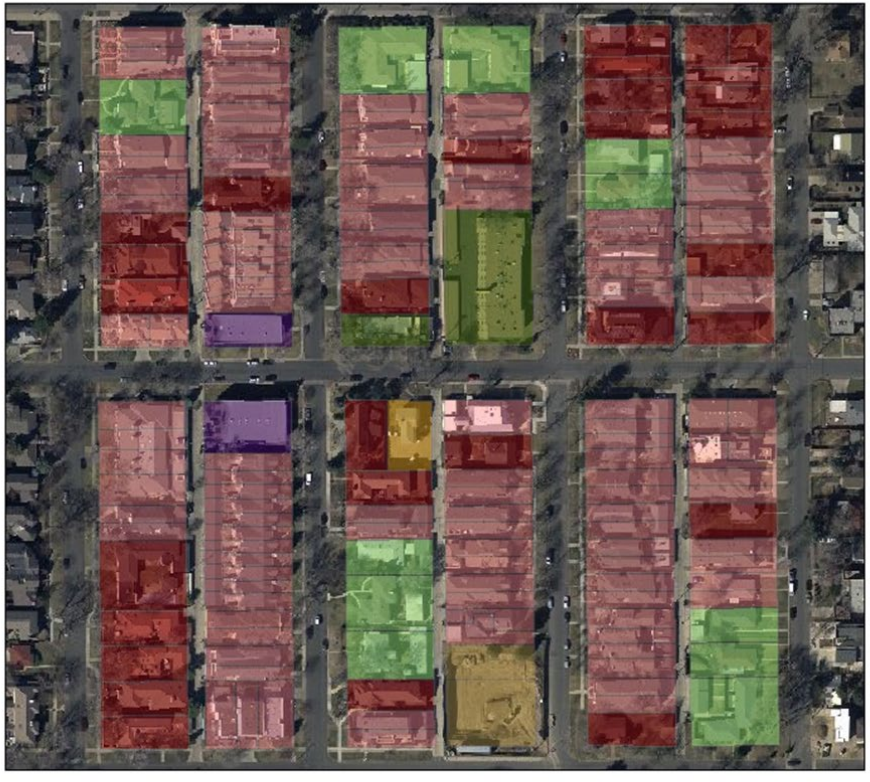
D_CLASS_CN

- SINGLE FAMILY
- VCNT LAND 0-1 ZONE
- VCNT LAND R-2, RS-2 ZONE

0 125 250 Feet

N

Changing from Single Family to Multifamily



N

0 110 220 440 Feet

Legend

D_CLASS_CN

- APT LOW-RISE>9UNT, WALK-UP
- APT W/2 UNITS
- APT W/3 UNITS
- APT W/4 UNITS
- APT W/5 UNITS
- CONDOMINIUM
- OFFICE W/RESID
- ROWHOUSE
- SINGLE FAMILY
- VCNT LAND R-2, RS-2 ZONE

Increase Multifamily Density

Turf Restrictions

~40% turf

~15% turf

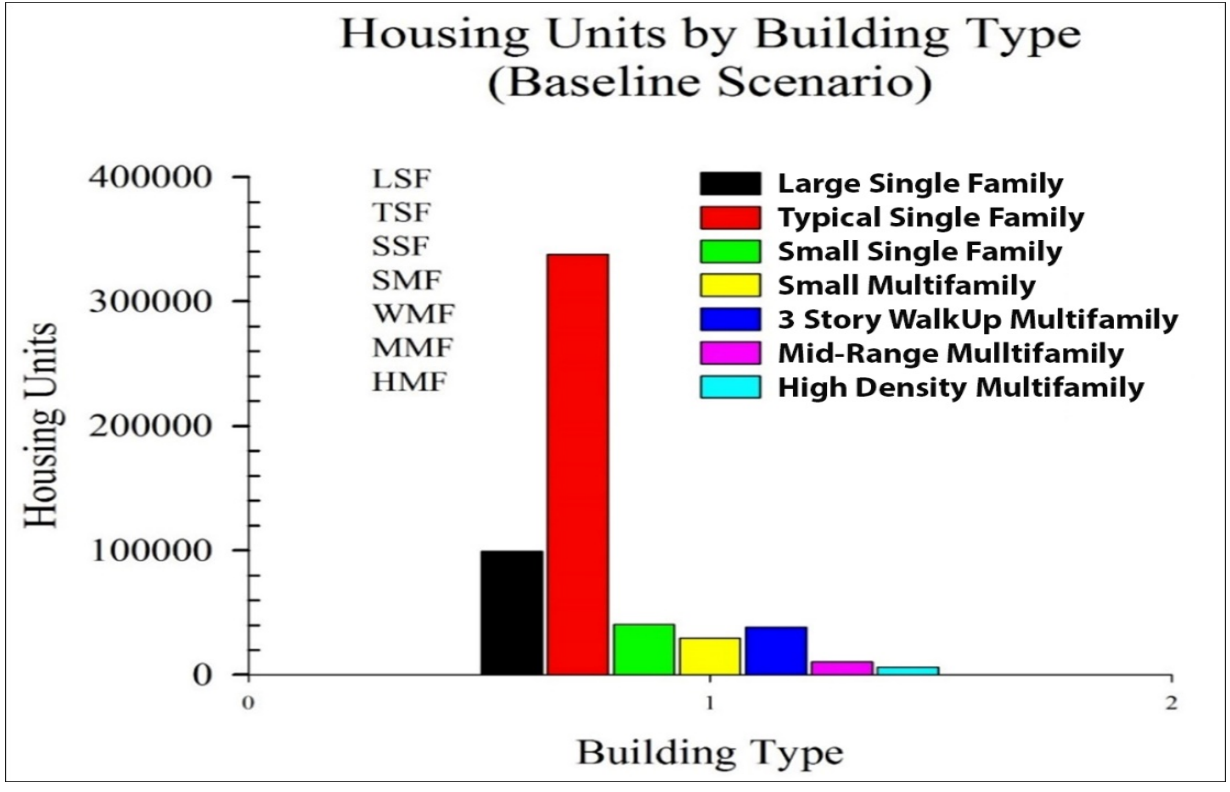
~20% turf

No maintained turf

Density

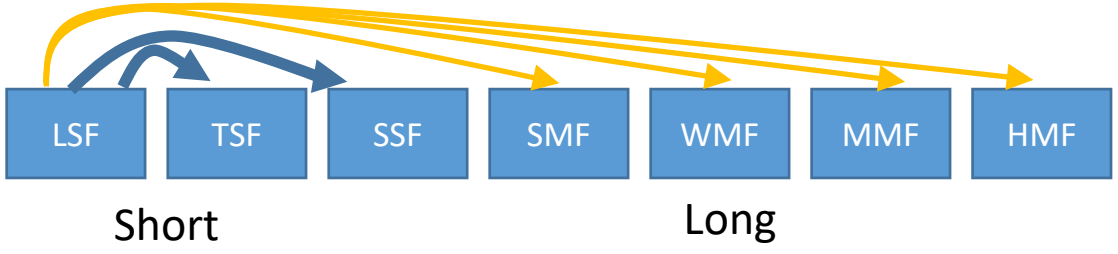
2010 Census	People per Square Mile
New York	27,000
	26,000
	25,000
	24,000
	23,000
	22,000
	21,000
	20,000
	19,000
	18,000
San Francisco	17,000
	16,000
	15,000
	14,000
	13,000
Chicago	12,000
	11,000
	10,000
	9,000
Baltimore	8,000
	7,000
Denver Water Service Area 2050	6,000
St. Louis	5,000
Denver Water Service Area 2010	4,000
	3,000
	2,000
Nashville	1,000

Allocation of Building Types 2040



Scenarios: Increasing Density – Key Concepts

- Scenario Movement



- Scenario Construction : different patterns of movement of households from one building type to another.

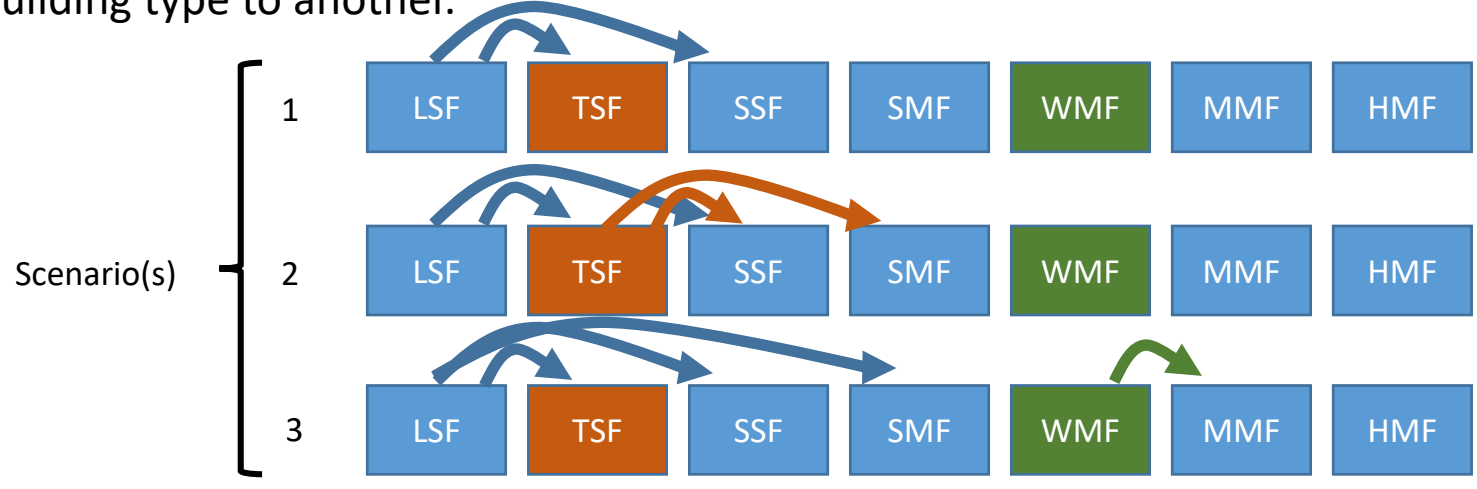
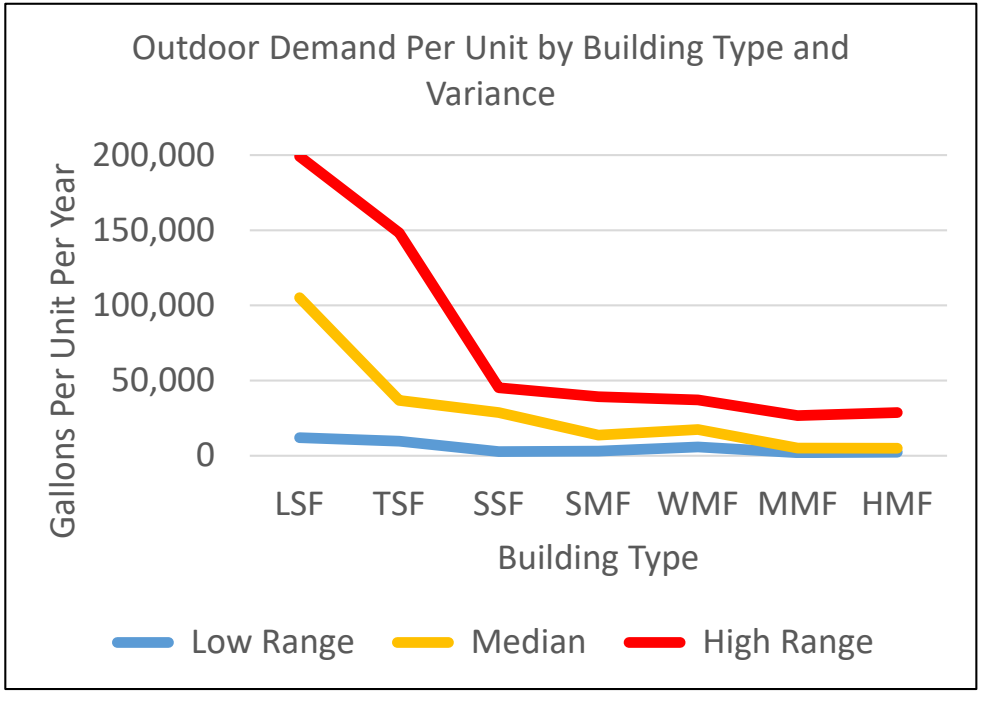


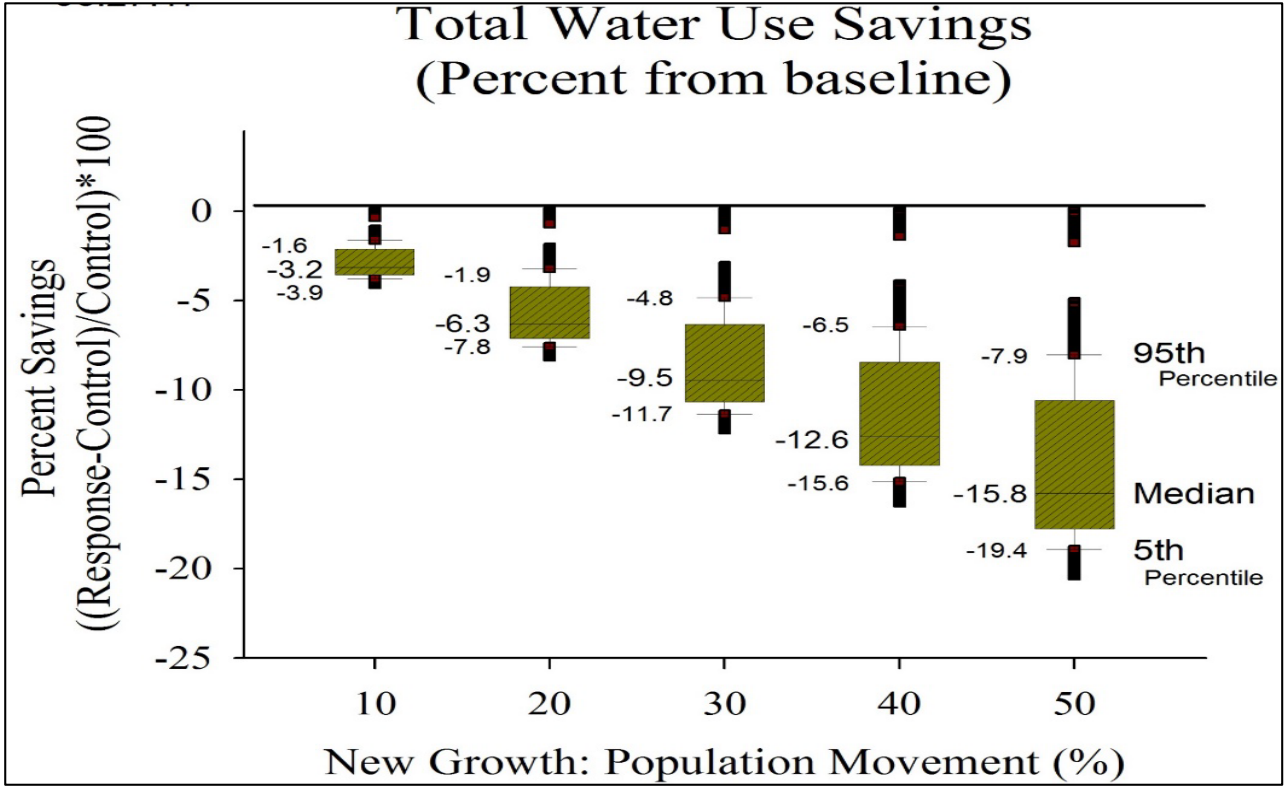
Figure 1

Strategic Insights- Density Increases

- Household movement from the Large Single Family and Traditional Single Family to any other building types provides the largest total water demand reductions of new housing and can result in 50% to 60% of the full potential from the more complex scenarios
- Scenarios that do not include LSF and TSF have little benefit.

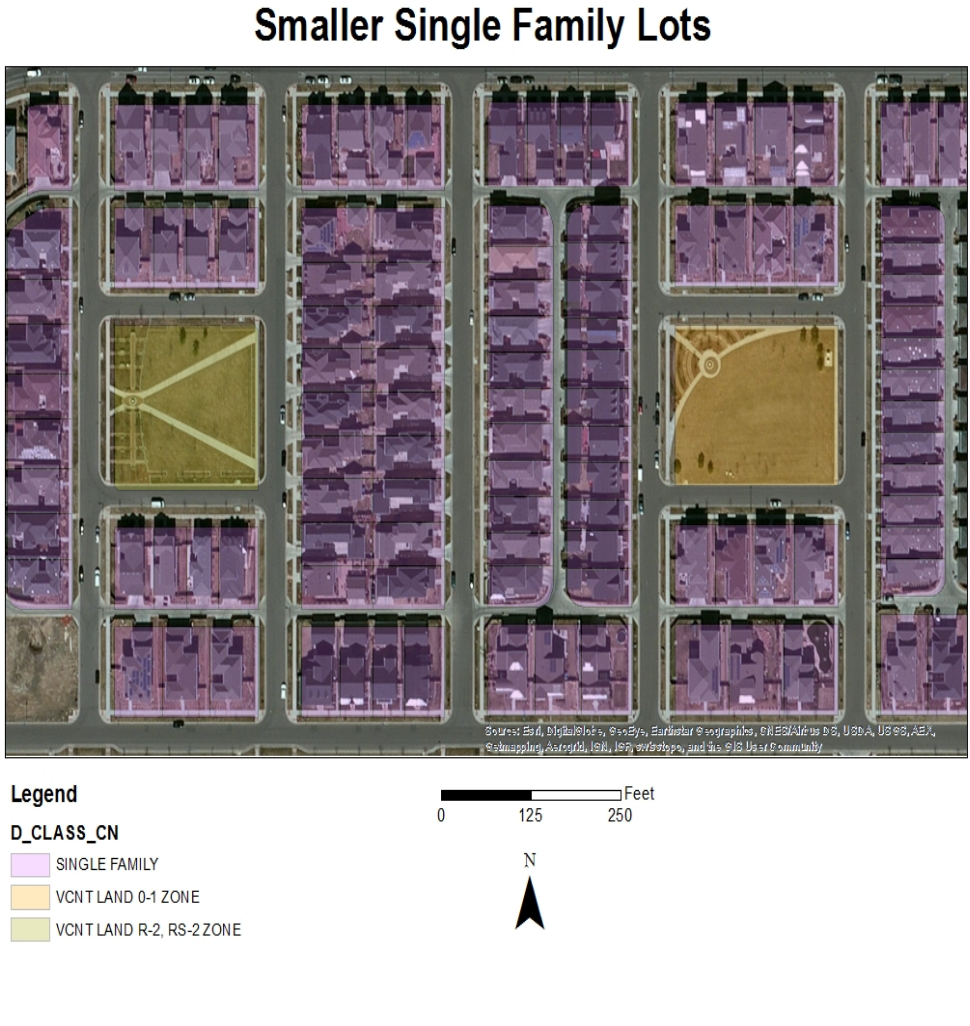


Scenario results



Strategic Insights – Density Increases

- Increasing density may decrease water demand of new growth in the range of 2% to 19%, with higher resource cost density increases associated with the higher (water) savings.
- Lower resource cost density increases may achieve 3% to 8% reduction for new housing.



Strategic Insights - Efficient landscaping

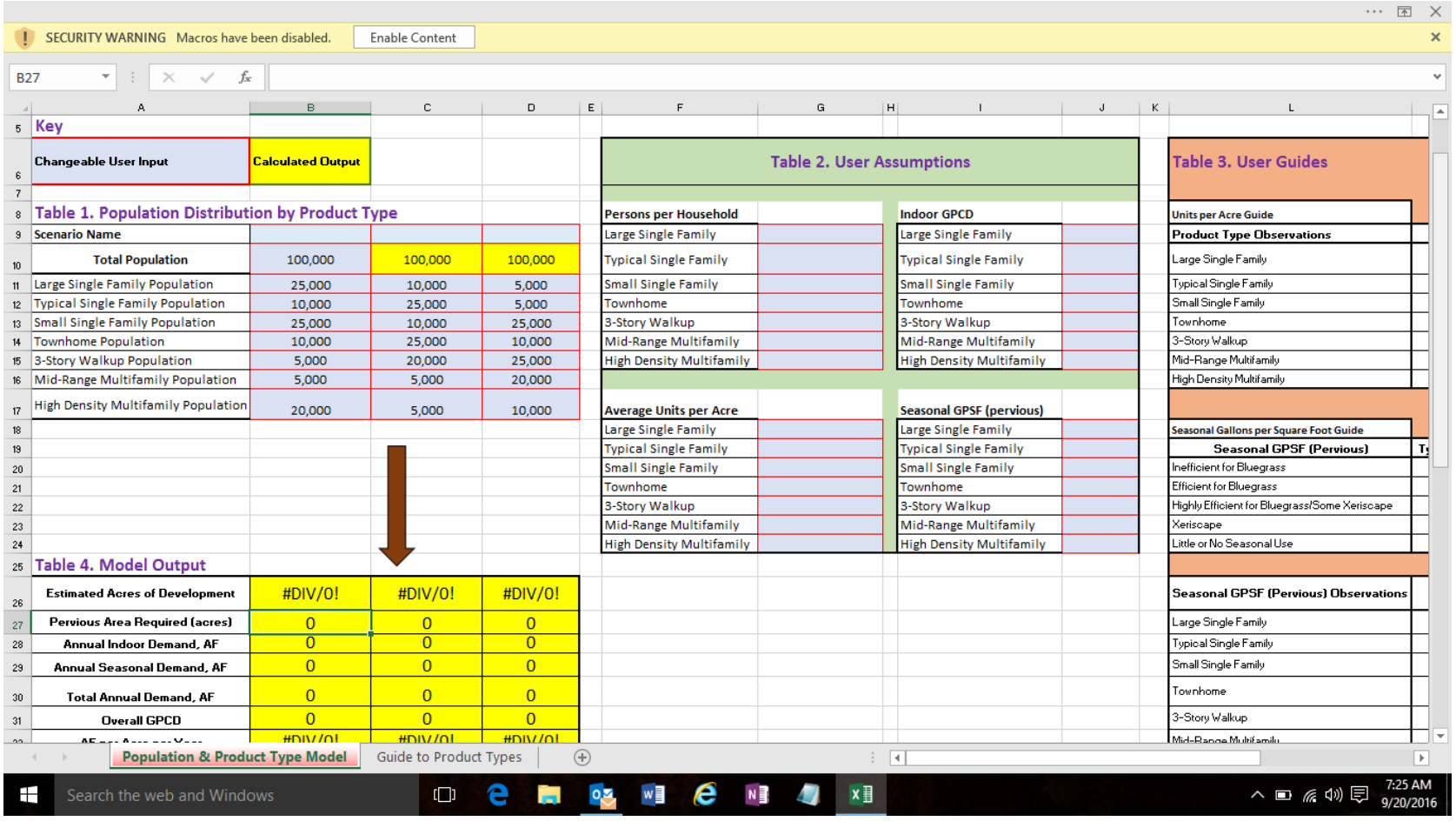
- Increasing the efficiency of irrigation may decrease water demand of new growth in the range of 5 to 25%, and be as effective, if not more, at reducing demand as increasing housing density.
- Combining low “resource cost” residential density increases with low “resource cost” reductions of irrigation may achieve reductions in total residential water demand of new growth by 5 to 15%.
- Education of homeowners is a critical step to achieving savings

40% turf

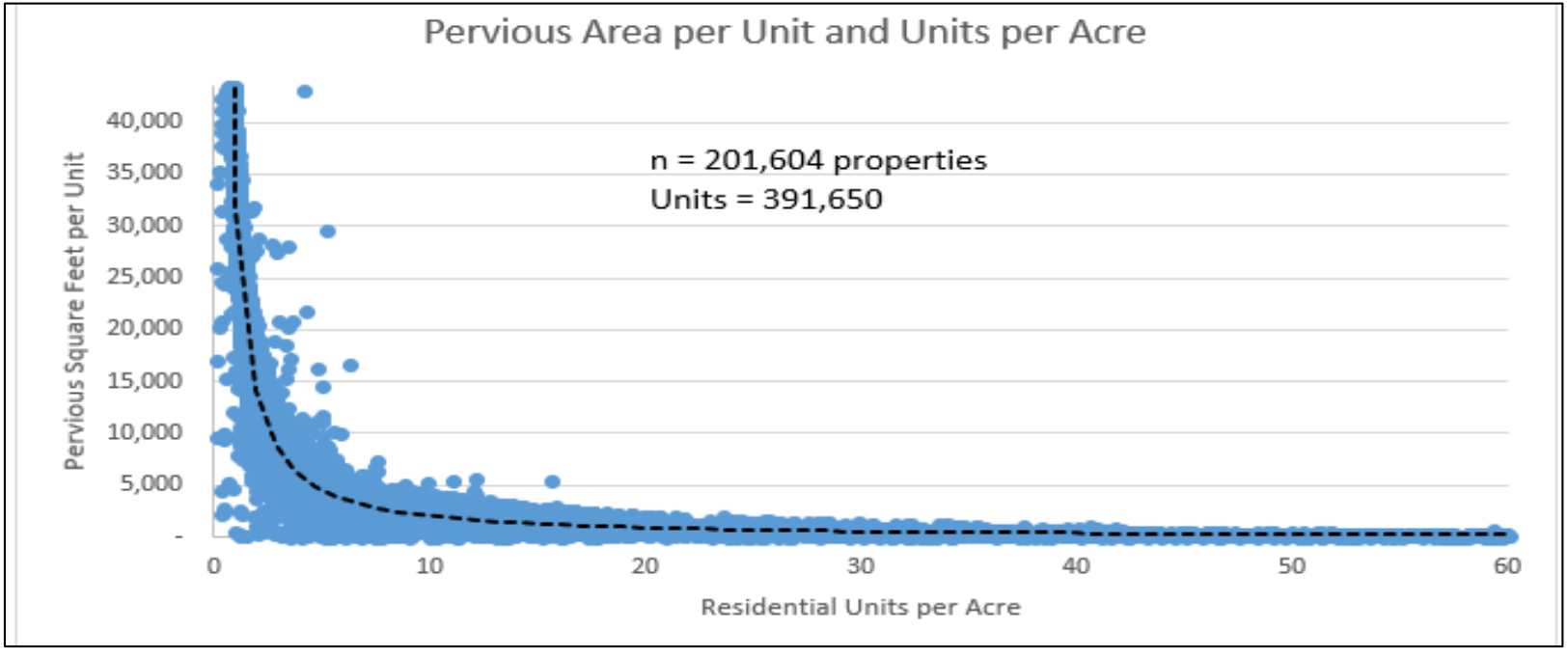
20% turf

No turf

Residential Land Use and Water Demand Tool



Pervious Area per Unit and Units per Acre

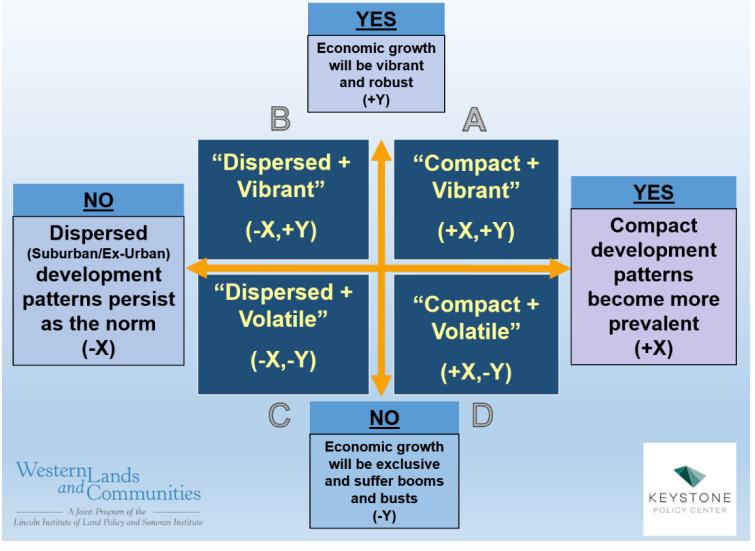


Recommended Strategic Levers

How can changes in urban form and landscaping practices for new growth and redevelopment assist in meeting future urban water demand along the Colorado Front Range?

Strategies were tested to see how well they performed in a variety of plausible futures that varied in terms of **future housing preferences**, the **strength of the economy**, and **innovations in transportation technology** such as autonomous vehicles, which may either reinforce sprawling land use patterns or help in concentrating residential development along transit corridors.

The strategies that worked well across the range of futures were selected for further consideration.



Recommended Strategic Levers

- Encourage the consideration of higher residential densities as a means to reduce water demand
- Adopt landscaping policies to lower future water demand from population growth
- Incorporate a One Water approach into planning
- Incorporate aspects of water planning into long range planning

Recommended Strategic Levers

- Share success stories and case studies
- Develop, track, and refine new metrics that link water use to land use
- Encourage water smart development through a suite of new local development standards and incentives
- Develop water smart design guidelines and standards for government-owned buildings, public spaces and rights-of-way


All reports, tools, and resources are available free of charge at:
https://keystone.org/waterandgrowthdialogue

Growing Water Smart

Workshop + Technical Assistance

- **Competitive Application Process**
  Community Readiness and Team Composition
- **Interdisciplinary Action Planning**
  Facilitated Time Together to Focus
- **Technical Assistance**
  Help + $$$ to Start

Front Range Development Patterns
J.Stapleton, aerial support provided by LightHawk

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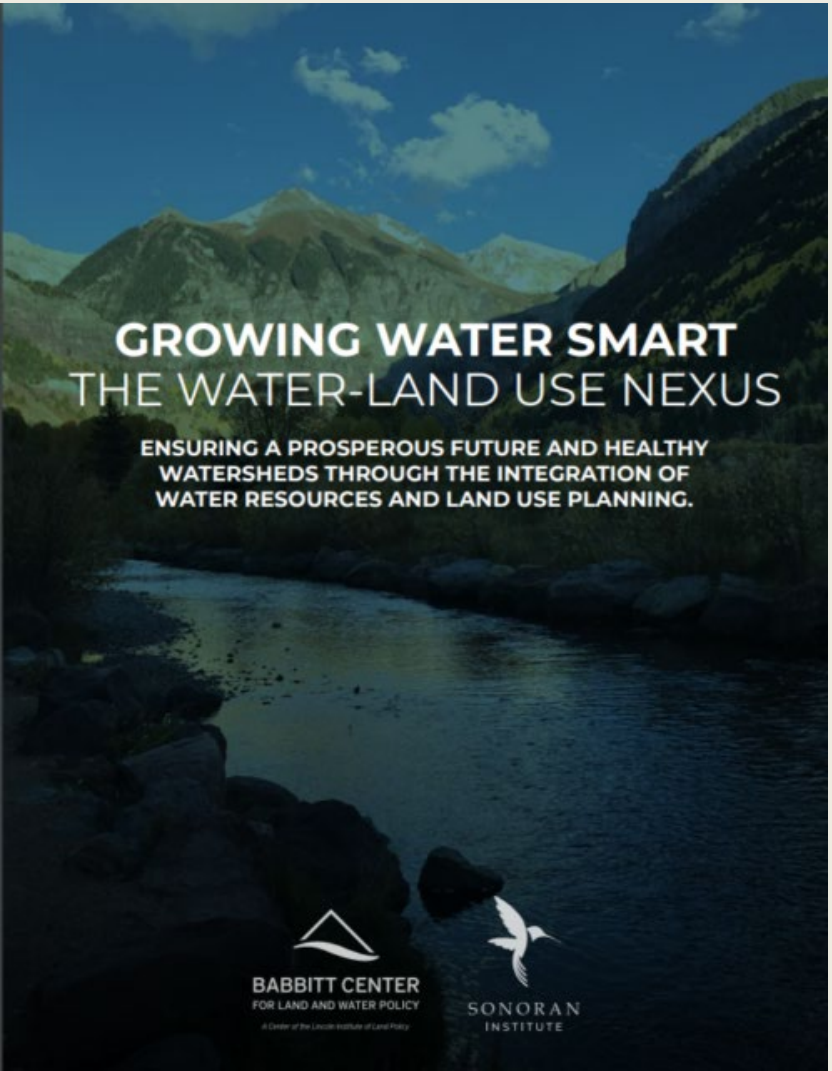
Growing Water Smart Toolbox



01 Planning + Policy Making

02 Adequate + Sustainable Water Supply Requirement

03 Water Smart Land Use Policy

04 Healthy + Resilient Watersheds

05 Water Efficiency Rate Structuring

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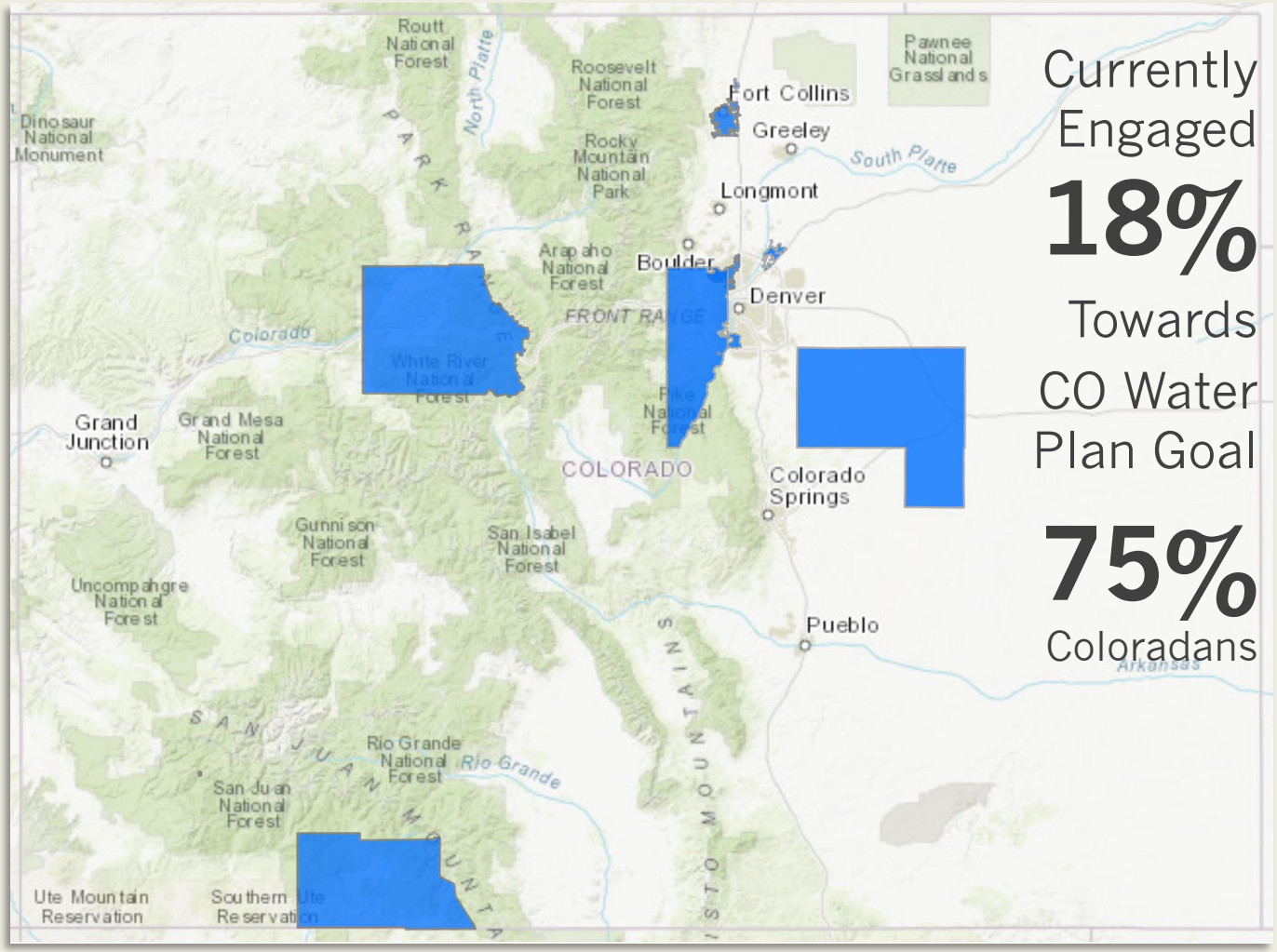
Colorado **Growing Water Smart** Communities



Currently Engaged

18%

Towards CO Water Plan Goal

75%

Coloradans

Round 1

Westminster
Fort Collins
Archuleta Co. + Pagosa Springs
Eagle Co.
Rico

Round 2

Littleton
Brighton
Wellington
Jefferson Co.
Elbert Co.

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