

# Reservoir Management in Montana: Challenges and Opportunities for Building Drought Resilience

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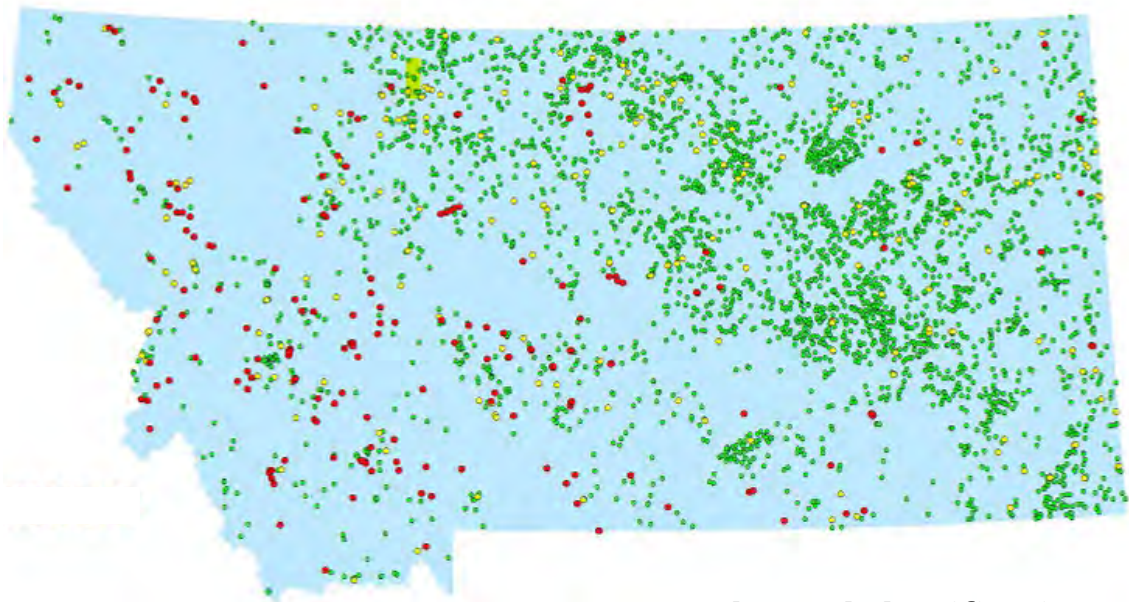
Sean R Heavey

# Historical context



- Western settlement and doctrine of prior appropriation
- Desert Land Act of 1877
- Reclamation Act of 1902
- Flood Control Act of 1944

# Montana's storage infrastructure

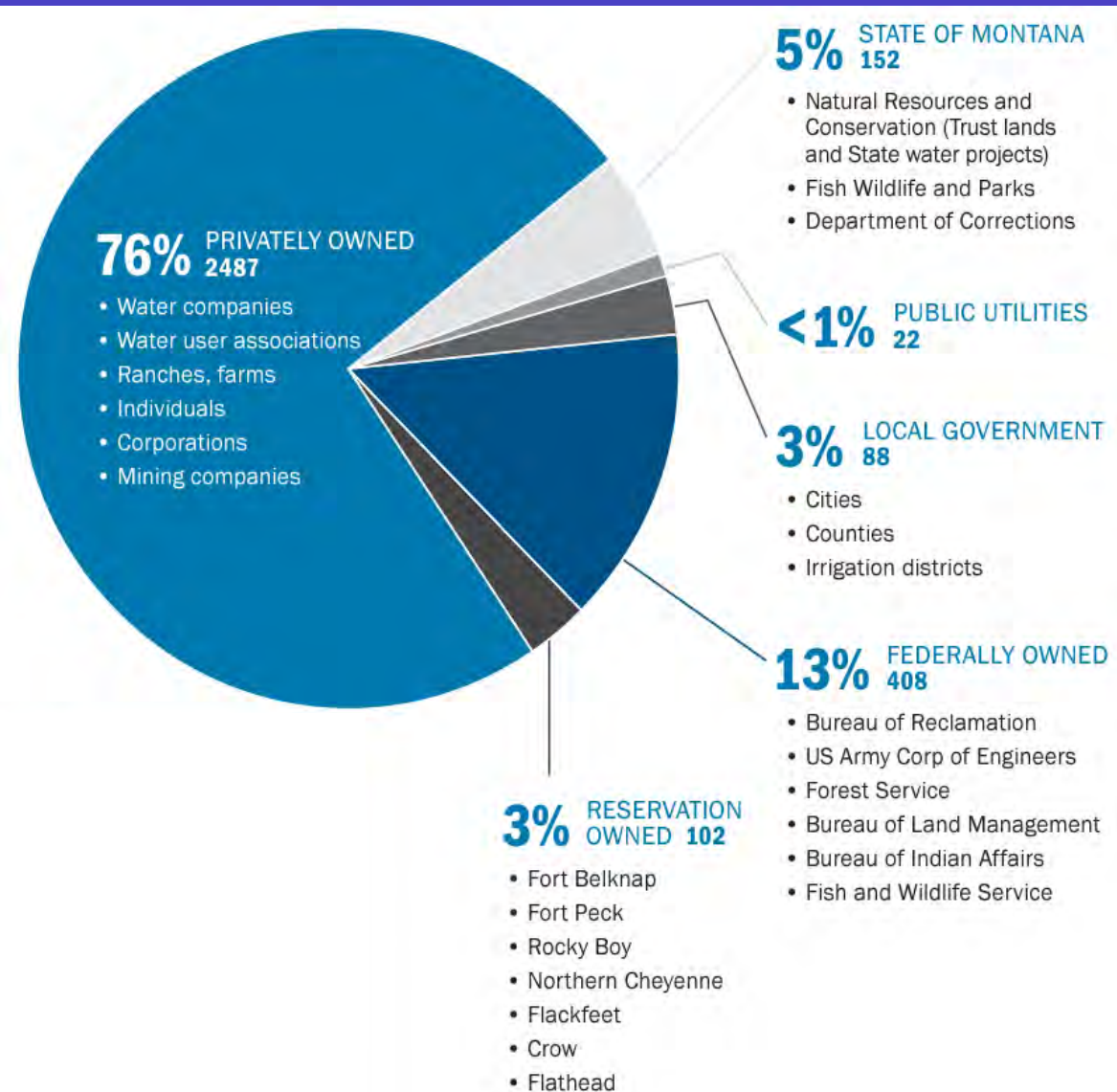


**Dam hazard classification:**

- Low (2,861)
- Significant (201)
- High (197)

- Over 64,000 reservoirs
- 3,259 that meet national dam criteria (height or capacity)

# Montana's storage infrastructure



Dam ownership dictates its operations:

- Rules and standards
- Regulatory agency
- Liability and responsibility

# Why is it so difficult to build more storage?



**1) Dams are expensive**

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**2) Lack of suitable locations**

# Why is it so difficult to build more storage?



- 1) Dams are expensive
- 2) Lack of suitable locations
- 3) Regulatory requirements**

*"The state has a legitimate and compelling interest in encouraging the construction of dams..."*

- Montana Dam Safety Act of 1985

# Why is it so difficult to build more storage?



- 1) Dams are expensive
- 2) Lack of suitable locations
- 3) Regulatory requirements
- 4) Public perceptions**



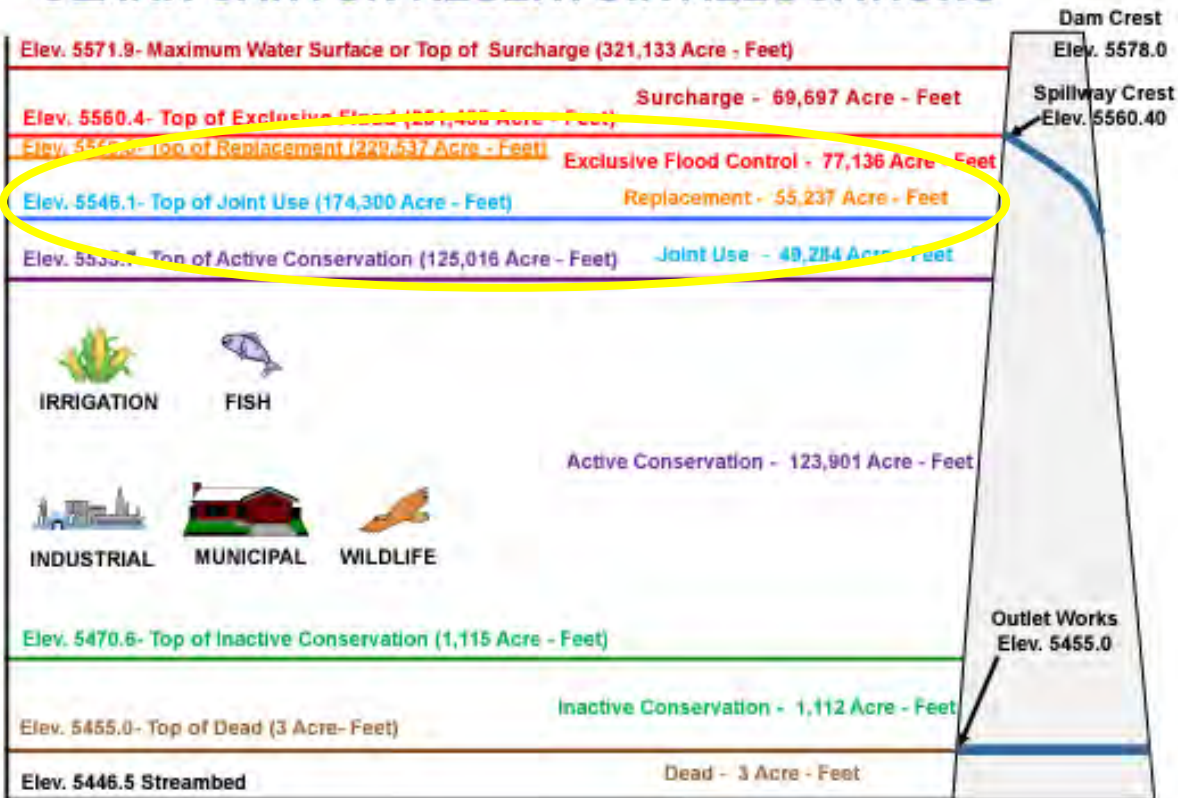
# What about increasing existing storage?



## 1) Physically changing the dam

# What about increasing existing storage?

## CLARK CANYON RESERVOIR ALLOCATIONS



- 1) Physically changing the dam
- 2) Changing operating plans and policy (forecast informed reservoir operations, FIRO)**

# Other considerations



- 1) Sedimentation
- 2) Safety/rehabilitation
- 3) Climate change and drought

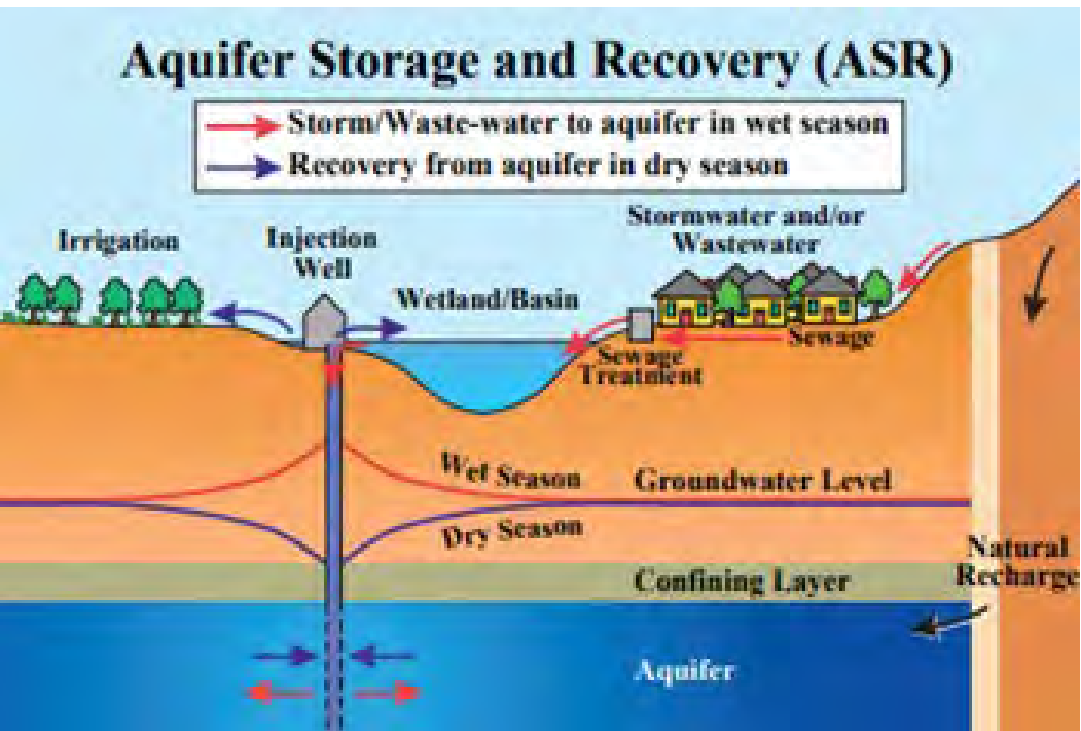
# Realistic options for storage



Tin Cup Lake/AP

## 1) Headwaters storage

# Realistic options for storage



1) Headwaters storage

**2) Groundwater - aquifer storage and recovery (ASR) and managed aquifer recharge (MAR)**

# Realistic options for storage



1) Headwaters storage

2) Groundwater - aquifer storage and recovery (ASR) and managed aquifer recharge (MAR)

**3) Natural storage**

# Realistic options for storage



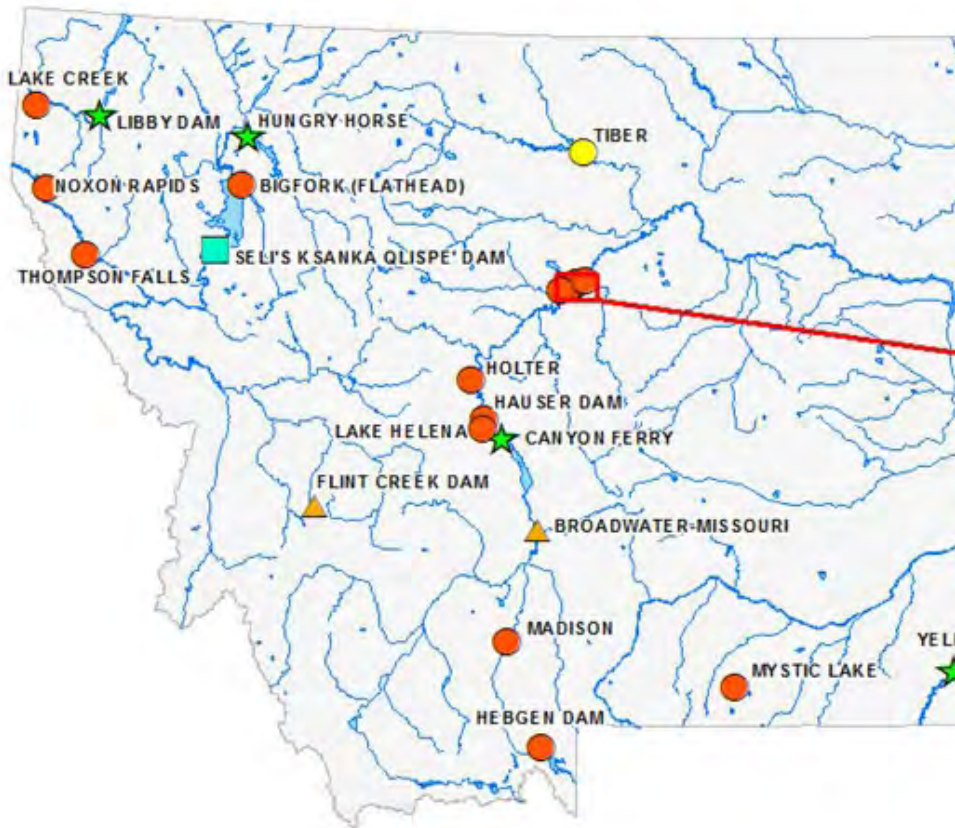
- 1) Headwaters storage
- 2) Groundwater - aquifer storage and recovery (ASR) and managed aquifer recharge (MAR)
- 3) Natural storage
- 4) Ongoing coordination, communication, and education**



Coming soon!  
**Drought.mt.gov**  
**and Montana**  
**Drought**  
**Management**  
**Plan**



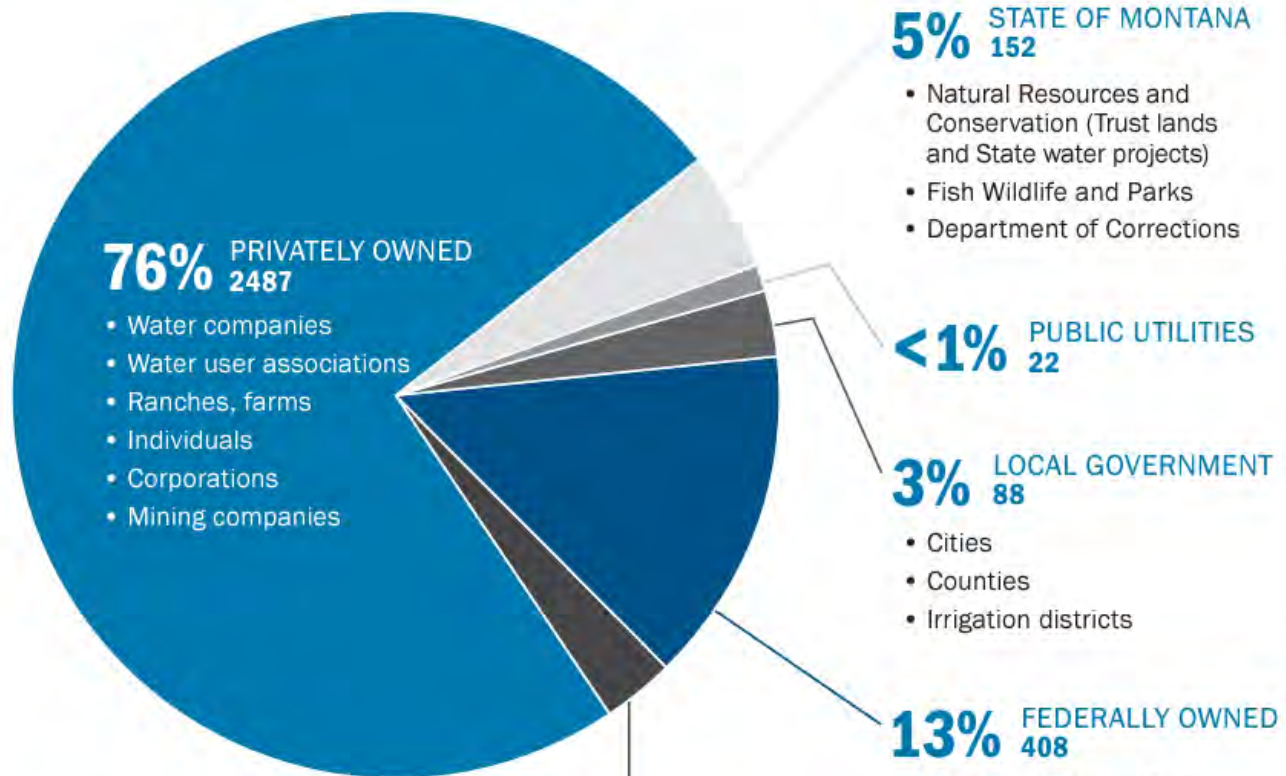




- **PRIVATELY OWNED DAMS**  
Privately Operated Hydropower  
FERC Regulated<sup>2</sup>
- **FEDERALLY OWNED DAMS**  
Privately Operated Hydropower  
FERC Regulated<sup>2</sup>
- ▲ **STATE/LOCALLY OWNED DAMS**  
State/Locally Operated Hydropower  
FERC Regulated<sup>2</sup>
- ★ **FEDERALLY OWNED DAMS**  
Reservation Operated Hydropower  
Self-Regulated

## OWNERSHIP OF MONTANA'S DAMS

(PER NATIONAL DAM INVENTORY)



### WHY DOES IT MATTER WHO OWNS THE DAM? WHO OWNS THE LAND?

Ownership dictates:

- Rules/standards that must be followed
- Regulatory agency
- Liability and responsibility

### 3% RESERVATION OWNED 102

- Fort Belknap
- Fort Peck
- Rocky Boy
- Northern Cheyenne
- Flackfeet
- Crow
- Flathead

### 5% STATE OF MONTANA 152

- Natural Resources and Conservation (Trust lands and State water projects)
- Fish Wildlife and Parks
- Department of Corrections

### <1% PUBLIC UTILITIES 22

### 3% LOCAL GOVERNMENT 88

- Cities
- Counties
- Irrigation districts

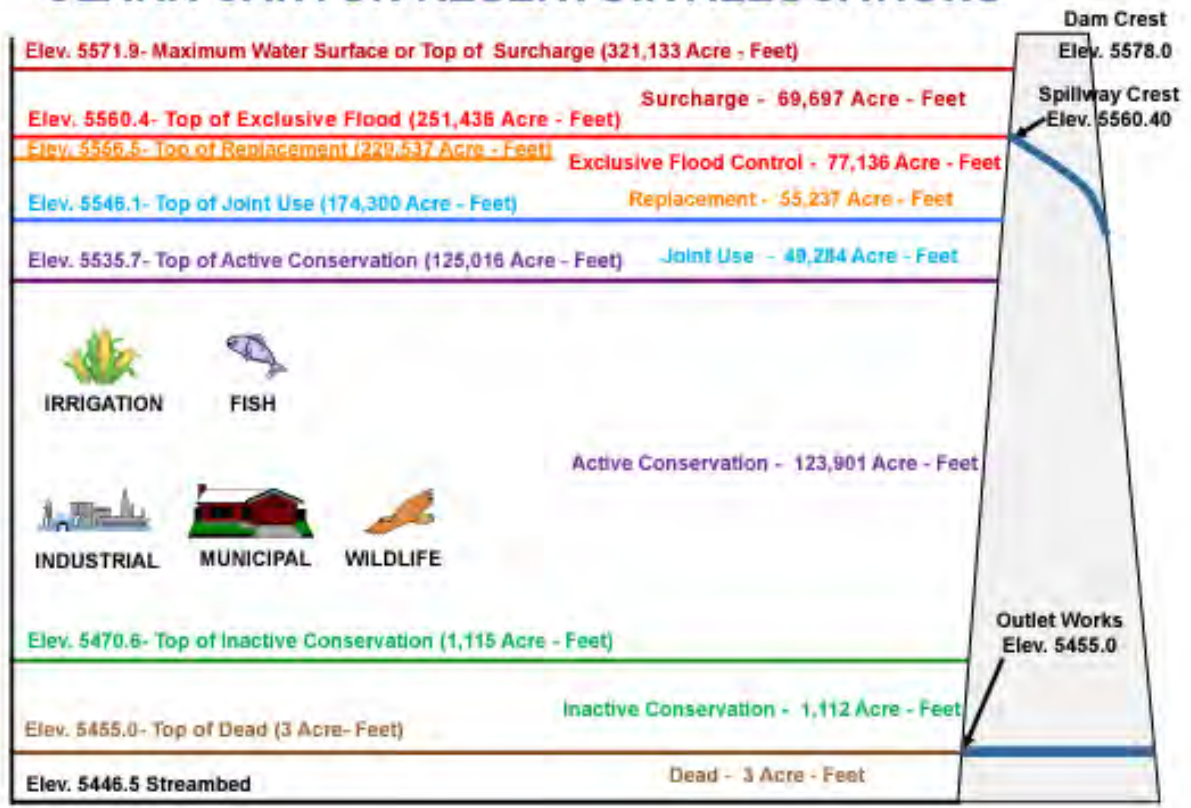
### 13% FEDERALLY OWNED 408

- Bureau of Reclamation
- US Army Corp of Engineers
- Forest Service
- Bureau of Land Management
- Bureau of Indian Affairs
- Fish and Wildlife Service

# Columbia River Basin



## CLARK CANYON RESERVOIR ALLOCATIONS



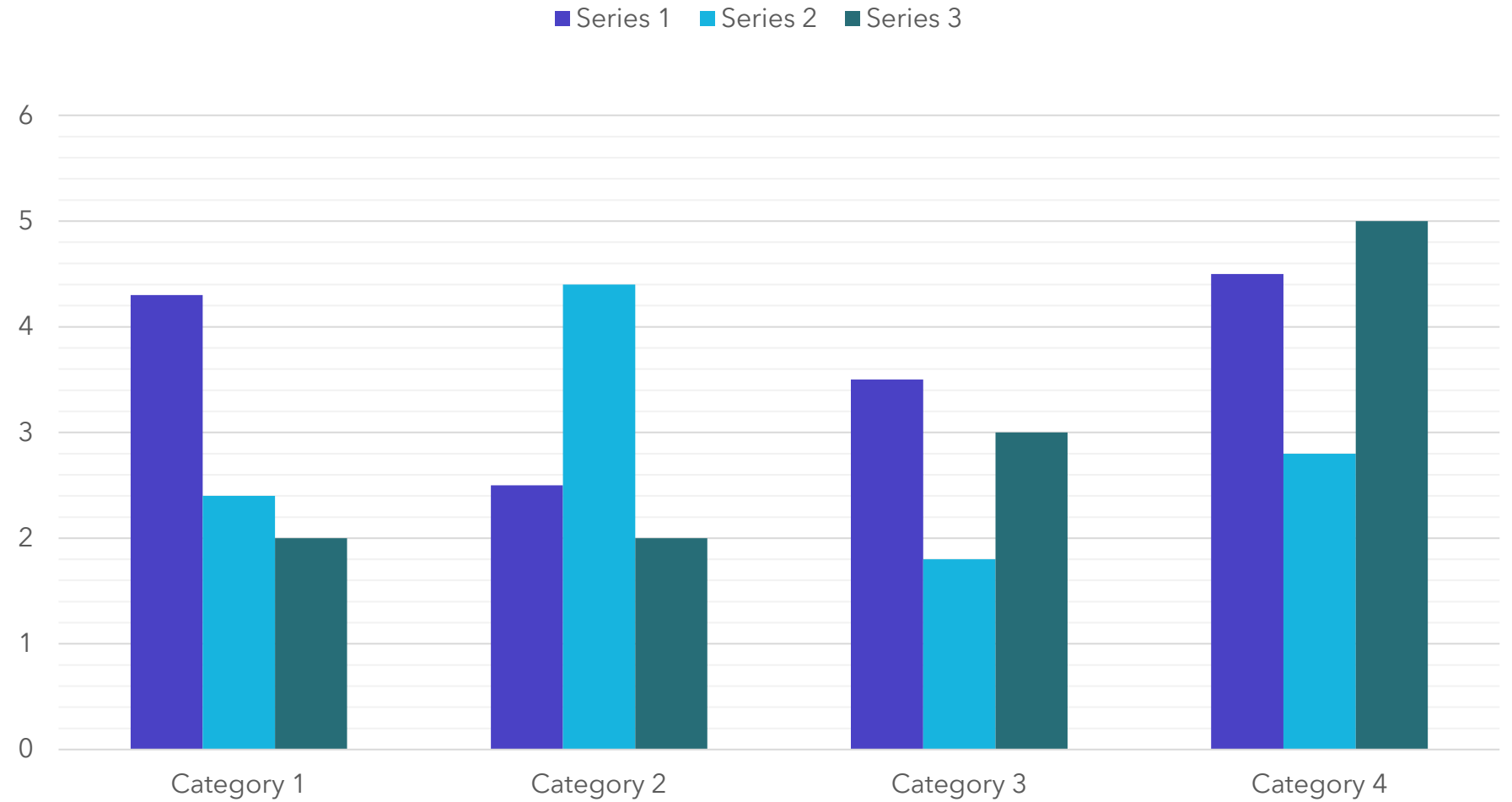
Revised 10/31/2019

# Regulatory challenges

Subtitle

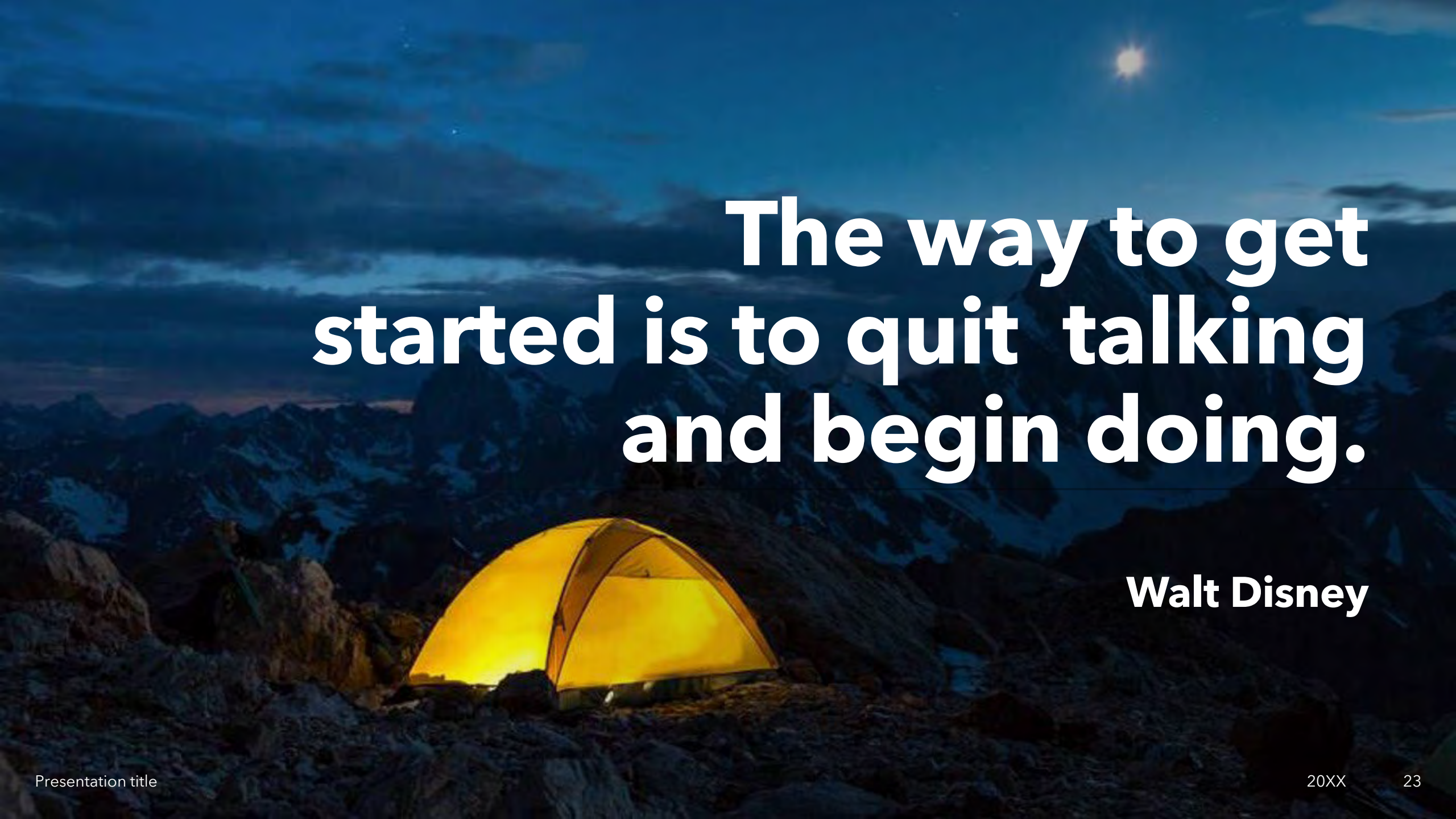


# Chart



# Table

	Category 1	Category 2	Category 3	Category 4
Item 1	4.5	2.3	1.7	5.0
Item 2	3.2	5.1	4.4	3.0
Item 3	2.1	1.7	2.5	2.8
Item 4	4.5	2.2	1.7	7.0

A glowing yellow tent is pitched on a rocky mountain peak at night. The tent is illuminated from within, casting a warm yellow light. The background shows dark, rugged mountain ranges under a deep blue night sky with a few stars and a bright moon in the upper right corner.

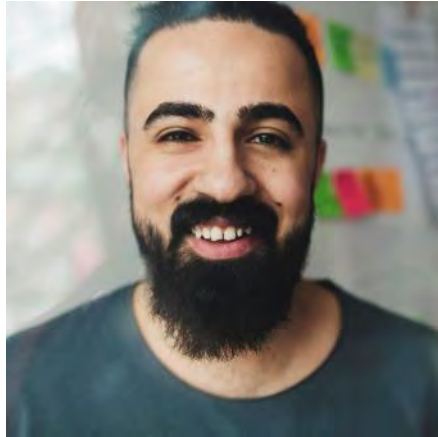
**The way to get  
started is to quit talking  
and begin doing.**

**Walt Disney**

# Team



**Name**  
Title



**Name**  
Title



**Name**  
Title



**Name**  
Title



# Timeline

## Title

To start a presentation, go to the Slide Show tab, and select From Beginning.

## Title

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## Title

The Notes pane is a box that appears below each slide. Tap it to add notes.

## Title

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## Subtitle

- Add text, images, art, and videos.
- Add transitions, animations, and motion.
- Save to OneDrive, to get to your presentations from your computer, tablet, or phone.

## Subtitle

- Open the Design Ideas pane for instant slide makeovers.
- When we have design ideas, we'll show them to you right there.

# Additional content

## Subtitle

- Add text, images, art, and videos.
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## Subtitle

- This PowerPoint theme uses its own unique set of colors, fonts, and effects to create the overall look and feel of these slides.
- PowerPoint has tons of themes to give your presentation just the right personality.

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# Summary

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