

Going Virtual!



SUSTAINING COLORADO WATERSHEDS 2020 CONFERENCE

A VIRTUAL EXPERIENCE



Business as (Un)Usual
Oct. 6-8, 2020



THANK YOU to our 2020 conference sponsors!



Sustaining (Benefactor) Level

WALTON FAMILY
FOUNDATION



Level

Headwaters (Presenting) Level



COLORADO
Department of Public
Health & Environment

River Level



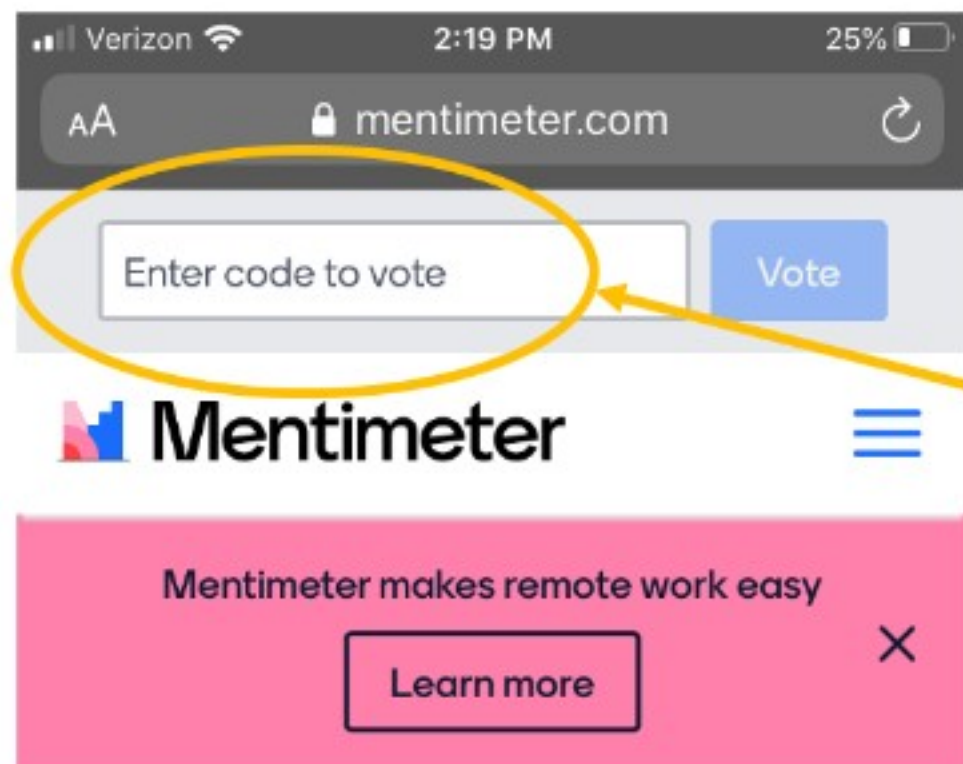
Stream Level



Scholarship Level

American Rivers, Colorado River District, Saint Vrain and Left Hand Water Conservancy District,
San Luis Valley Water Conservancy District, Vranesh and Raisch





Create interactive presentations & meetings, wherever you are

Get real-time input from remote teams and online students with live polls, quizzes, word clouds, Q&As and more



Using Mentimeter

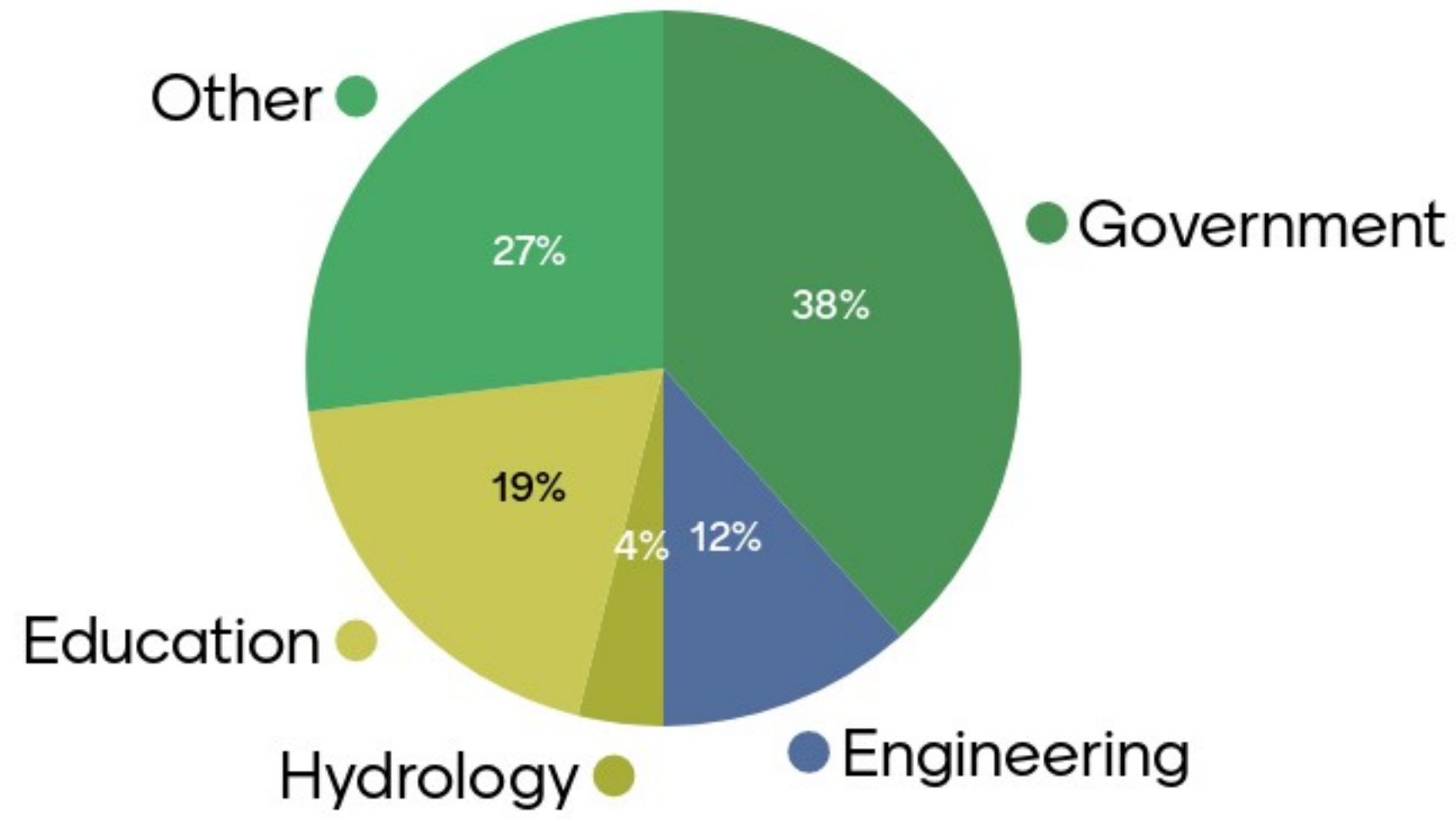
- Type Menti.com into your phone or computer's web browser
- Enter the code above into the code bar
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Panel Discussions, Q&A, Polling

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- Please reserve GoToWebinar's 'Question' box for technical issues & 'Chat' box for resources.
- We have a fixed time for questions. Please contact individual presenters for unanswered questions. Speaker info can be found in Expo.



Which work sectors are in the audience?





(Un)Usual Best Management Practices

**Rural
and
Urban**



Rural Innovations in Watershed Management



Phil Brink - Brink, Inc.

and Brianna Trotter - CSU, CLEAN Center

Blake Osborn, CSU Colorado Water Center

and Luke Javernick - River Science

Melissa Daruna – Keep It Colorado



Demonstrating Ag Progress on Water Quality:



Modeling the Effectiveness of EQIP-funded conservation practices.



Project Roles:

CSU Clean Center: (Tyler Wible, Brianna Trotter, Mazdak Arabi) Modeling & Analytical Lead / Co-coordinator

Brink, Inc. (Phil): Overall Project Coordinator



Project Purpose:

Quantify how selected NRCS – EQIP conservation practices are affecting edge-of-field discharges of Nitrogen and Phosphorus.

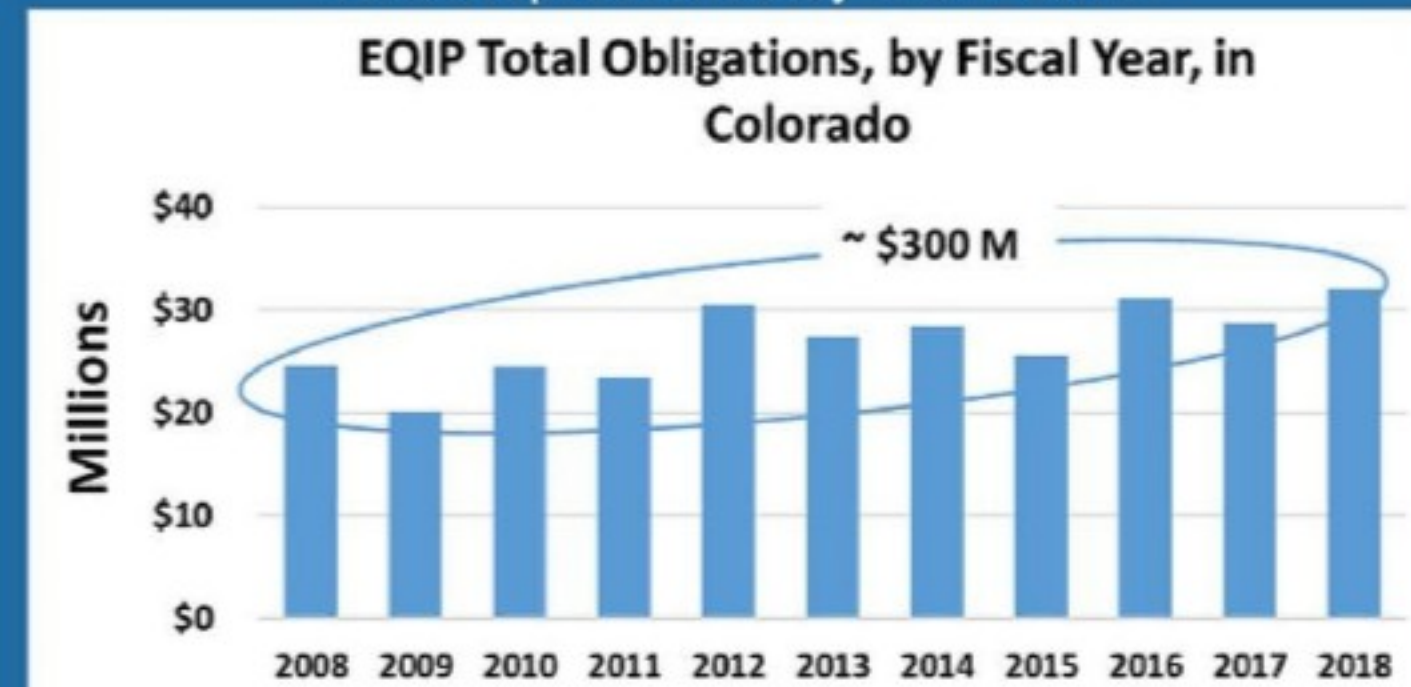


This project combined:

- 1) Existing USDA – NRCS Environmental Quality Incentive Program (EQIP) conservation practice data (2008 – 2018)
- 2) CSU CLEAN Center's Edge-of-Field Conservation modeling tool.

- Interfaces with USDA – ARS Soil Water Assessment Tool (SWAT).
- SWAT is a watershed-scale hydrological transport model used to predict nonpoint source discharges based on land use and land management practices.

Value represented by EQIP data:



Source: Colorado NRCS, 2019. B. Ross; ASTC Programs. Does NOT include \$ spent by producers.

Scenarios Modeled:

1. Baseline Scenario (current conditions without EQIP)
2. Practice-in-Use Scenario (EQIP practice in use)



Modeling Study Results:

- Report with executive summary available.
- Will be published in a refereed scientific journal.

Limitations / Temporal Context:

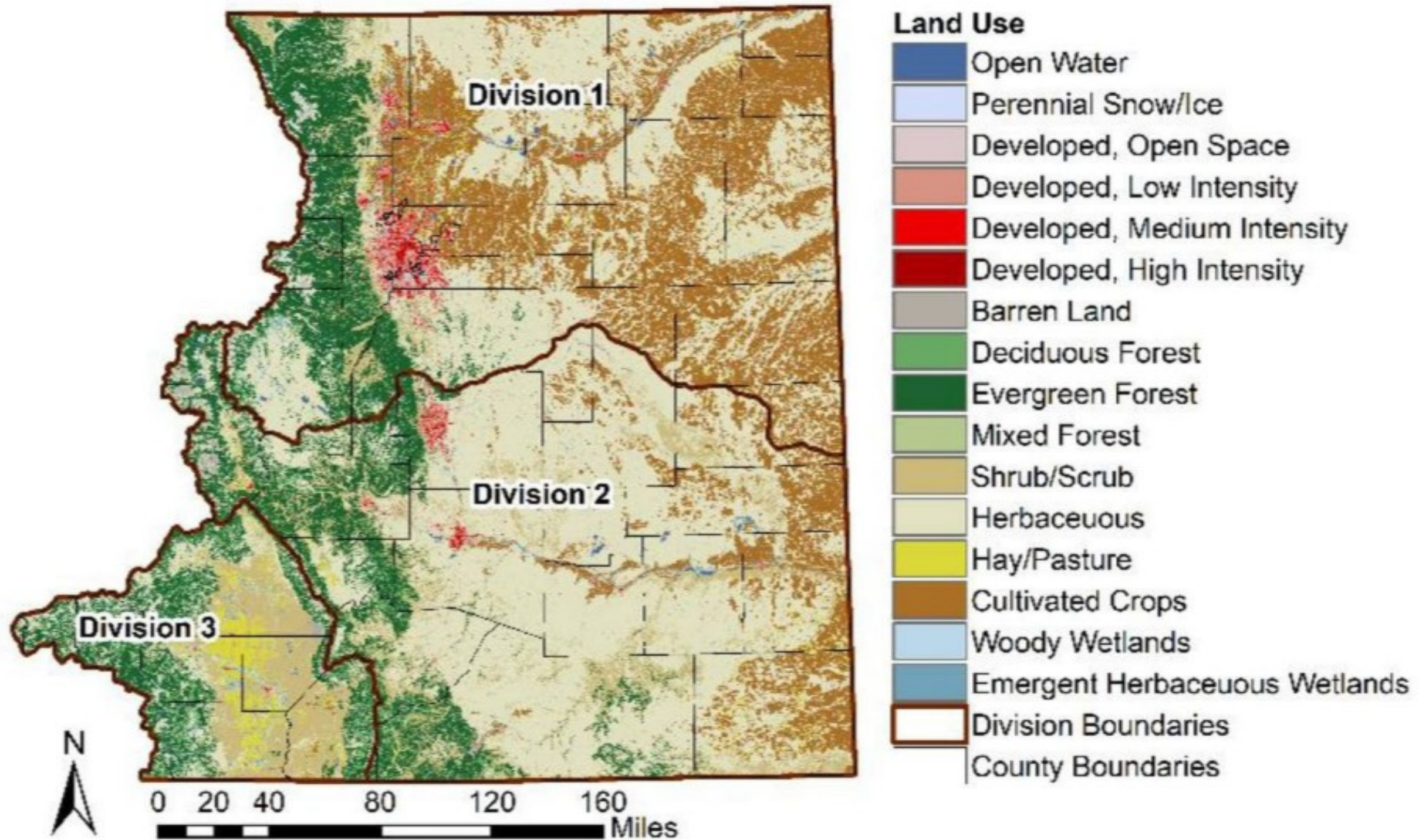
- Model can never perfectly represent reality.
- 11 years represents a snapshot in time. Ag producers have been implementing conservation practices for 80+ years.
- Technology is enabling increased precision application of nutrients and water.
- Rising baseline efficiency means lower incremental gains going forward.

Summary of Findings:

- Colorado agricultural producers continue to make progress in protecting water quality by reducing pollutant losses from fields by using conservation practices.

STUDY AREA: COLORADO, USA

Land Use in the Study Watersheds



IRRIGATED AGRICULTURE (2015)



Combined

- ~1,750,000 Acres
 - ~48,000 fields

South Platte and Republican River Basin

- ~809,000 Acres
 - ~22,000 fields

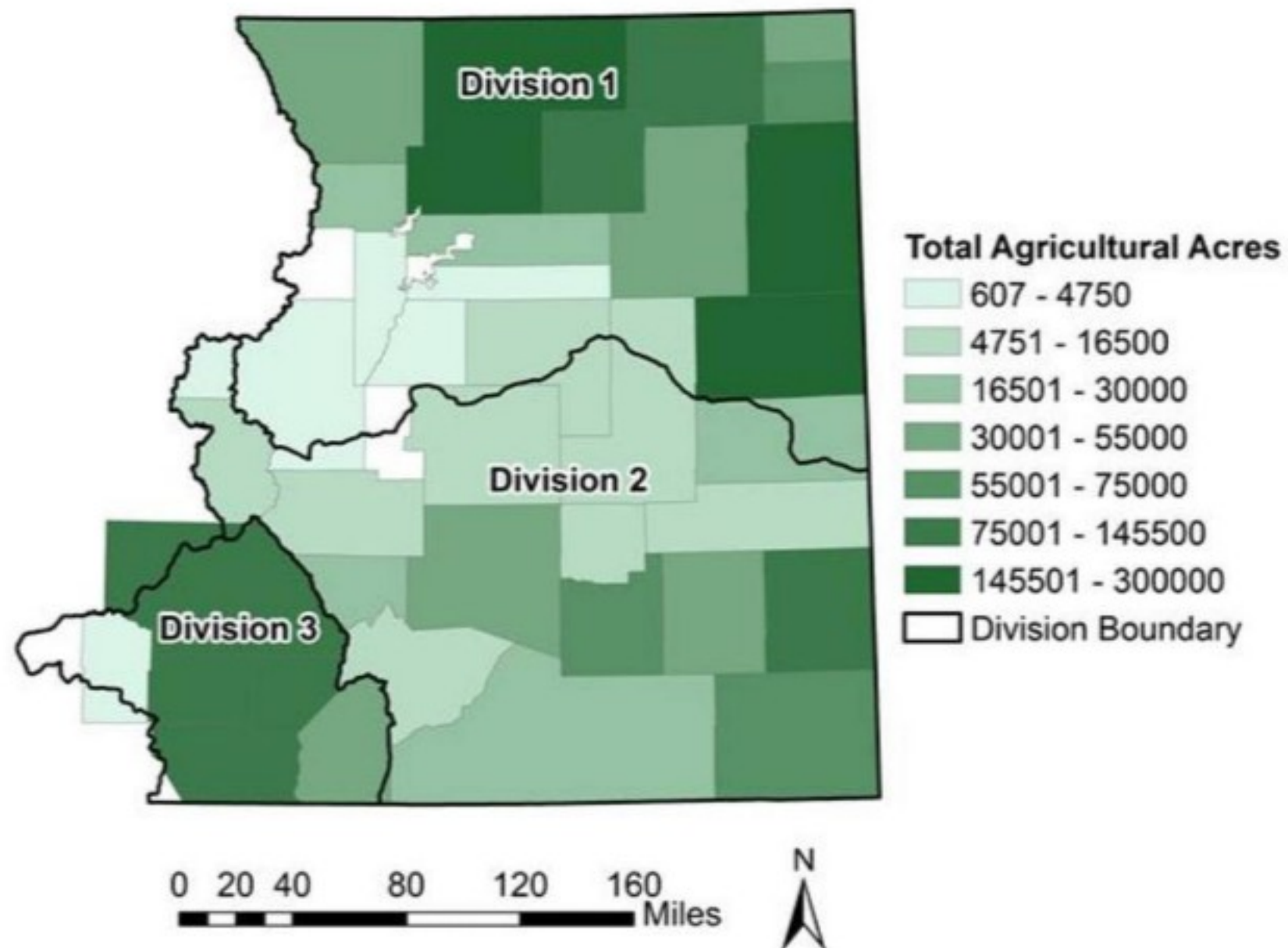
Lower Arkansas River Valley Irrigated Agriculture

- ~431,000 Acres
 - ~17,000 fields

San Luis Valley Irrigated Agriculture

- ~510,000 Acres
 - ~8,900 fields

Total Agricultural Acres by County in the Study Area



CROP GROWN (2008-2018)



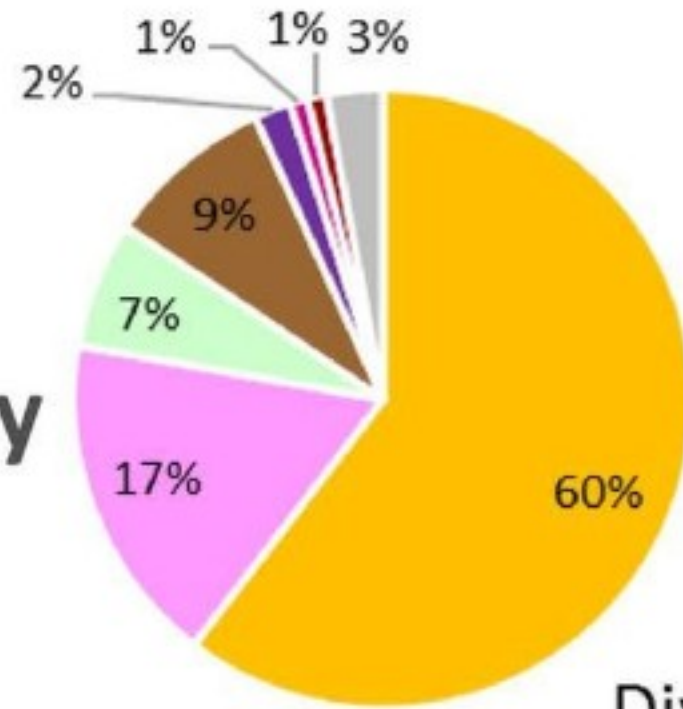
NASS Satellite Imagery

- From USDA
 - ~48,000 fields

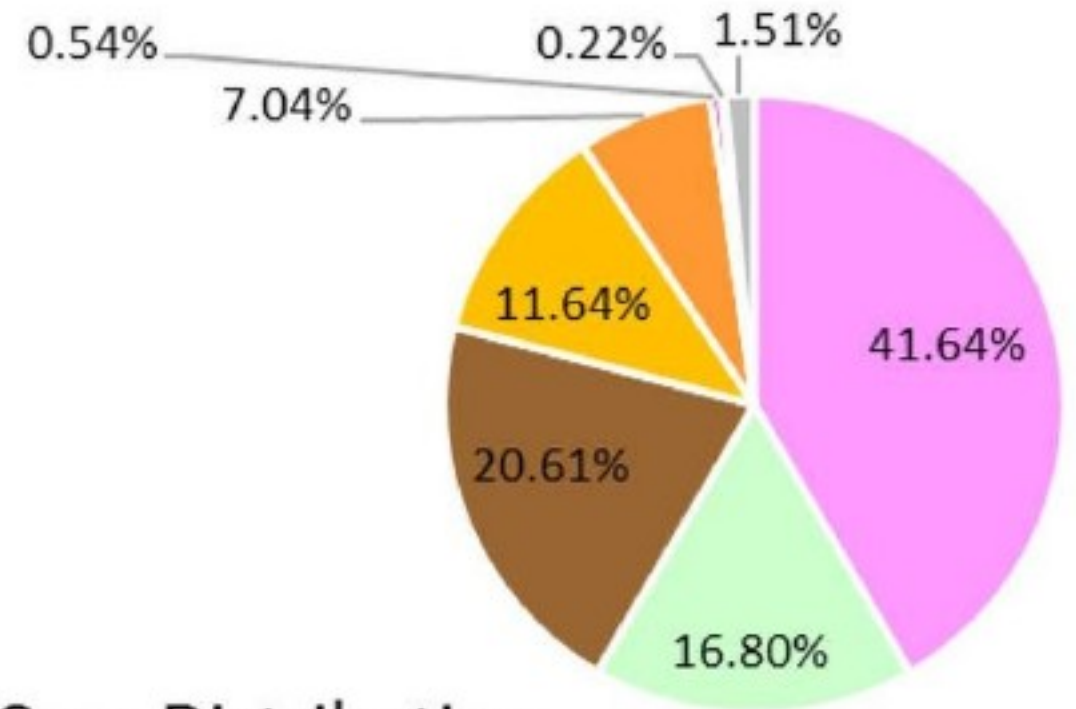
Modeled Dominant and Key Crops

- South Platte/Republican
 - 97% Coverage
- Arkansas
 - 98% Coverage
- Rio Grande (San Luis Valley)
 - 92% Coverage *

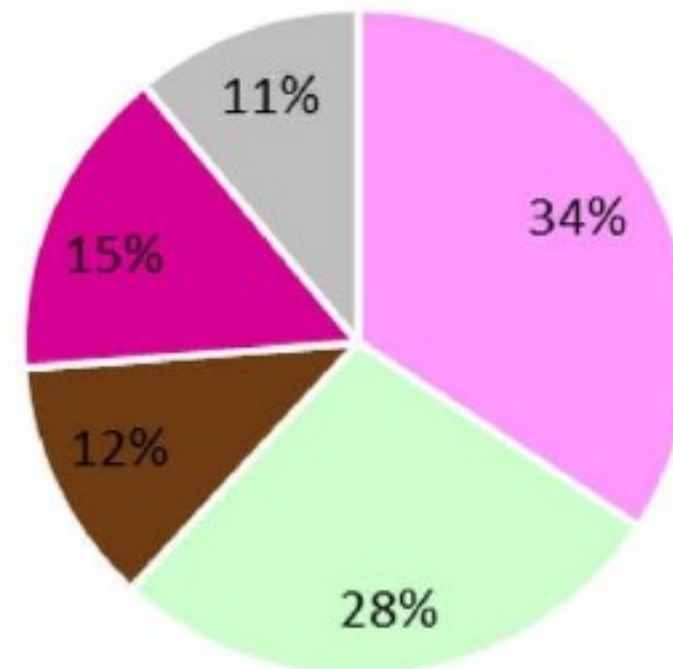
Div. 1 Crop Distribution



Div. 2 Crop Distribution



Div. 3 Crop Distribution



COLORADO AGRICULTURAL SURVEY*



Overview

- Statewide survey
 - Targeted towards irrigated farms with at least 100 acres
 - Sent in 2011 (for the 2010 crop year)
- Focus on BMP adoption rates and costs
- Response rate of 37%, but still useable

Results

- Tillage
 - 60% Conventional
 - 30% Reduced
 - 10% Strip
- Fertilizer
 - 70% Split-Apply



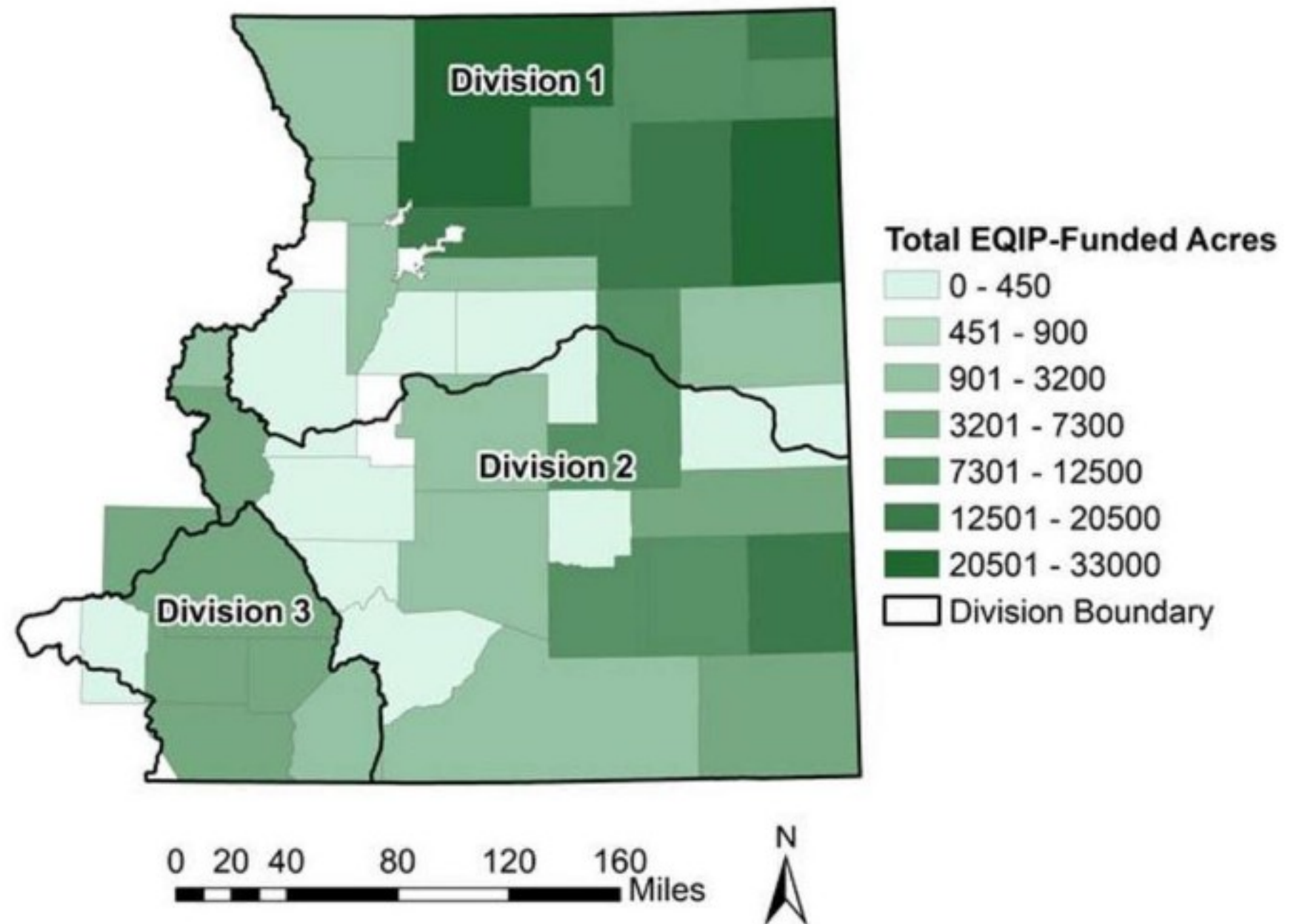
*Technical Report TR13-10, Agricultural Experiment Station

EQIP OVERVIEW



- USDA Cost-Share Projects
- Implemented between 2008 and 2018
- Examples Include
 - Irrigation
 - Tillage
 - Cover Crops
 - Prescribed Grazing
- CLEAN Center Modeling
 - Irrigation
 - Tillage
 - Filter Strips

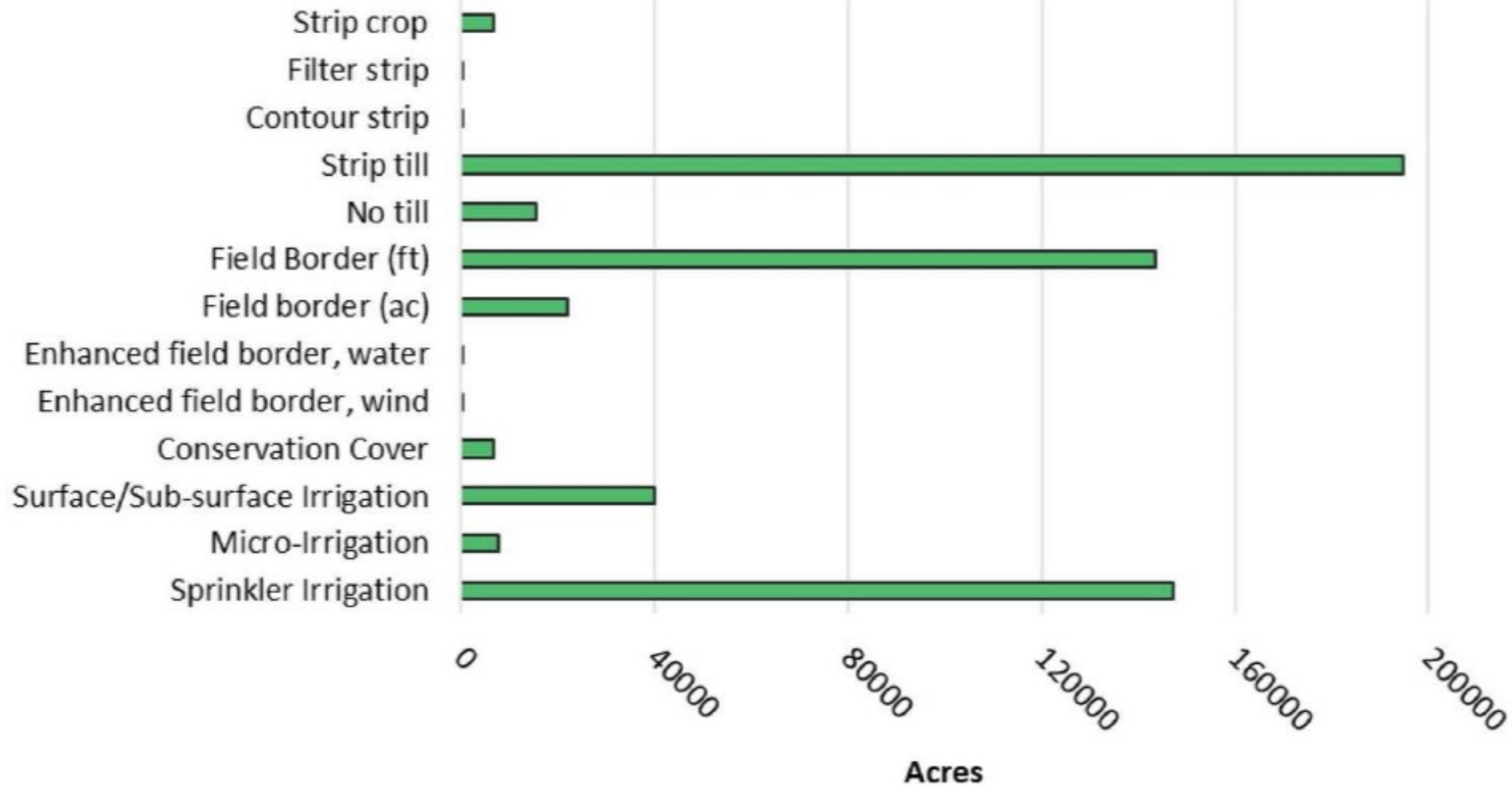
Total EQIP-Funded Acres
by County in the Study Area



EQIP ACRES FUNDED



EQIP-Funded Conservation Practices Assessed in this Analysis



AGGREGATE RESULTS



EQIP-Funded Conservation Practice	% Reduction of Total Nitrogen	% Reduction of Total Phosphorus
Baseline	-	-
Irrigation (Sprinkler and Drip)	7.1	33.5
Field Border	6.3	30.1
Strip Till	6.9	29.6
No Till	6.9	24.4
Strip and No Tillage Combination	6.4	23.4
Total EQIP Progress	8.2	27.7

* Due to non-linear interactions between conservation practices per field, these reductions will not add linearly to the Total EQIP Progress

Discussion

- **Tyler Wible**

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- **Phil Brink**

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@ phil@brinkinc.biz

- **OWSI Office**

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🌐 owsi.colostate.edu



**ONE WATER
SOLUTIONS
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class research with
real world water
challenges

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water systems with
urban planning



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Agriculture**
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agricultural
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changing world



**Water and
Energy**
Exploring tradeoffs
among interconnected
water and energy
systems



**Ecosystem
Services**
Improving physical,
chemical, and
biological integrity
of water systems

owsi.colostate.edu
Colorado State University

Low-tech and process-based restoration (PBR) techniques to enhance riparian function: *A community research model*



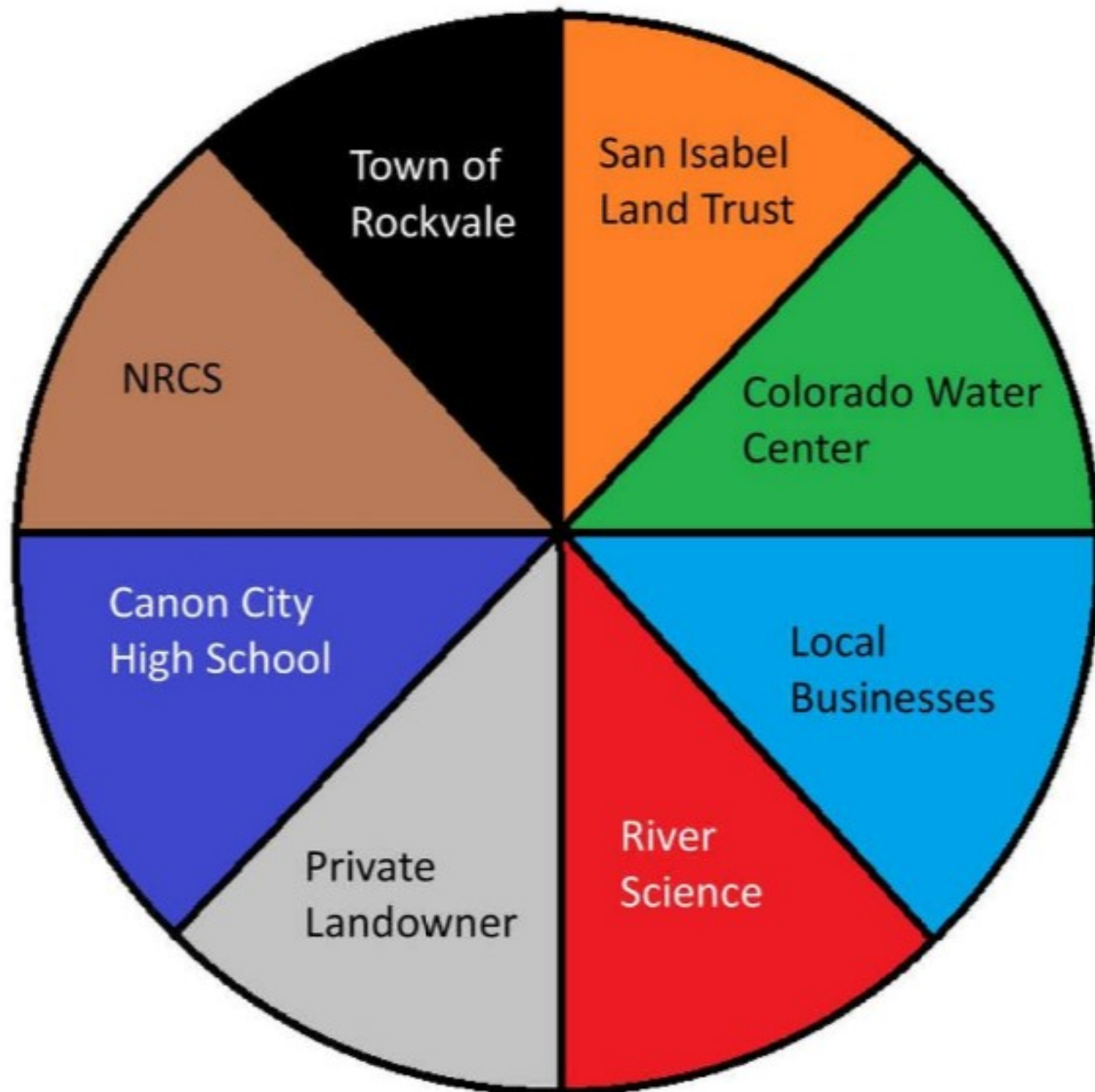
Blake Osborn
Colorado Water Center



Luke Javernick
River Science



Community-Based Research and Education



Research Model



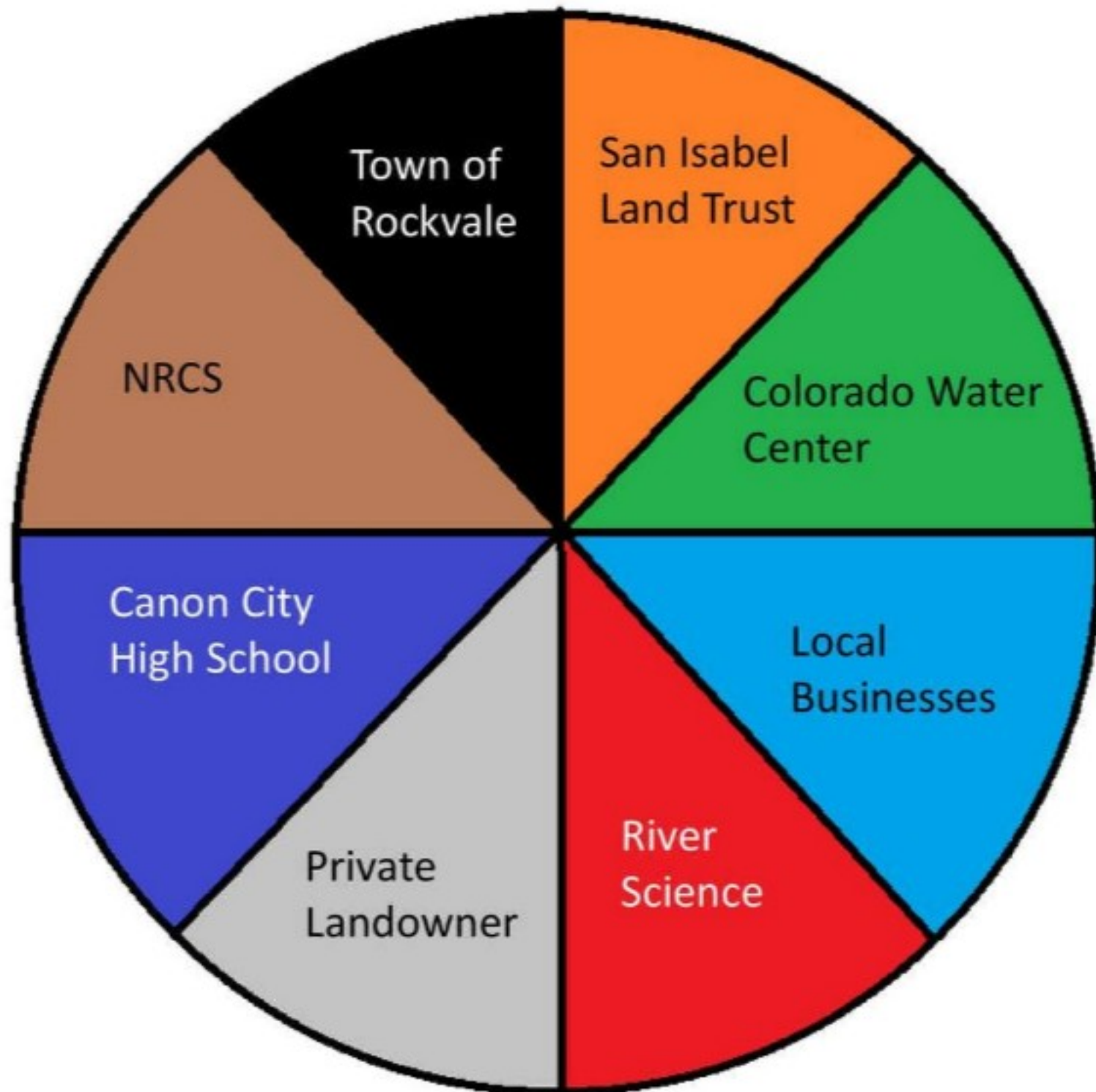
Community Engagement



CC BY Jeremy Maestas



Community-Based Research and Education



River Science

A CCHS Class



Old Question: When are we ever going to use this?

New Answer: In about 10 minutes!

Concepts

Experiences

Capstones

Internships

Careers

Success of Partnerships





ROLL FOOTAGE



Low-tech and process-based restoration (PBR) techniques to enhance riparian function: *A community research model*



Blake Osborn
Colorado Water Center



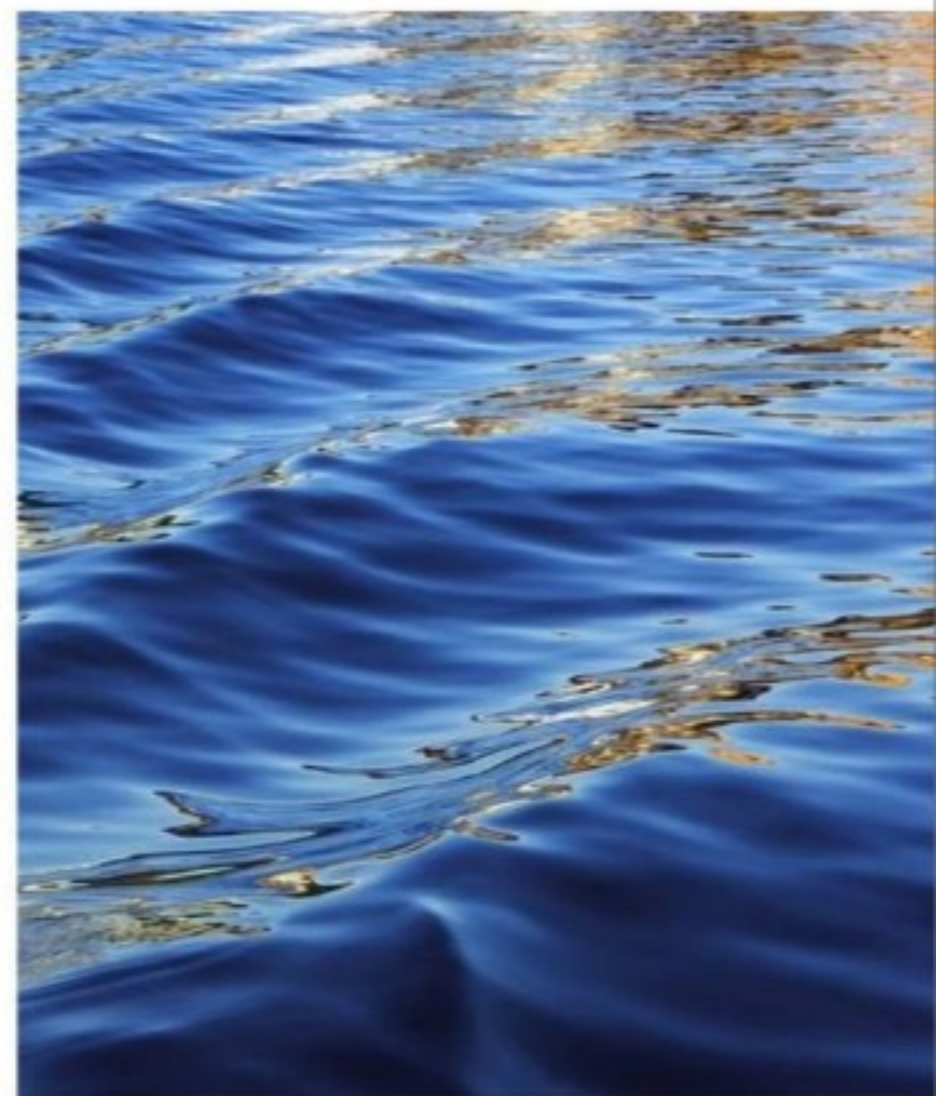
Luke Javernick
River Science





Land and Water Connected

Innovative land and water projects from Colorado's
land trust community.





Water Quality & Land Conservation

Mountain Area Land Trust partnered with University of Denver.

Baseline water quality testing on conserved properties.

Water Quality and Land Conservation

Partnered program with multiple landowners.

Picture of overall health of the streams.

Baseline data for future planning for landowners and the land trust.





Protecting Agricultural Economies

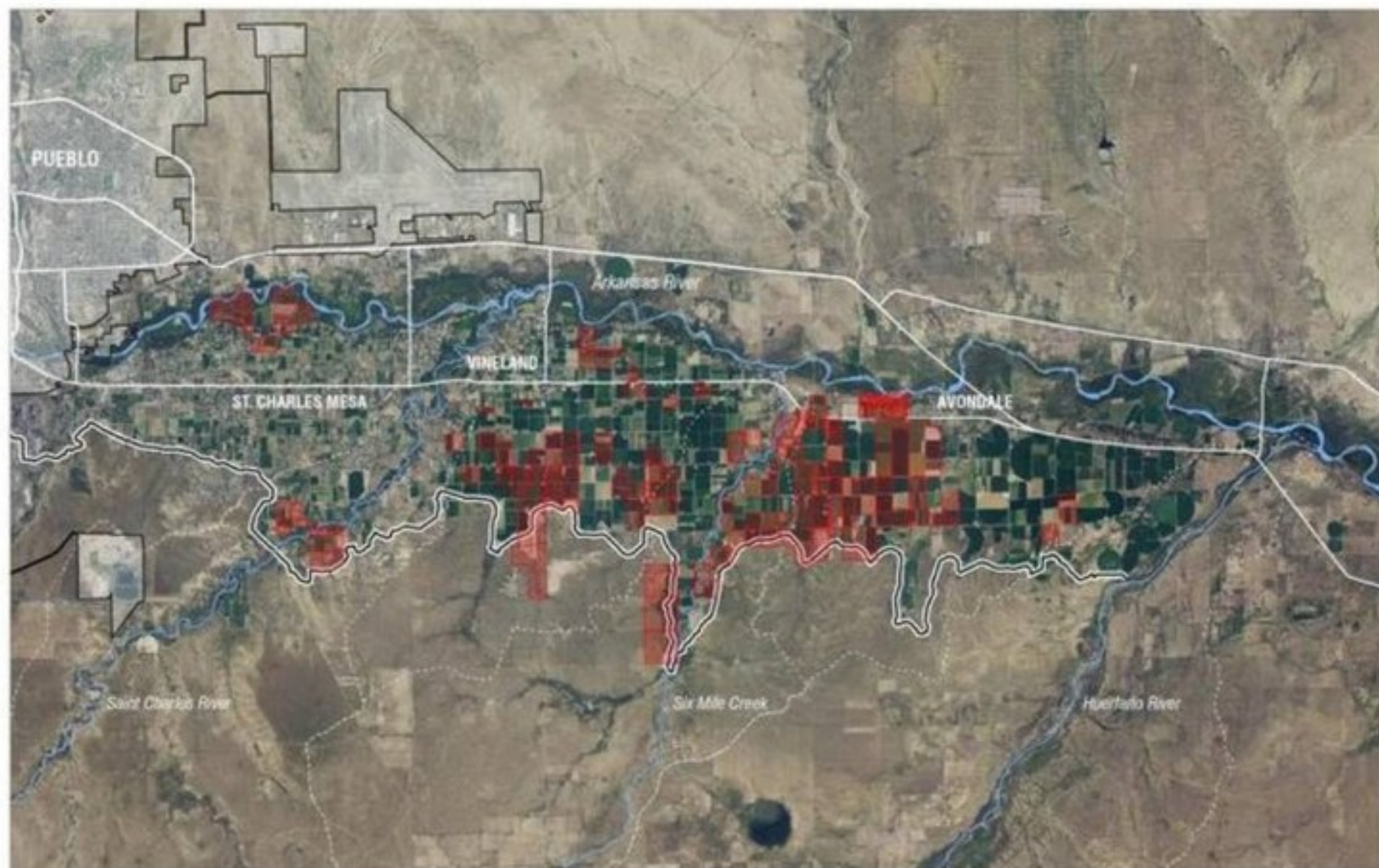
Bessemer Farmland Conservation Project lead by Palmer Land Trust.

Strategic agricultural land planning happening community-wide.

Protecting Agricultural Economies

Identifying critical production areas of Pueblo County.

Balancing needs of municipal growth.





Community Resource for more than People

Crested Butte Land Trust and the
Slate River Working Group.

Community Conservation to
benefit all.

Community Resource for more than People

Thriving wildlife habitat through volunteer no-float periods.

River intern monitors river access and provides education to the public.

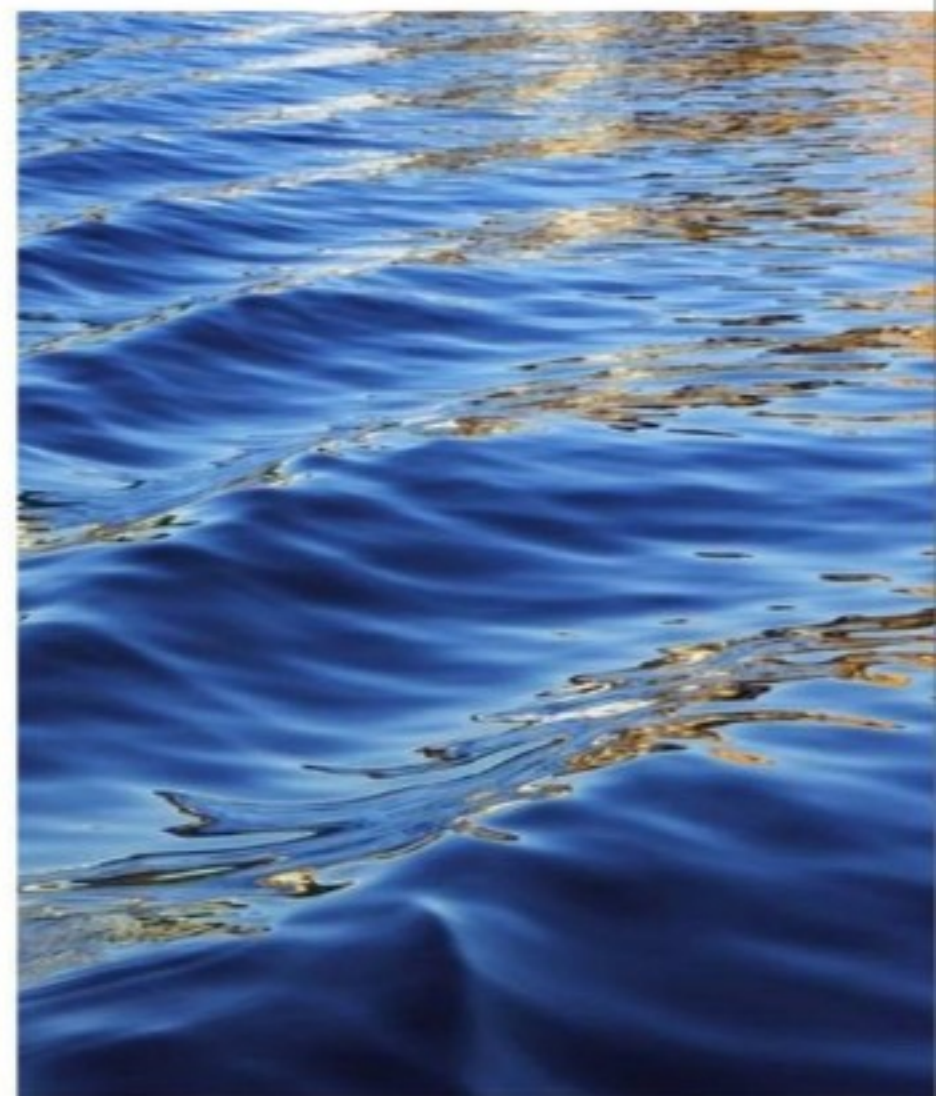
Community pride in resource management.



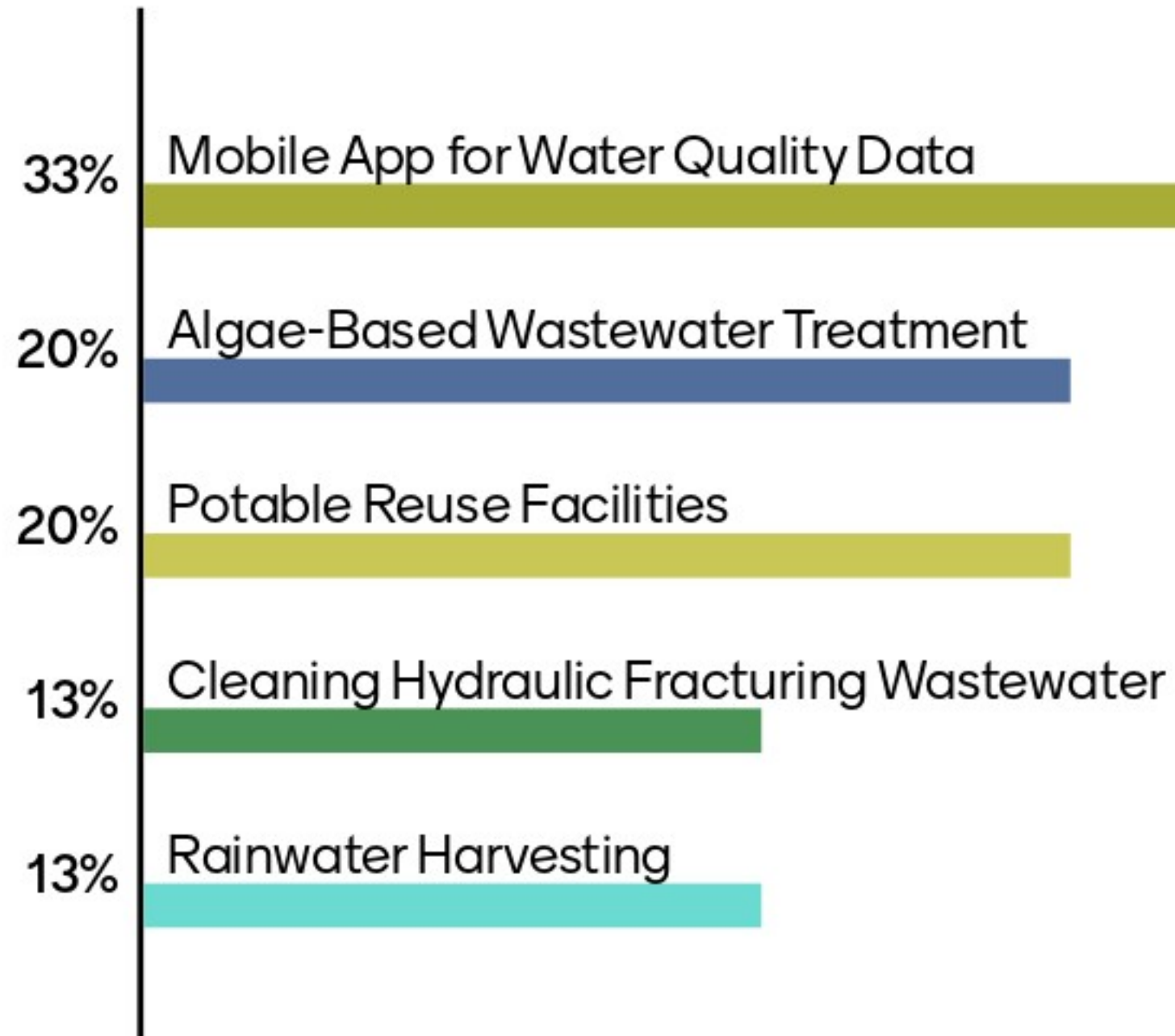


Growing Interest

- Increased interest from land trusts.
- Increased interest from the water community.
- Connections with CWCB, state planning efforts and regional work.
- Wholistic approach to policy and emerging opportunities.



Rate these water innovation techniques



Q&A: Enter your questions for our presenters!



How can I enroll in the class? :)

Is the progress from eqip "enough" ? How will these results impact implementation of reg 85?

Blake/Luke - what kind of baseline data collection lends itself to volunteers/students? Cross-sections, observations, what else?

For Luke and Blake, I'd like to hear a little more about the results from research side of the research and restoration partnership with the community.

For Luke/Blake, what research results/key indicators are you looking at?

Luke and Blake, have you produced a summary of your education program that can be used by others?

Is there a report on the Pueblo and Palmer land trust project available somewhere?



Tips to become a better conversationalist

LESSON 10: ASK PEOPLE QUESTIONS THAT GIVE THEM AN OPPORTUNITY TO TALK ABOUT THEMSELVES.



URBAN INNOVATIONS FOR WATERSHED HEALTH

Moderator: Mary Powell



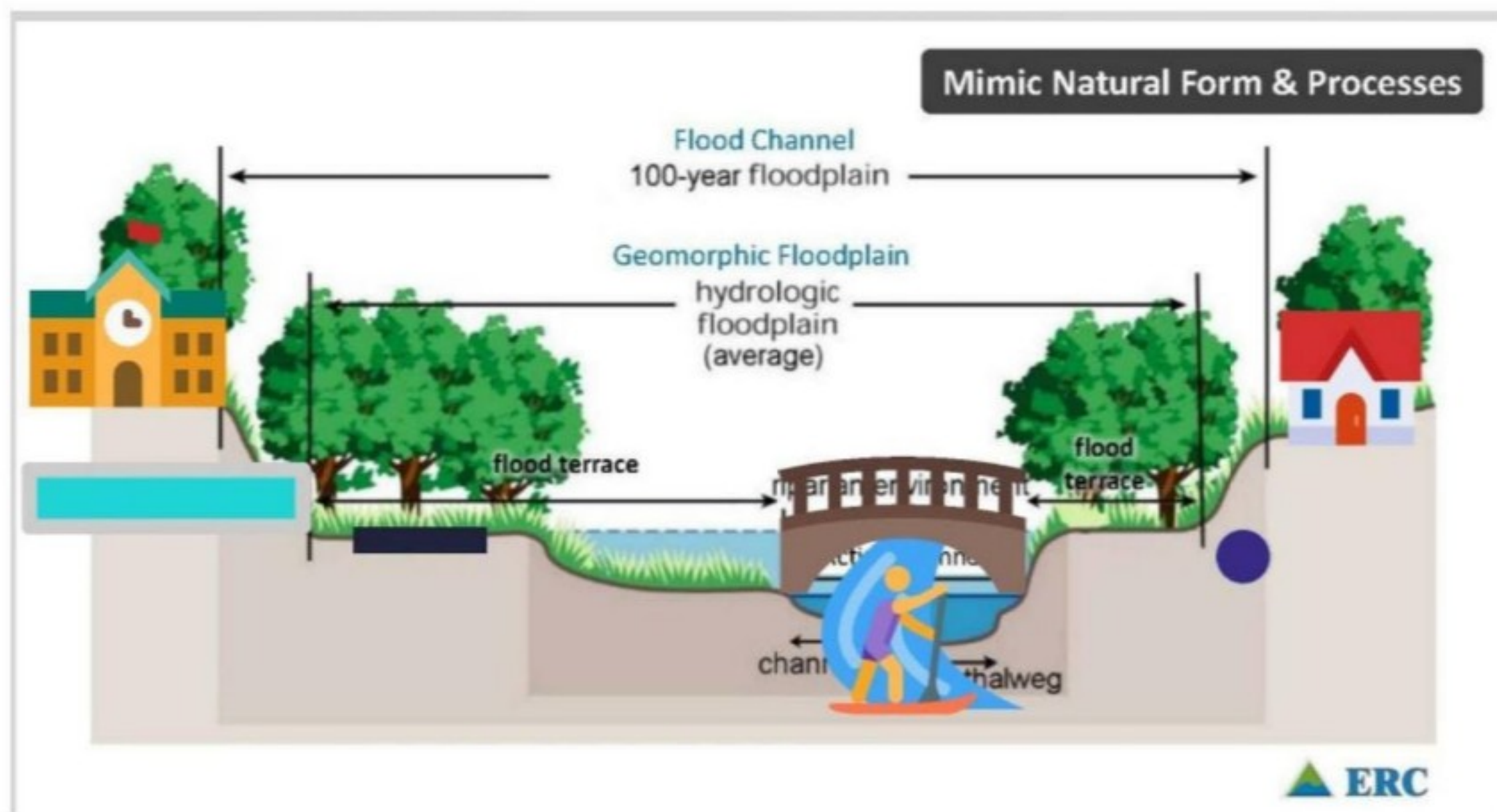
Chasing Unicorns: A Business as (Un)Usual Model for Urban Stream Management

Mary Powell and Laura Kroeger
Mile High Flood District



Integrated Physical Condition Assessment of Urban Streams

A Novel Procedure for Diagnosing and Quantifying Change



STREAM ASSESSMENT PROCEDURE



OVERVIEW OF ASSESSMENT DEVELOPMENT

High Functioning Low Maintenance Streams

Work within stream ecosystem to understand and balance the contextual elements that tell the story of what is the highest functioning system with the lowest long term maintenance cost



STREAM ASSESSMENT PROCEDURE



OVERVIEW OF ASSESSMENT DEVELOPMENT

Pillar	Function (one word description)	Management strategy statement supporting MHFD mission.
Hydrology	Distributes	Mimic natural runoff rates and/or limit and mitigate adverse changes to watershed runoff.
Hydraulics	Moves	Safely convey watershed runoff minimizing risk to life and property through preservation and mitigation.
Geomorphology	Responds	Integrate sediment continuity and trajectories throughout a stream network to maintain hydraulic conveyance.
Vegetation	Stabilizes	Support healthy vegetative communities within stream corridors to support stability and maintain conveyance.
Human Connection	Stewardship	Protect people and property from flood risks while providing the highest value use of stream corridors.

STREAM ASSESSMENT PROCEDURE



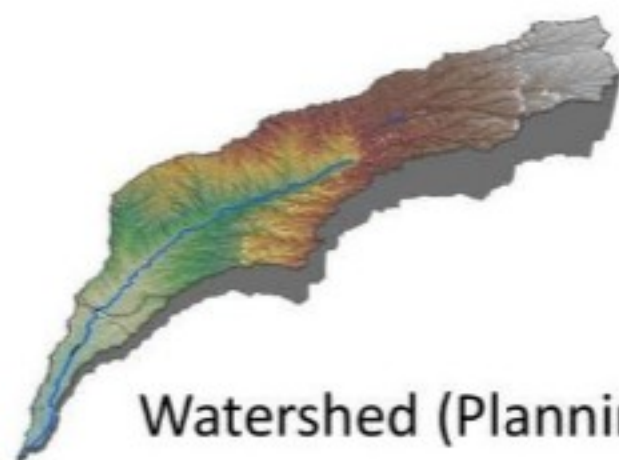
OVERVIEW OF ASSESSMENT DEVELOPMENT



The framework focuses on integrating the objectives of:

- flood protection,
- stream processes, and
- social/community uses

At multiple scales...



Watershed (Planning)



Corridor (Stream Management)



Reach (Project)

Riverscapes – Safely conveying flood and storm flows

Landscapes – Land management as land use continues to change

STREAM ASSESSMENT PROCEDURE



OVERVIEW OF ASSESSMENT DEVELOPMENT

PART 2

Collection → **Insight** → **Action**



Select all images with High Functioning Low Maintenance Streams (HFLMS)



1



2



3



4



5



6



7



8



9

MHFD
MILE HIGH FLOOD DISTRICT

Protecting People, Property
and Our Environment.



Thank you

Mary Powell and Laura Kroeger
Mile High Flood District



MHFD
MILE HIGH FLOOD DISTRICT

Protecting People, Property
and Our Environment.

Laying out the Land to Preserve the Stream Network, Reduce Runoff, and Enhance a Community



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October 6-8, 2020

Jim Wulliman, PE

Sara Johnson, PE, CFM

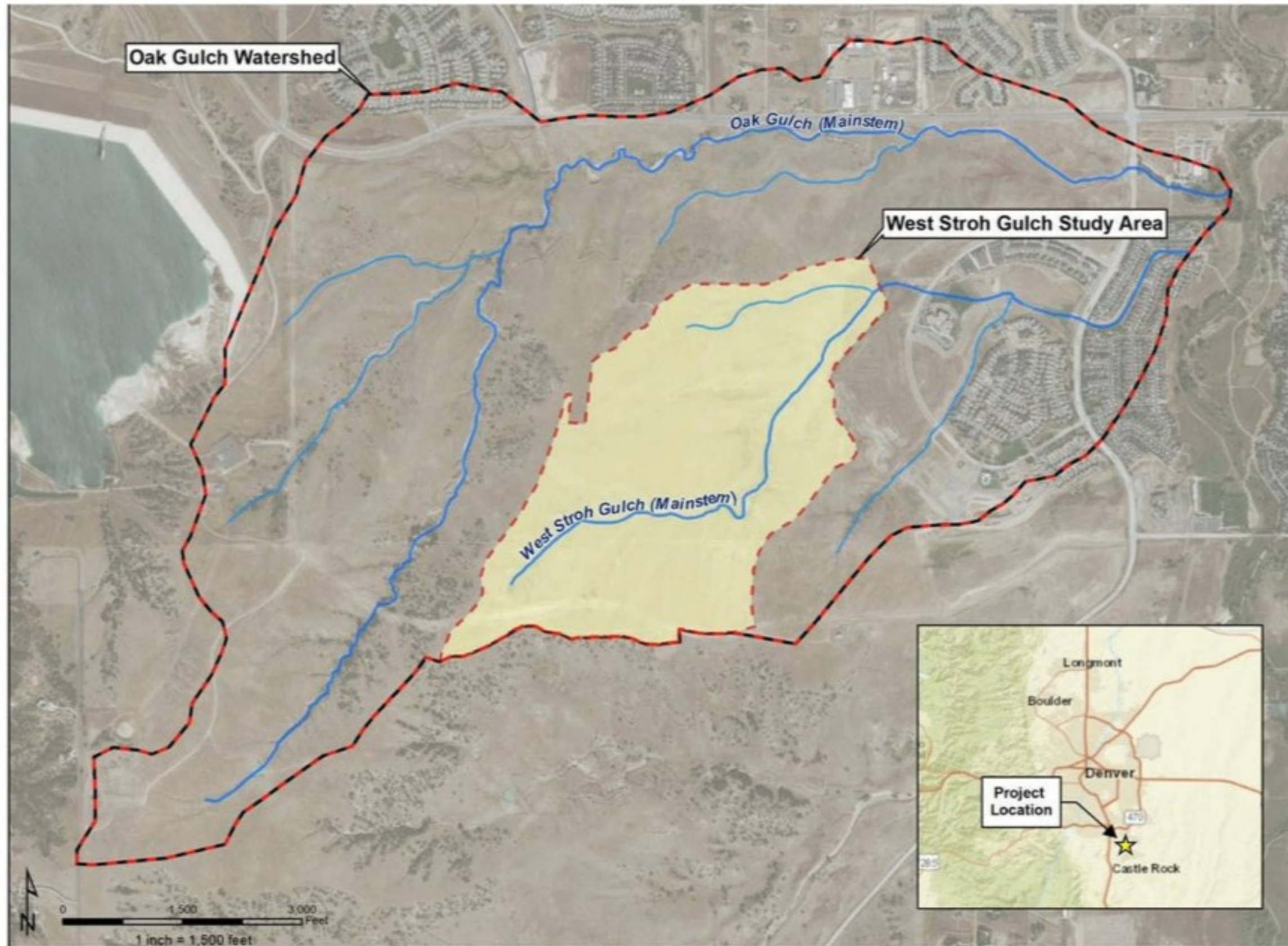
Muller Engineering Company in partnership
with Mile High Flood District, Town of Parker and the
Anthology North Development Team

Partnering with Development -- the Goals



- 1. Work with the land to manage stormwater**
- 2. Preserve high-value open spaces**
- 3. Create high functioning lower maintenance streams**
- 4. Maintain desired densities**
- 5. Manage costs**

Where we started – Stroh Gulch pilot study



Where we started – Stroh Gulch pilot study

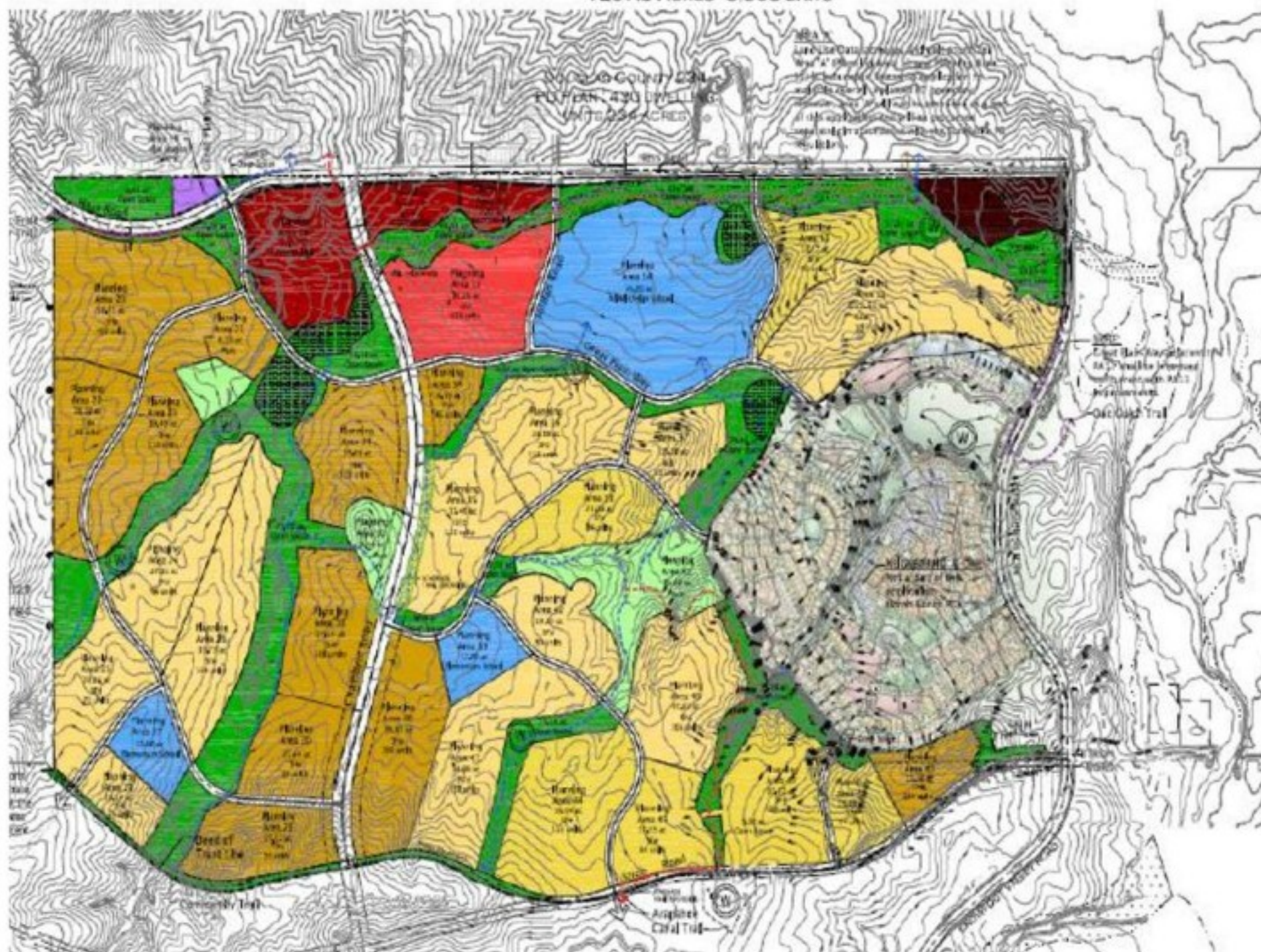


ANTHOLOGY NORTH DEVELOPMENT PLAN

AMENDMENT #1

COUNTY OF DOUGLAS, STATE OF COLORADO.

1207.9 ACRES - 3,305 UNITS



Anthology North Development Plan Chart

June 11, 2014

Parcel#	Land Use	Gross Acres	Max. Density per Dev Guide	Net Acres	DU (x units or plots)
Pa-01	SFR	10.02	4.5	22.0	221
Pa-02	Commercial	18.20	220	15.95	-
Pa-03	SFR	18.57	8.5	17.10	60
Pa-04	Widening School	75.00	-	70.67	-
Pa-05	RU	38.25	220	30.12	121
Pa-06	Commercial	9.12	220	7.30	-
Pa-07	Commercial	6.17	220	4.37	-
Pa-08	Commercial	28.92	220	25.62	-
Pa-09	Fire Station	3.68	-	3.00	-
Pa-20	TRs	38.71	14.0	37.36	131
Pa-21	Park	6.12	-	6.12	-
Pa-22	TRs	22.20	14.0	21.57	68
Pa-23	TRs	35.40	14.0	33.88	131
Pa-24	SFR	27.51	4.5	25.80	90
Pa-25	SFR	22.18	4.5	21.00	78
Pa-26	SFR	35.40	4.5	34.70	134
Pa-27	School	12.00	-	11.56	-
Pa-28	SFR	18.14	4.5	16.70	58
Pa-29	TRs	20.02	14.0	19.80	60
Pa-30	TRs	27.44	14.0	26.80	90
Pa-31	TRs	27.14	14.0	22.95	131
Pa-32	Park	6.04	-	7.87	-
Pa-33	TRs	28.05	14.0	23.64	111
Pa-34	TRs	18.30	6.5	16.75	45
Pa-35	SFR	37.40	4.5	35.07	131
Pa-36	SFR	28.39	4.5	26.32	111
Pa-37	SFR	16.15	4.5	13.94	58
Pa-38	SFR	27.20	6.5	19.07	64
Pa-39	School	12.00	-	11.76	-
Pa-40	TRs	36.80	8.5	27.12	134
Pa-41	SFR	34.00	4.5	33.20	131
Pa-42	SFR	18.13	4.5	17.90	60
Pa-43	Park	27.85	-	21.00	-
Pa-44	SFR	38.04	6.5	33.97	131
Pa-45	SFR	27.53	6.5	18.70	64
Pa-46	SFR	38.87	4.5	30.48	131
Pa-47	SFR	30.30	6.5	23.84	121
Pa-48	SFR	12.45	6.5	11.01	54
Pa-49	TRs	12.35	14.0	11.95	131
Subtotal		565.13		474.64	3,305
Land Use		Gross Acres	Max. Density per Dev Guide	Net Acres	DU (x units or plots)
RU		38.25	-	30.12	423.33
Residential		781.59	-	648.33	2,777.68
Open Space		241.78	-	224.73	-
Parks		47.57	-	45.09	-
Schools		18.00	-	17.95	-
Fire Stations		3.68	-	3.00	-
Commercial		67.93	-	58.14	-
TOTALS		1,297.84		1,101.36	3,305
SFR Total		146.84	6.5	137.87	587.30
SFR Total		382.62	4.5	290.83	1,142.68
TRs Total		251.93	14.0	222.82	1,154.68
RU Total		38.25	220	30.12	423.33
TOTALS		799.64		676.47	3,305

Where we started – Stroh Gulch pilot study



Traditional lot layout



Lot layout to preserve stream network



Where we started – Stroh Gulch pilot study



Traditional detention and hard grade control



Distributed detention and softer channels



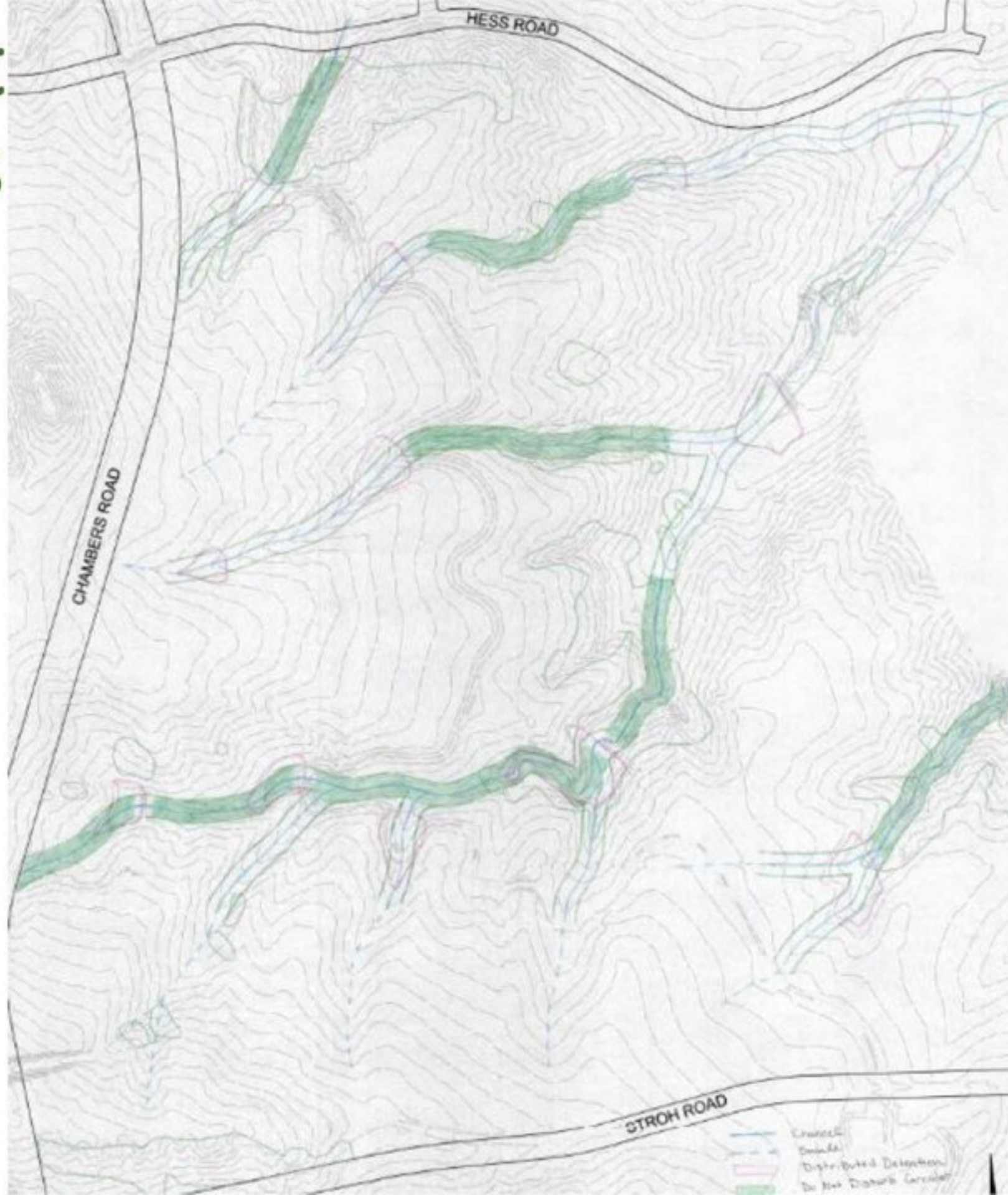
Current Process



Assess existing stream network



Current Process



Assess existing stream network



Delineate stream corridors

Current Process



Assess existing stream network



Delineate stream corridors



Iterate development layout

Current Process



Assess existing stream network



Delineate stream corridors



Iterate development layout



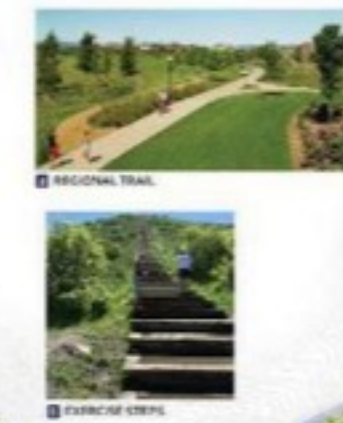
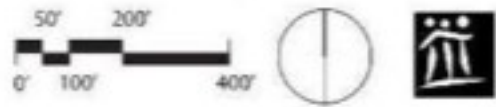
Strategically distribute detention



Result



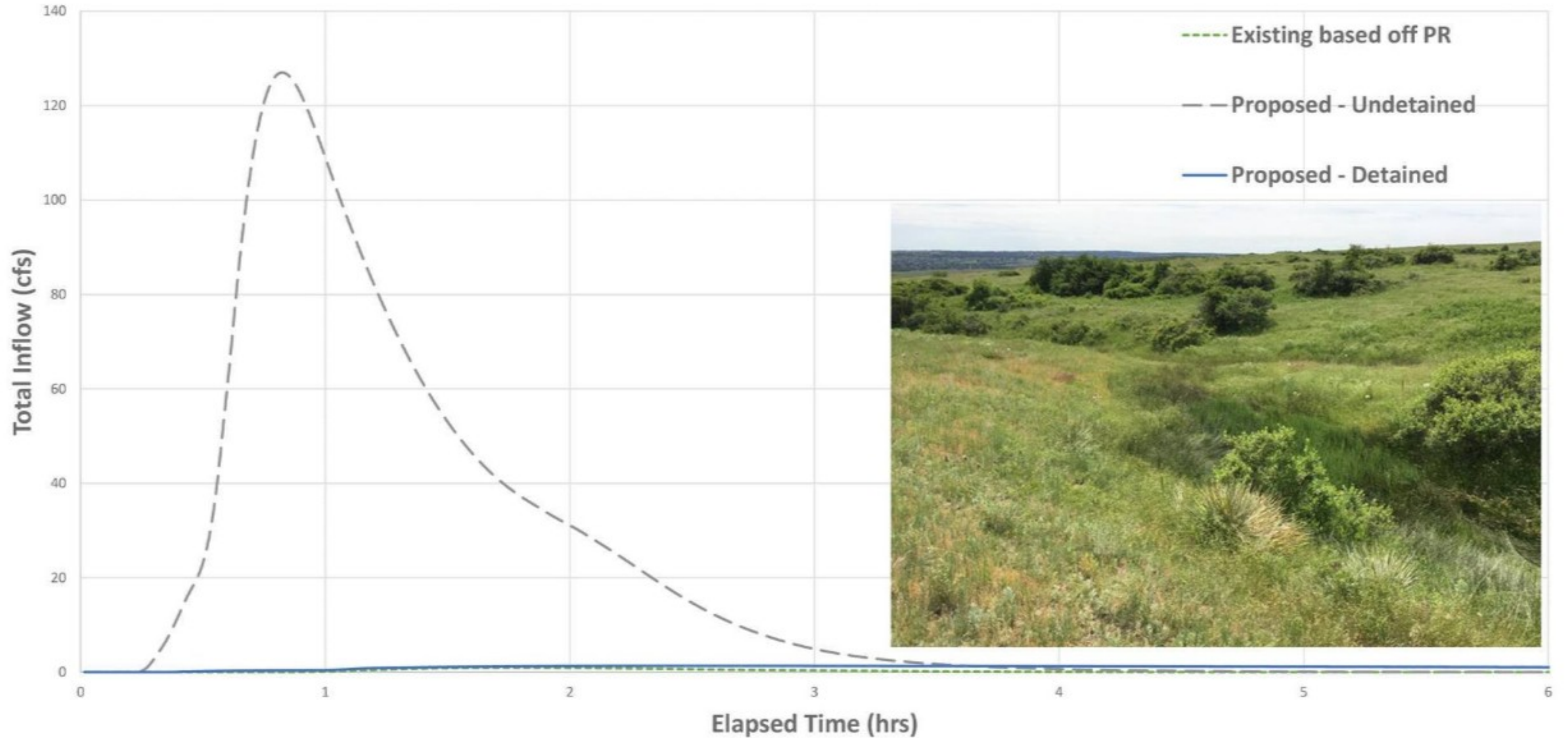
ANTHOLOGY - Segment 1- Open Space Concept Plan- November 2019



Result



Stroh Trib 2 (Main Stem): 2-yr Hydrographs



What does it take to achieve goals?



1. Genuine desire to find common goals between local government, developer, and designers regarding land, money, and time (everyone will be making concessions).



What does it take to achieve goals?



2. Early start/early communication of process and expectations (specifically during planning before the project becomes a project with the local government).



What does it take to achieve goals?

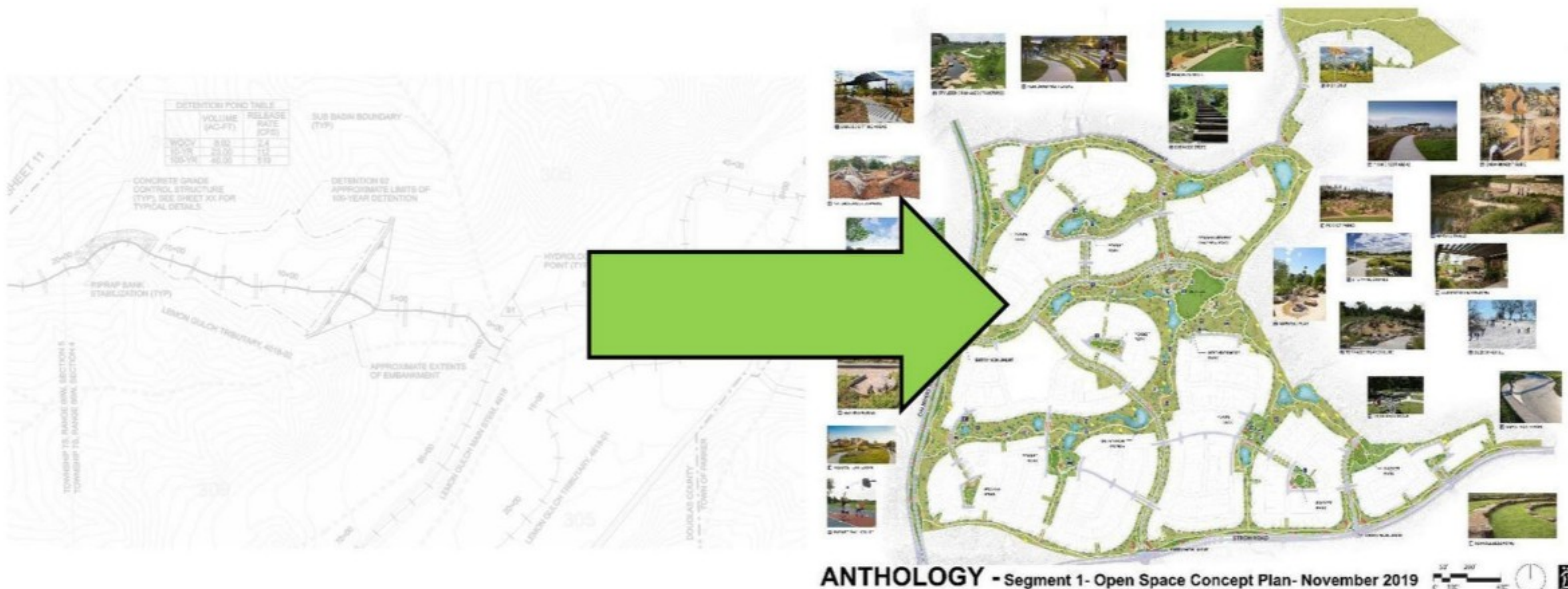


3. Promote an environment for collaboration by City, developer, designers – pressing in and moving toward one another founded on common goals.



What does it take to achieve goals?

4. Applying current stormwater technology; not assuming older master plan approaches to appropriately bid.



ANTHOLOGY - Segment 1- Open Space Concept Plan- November 2019

Laying out the Land to Preserve the Stream Network, Reduce Runoff, and Enhance a Community



Sustaining Colorado Watersheds Conference

“Business as (Un)Usual”

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Jim Wulliman, PE

Sara Johnson, PE, CFM

Muller Engineering Company in partnership
with Mile High Flood District, Town of Parker and the
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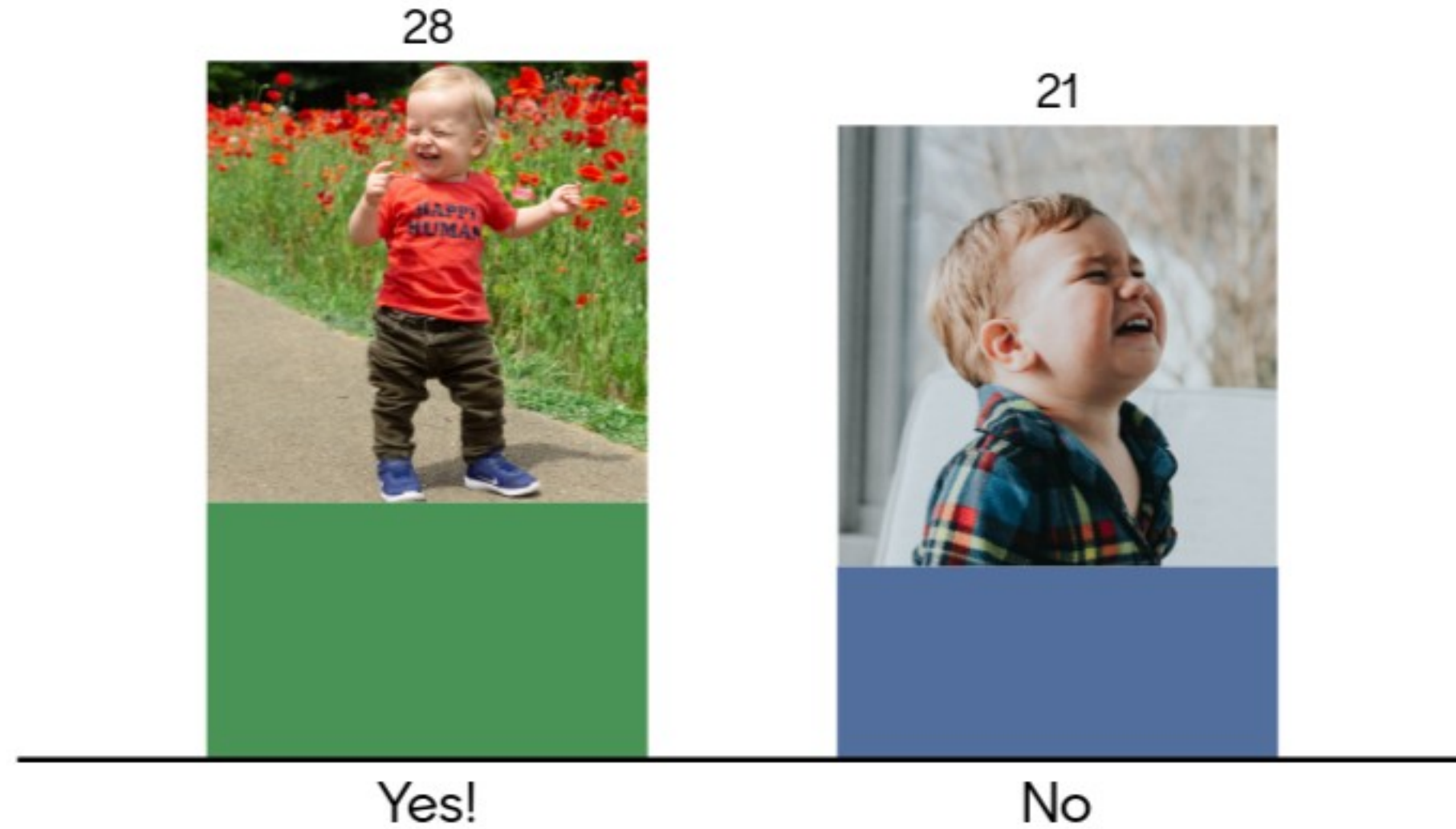


HIGH LINE CANAL CONSERVANCY

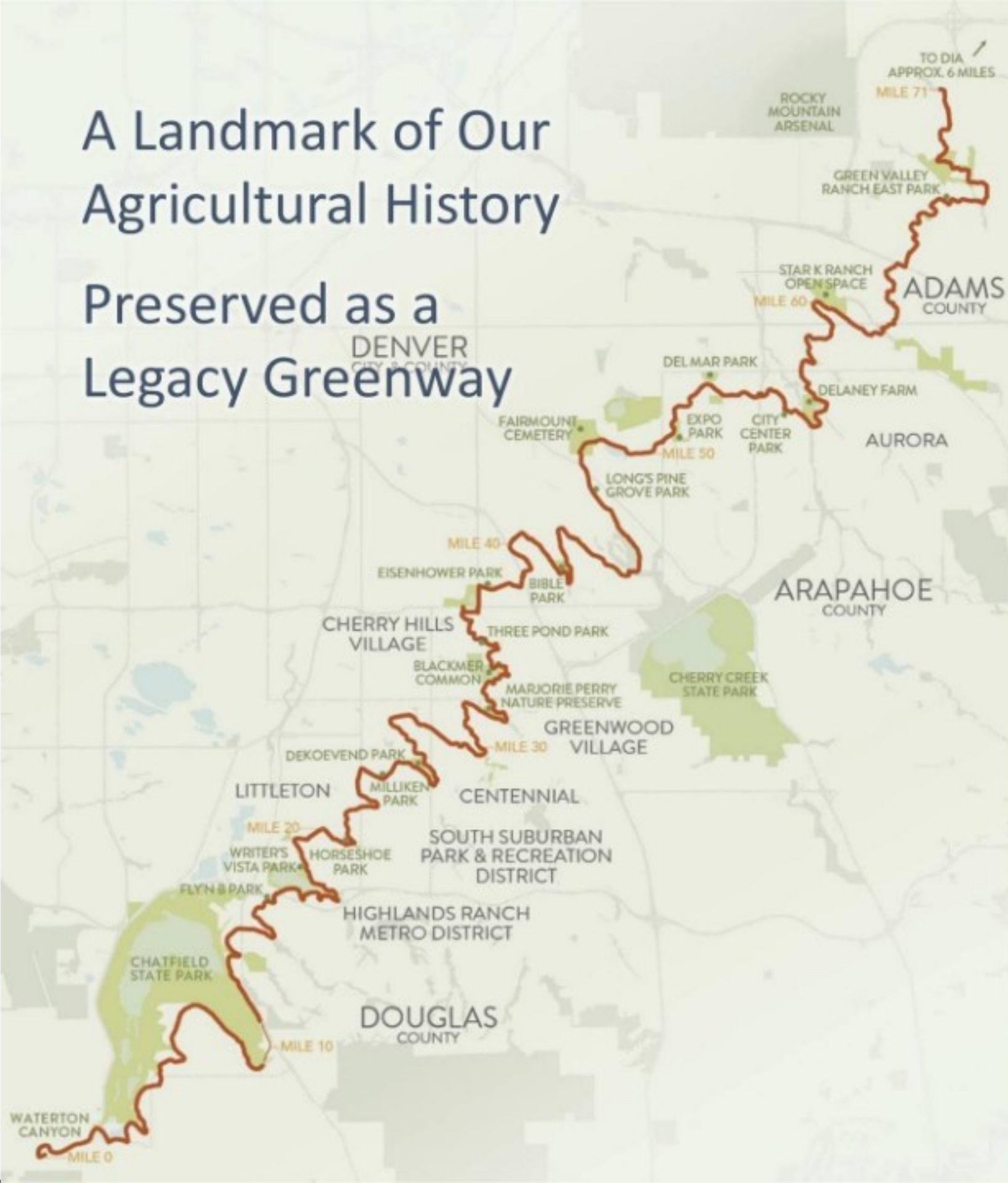
Connecting Communities – Connecting Nature
From the Foothills to the Plains

Transforming the High Line Canal in the Most (Un)Usual Way
Sustaining Watersheds Colorado
October 7, 2020

Have you ever recreated on the High Line Canal?



A Landmark of Our Agricultural History Preserved as a Legacy Greenway



Denver Metropolitan Area, CO
The High Line Canal
850 acres

Denver, CO
City Park
330 acres

New York City, NY
Central Park
840 acres


350,000
residents
within one mile


500,000+
trail users
per year

LAST CENTURY'S INFRASTRUCTURE



HIGH LINE CANAL
CONFERRANCY

THIS CENTURY'S OPEN SPACE NETWORK



HIGH LINE CANAL
CONSERVANCY

OUR STRATEGY: PARTNERSHIPS



Canal Collaborative

Arapahoe County

City of Aurora

Cherry Hills Village

City and County of Denver

Denver Water

Douglas County

Greenwood Village

Highlands Ranch Metro District

Littleton

Mile High Flood District

South Suburban Parks and Rec. District

High Line Canal Conservancy

Southeast Metro Stormwater Authority



HIGH LINE CANAL
CONSERVANCY



HIGH LINE CANAL
CONSERVANCY

A Collaborative Framework for Our Regional Legacy

September 2019

STORMWATER MANAGEMENT



cleaner water
with stormwater
management

40%

Canal
will be
wet

100

more
days per
year

KEY STUDIES: MAKING THE CASE FOR THE TRANSFORMATION



HIGH LINE CANAL FEASIBILITY STUDY FOR STORMWATER RUNOFF REDUCTION & TREATMENT AUGUST 2014

PREPARED FOR:
URBAN DRAINAGE & FLOOD CONTROL DISTRICT
DENVER WATER
CITY & COUNTY OF DENVER
AURORA WATER
ARAPAHOE COUNTY
DOUGLAS COUNTY

PREPARED BY:
RESPEC CONSULTING & SERVICES
720 SOUTH COLORADO BLVD, SUITE 4105
DENVER, COLORADO, 80246



HIGH LINE CANAL STORMWATER AND OPERATIONS MASTER PLAN – FINAL REPORT OCTOBER 2018

PREPARED FOR:
URBAN DRAINAGE & FLOOD CONTROL DISTRICT
DOUGLAS COUNTY
AURORA WATER
CHERRY HILLS VILLAGE
SOUTHEAST METRO STORMWATER AUTHORITY

GREENWOOD VILLAGE
LITTLETON
CITY AND COUNTY OF DENVER
DENVER WATER

PREPARED BY:
RESPEC CONSULTING AND SERVICES, INC.
720 S COLORADO BOULEVARD
SUITE 4105
DENVER, CO 80246
303.757.3855

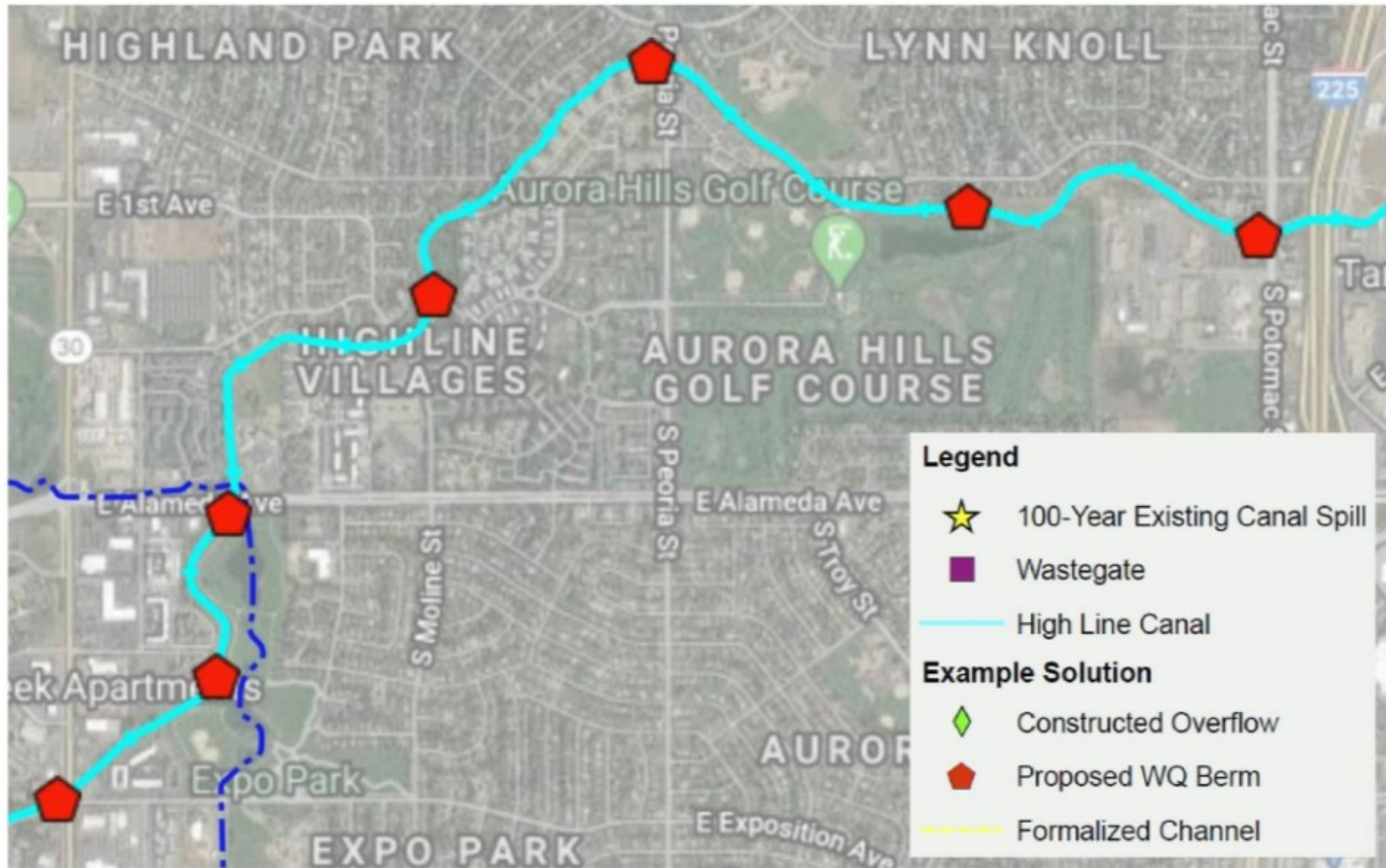


Technical Leadership Team

- Cities of Aurora, Cherry Hills Village, Greenwood Village and Littleton
- City & County of Denver
- Denver Water
- Douglas County
- Highlands Ranch Metro District
- Mile High Flood District
- RESPEC Engineering CANAL CONSERVANCY
- SEMSWA

Recommended Solutions: Water Quality

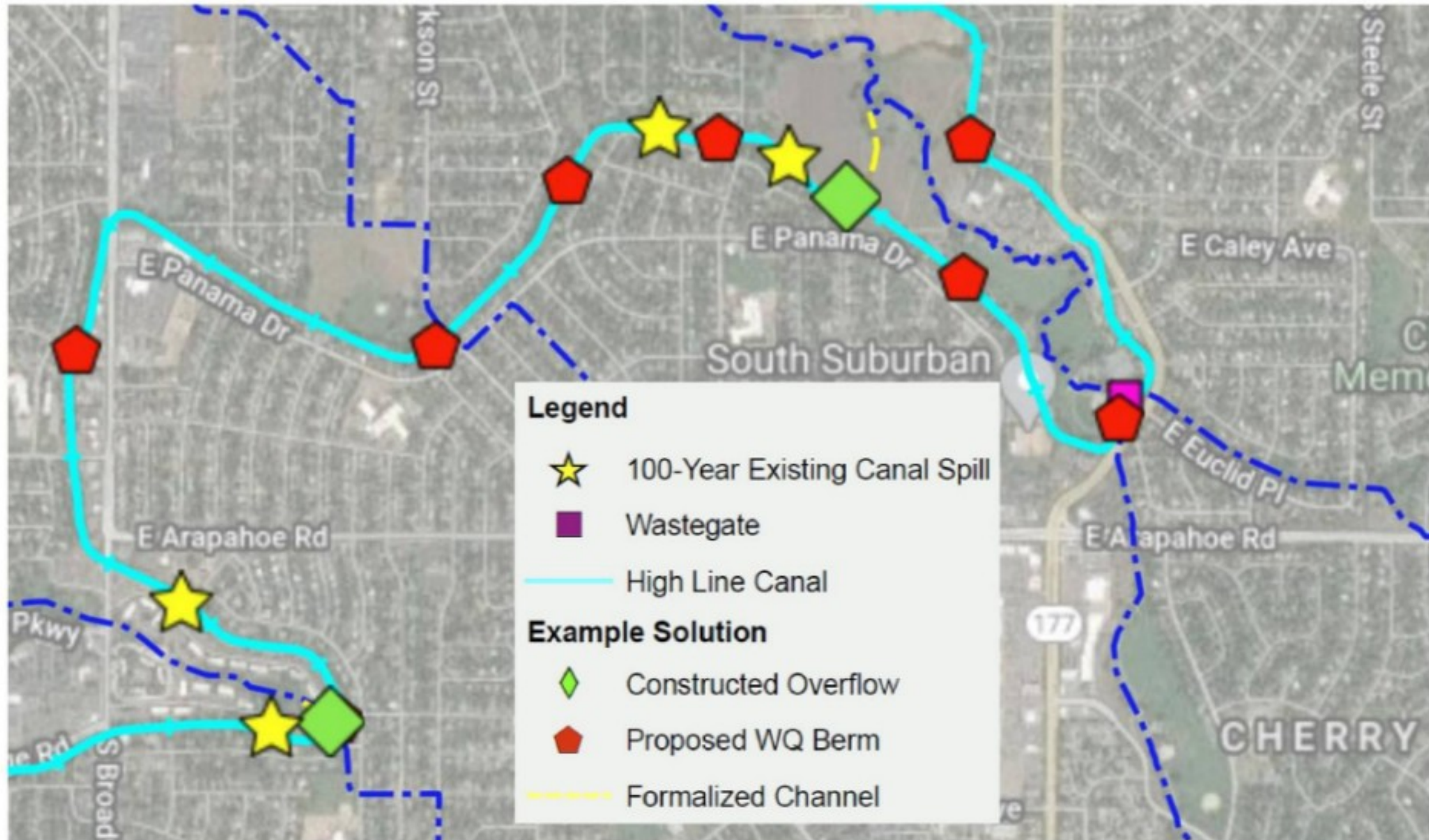
Water Quality Berms (92)



Source: Stormwater and Operations Master Plan

Recommended Solutions: Localized Flood Mitigation

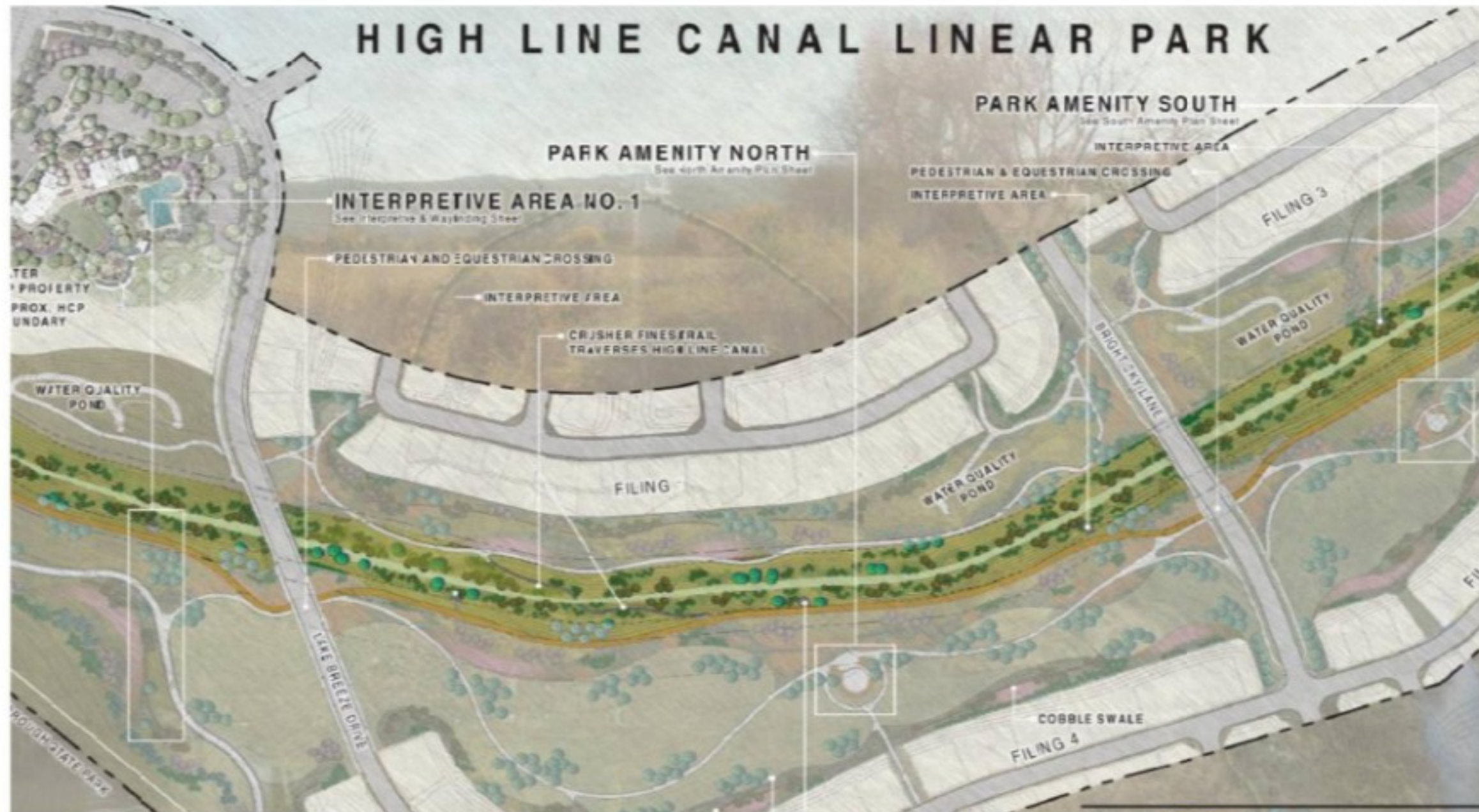
Constructed Overflows (13) Raised Embankments
Formalized Channels (8)



Source: Stormwater and Operations Master Plan

Douglas County Stormwater Project: Solstice Development

- Developer-led project
- Construction underway
- Stormwater conveyance
- 3.5 miles transformed



City of Littleton Stormwater Project: Windermere Trails

- Developer-initiated project
- Stormwater conveyance
- Construction completed in June
- 1 mile transformed



City of Greenwood Village Stormwater Project

- Jurisdiction-led project
- Flood mitigation
- Construction to begin Fall 2020
- 2.5 miles transformed



City & County of Denver Stormwater Project: Eisenhower Park

- Jurisdiction-led project
- Water Quality
- Formalize stormwater outfalls
- 1.5 miles transformed



Summary of Canal-Wide Benefits

Community Health

10,580 residents benefitting
within 1/4 mile of the canal
= \$3.8M
Potential avoided medical costs
from health benefits

Water Quality

51 acres existing green
infrastructure
= \$1.7M
Avoided costs to purchase
land to replace existing
green infrastructure

46 acres proposed green
infrastructure (berm areas)
= \$1.5M
Avoided costs to purchase
land to replace existing
green infrastructure

Habitat

737 Acres (64%)
forest/natural riparian
habitat in 75-ft buffer
= \$25M
Purchase riparian habitat
replacement acres

10,787 high value native
trees along canal
= \$5.4M
O&M costs deferred by using
stormwater to prevent tree loss,
\$2.7M for native
tree replacement

19,055 trees
along canal
= \$ 25.9M
Value of
existing trees

What additional (un)usual benefits of transitioning the Canal to green stormwater infrastructure could we consider?

animal migration



THANK YOU.

Q&A: Enter your questions for our presenters!



Is the canal considered waters of the US?

Cathy & Josh...what was the biggest challenge in transforming an irrigation water distribution system to a stormwater collection system?

For the development highlighted---Are there/were there permitting hurdles locally associated with the new distributed stormwater treatment design?

Types of filtration systems incorporated into the canal?

Jim & Sara - Did the Town of Parker need to update their code/design criteria in order to allow such a natural development? Or was this just a developer-initiated idea?

If we know that water quality decreases with current stormwater conveyance, why don't we send all stormwater through green infrastructure?

Jim - When setting the stream corridor boundaries for the planned development how was the corridor width determined?

Are you including plant nurseries in the conversations? They can provide the tools for your project

Teach people traveling along canal where watershed boundaries & channels are (local geography)



Q&A: Enter your questions for our presenters!



How do you mitigate the effects of dog waste ?

Are you using GIS in your project? I am attaching an example we are using here in Arbor Valley Nursery <https://arcg.is/CmfDP>

Retrofits in fully built-out watersheds





Business as (Un)Usual
Oct. 6-8, 2020



THANK YOU!

Our next session begins right after this at 2:10pm!
Going to (Un)Usual Scales for Future Impact

To get there....

Close out of this Webinar session, return to EXPO, and navigate to Session 4 on Oct. 7

Then open that session and click "Join" to enter the next Webinar session