River freedom – risk - resilience

Jen Shanahan
Watershed Planner
City of Fort Collins Natural Areas

River freedom = lateral movement

Another perspective:

River freedom = constrained channel lateral movement but complete floodplain access (no/low risk factors for flood flows on floodplain)

Wide valleys

Flood safety and protection of public assets

+

ecological resilience

=

community resilience

Ecological resilience includes self- sustaining habitats

Lower management cost for local governments and land owners

Degrees of Freedom

1	Bridge, culvert, max. flow capacity, no vegetation
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9	Levy set back to outer bound of 100 yr floodplain

RISK

SELF-SUSTAINING HABITATS

Deformable boundaries

Managing Infrastructure in the Stream Environment

Advisory Committee on Water Information
Subcommittee on Sedimentation
Environment and Infrastructure Working Group

Prepared by:

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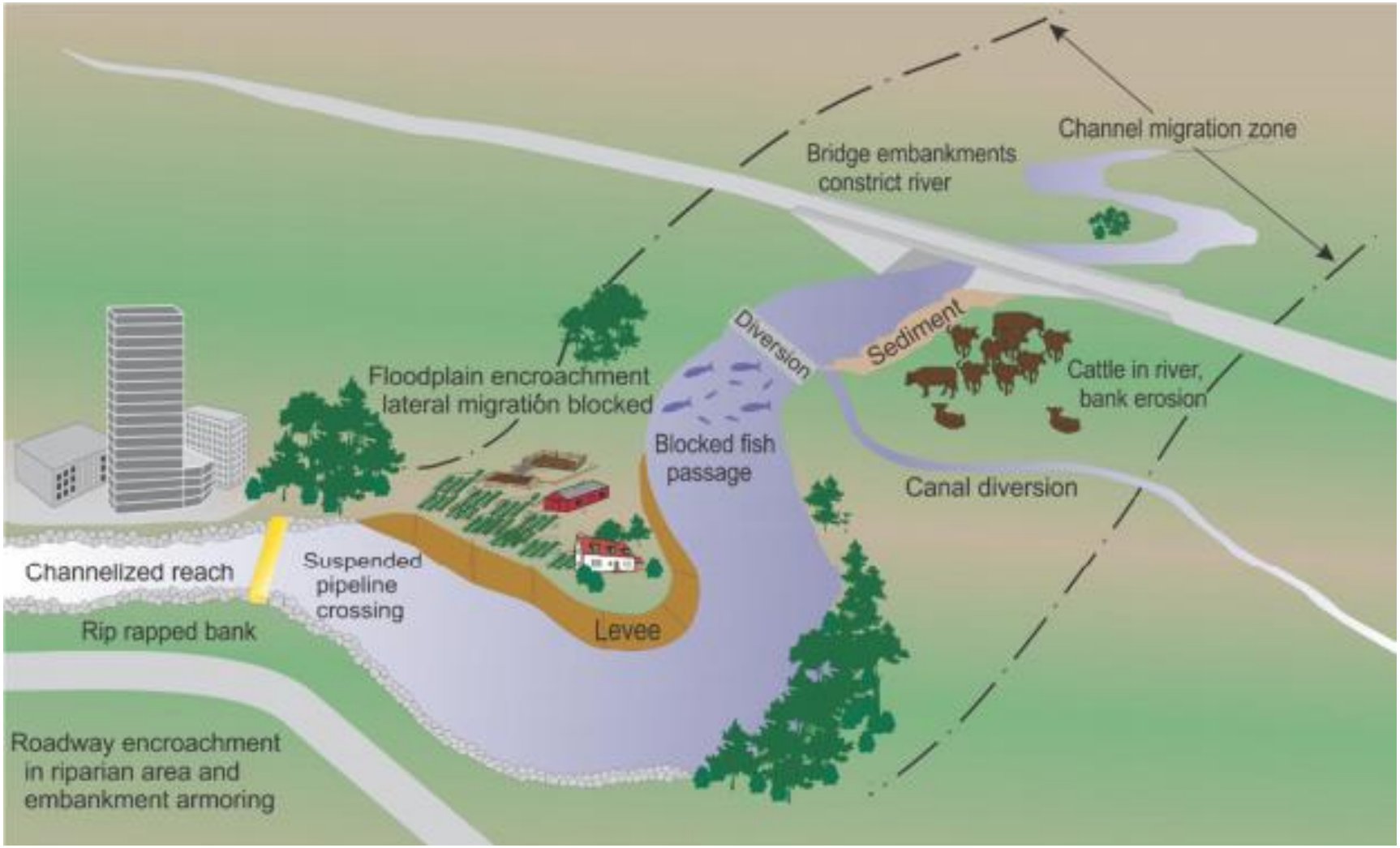
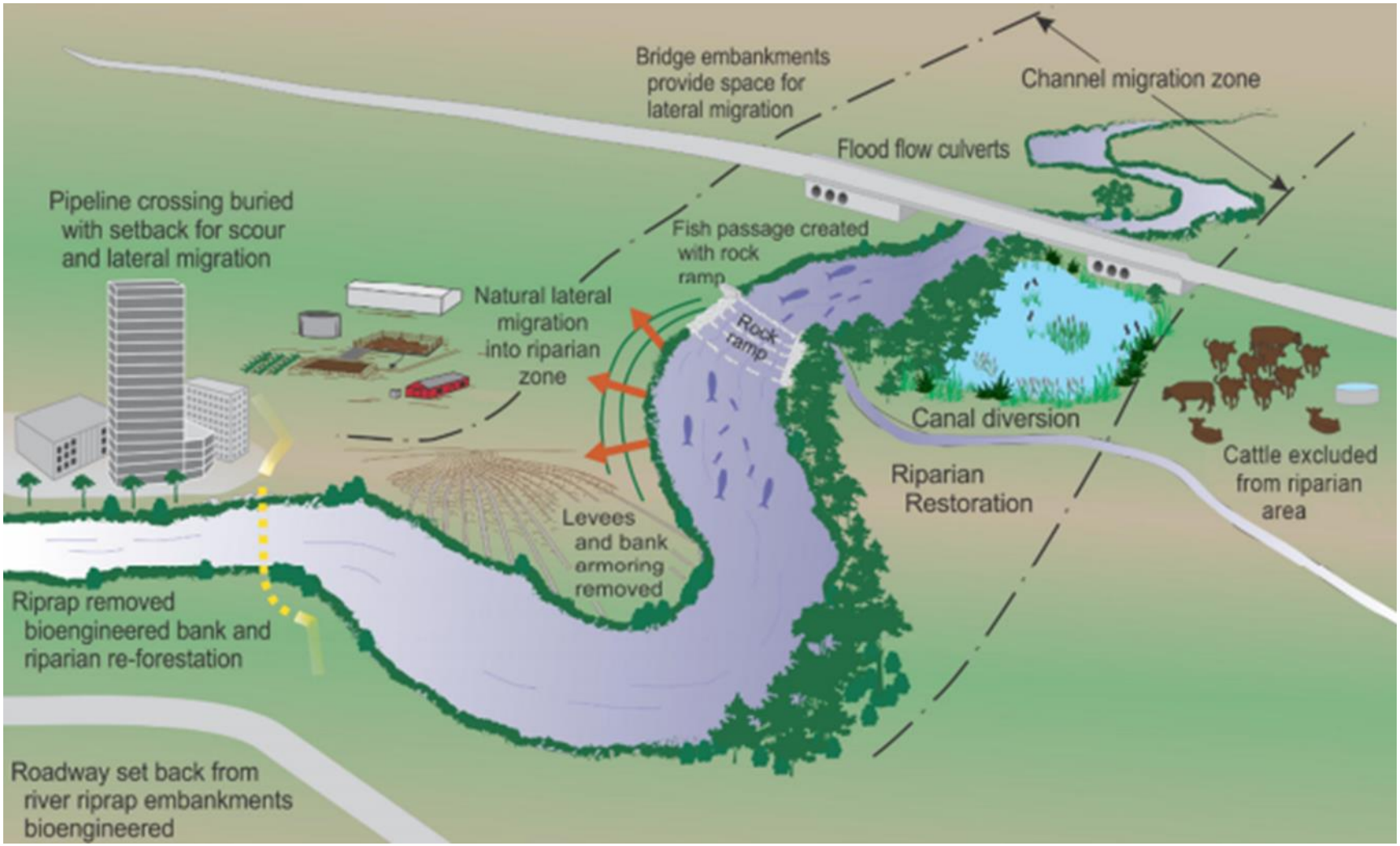
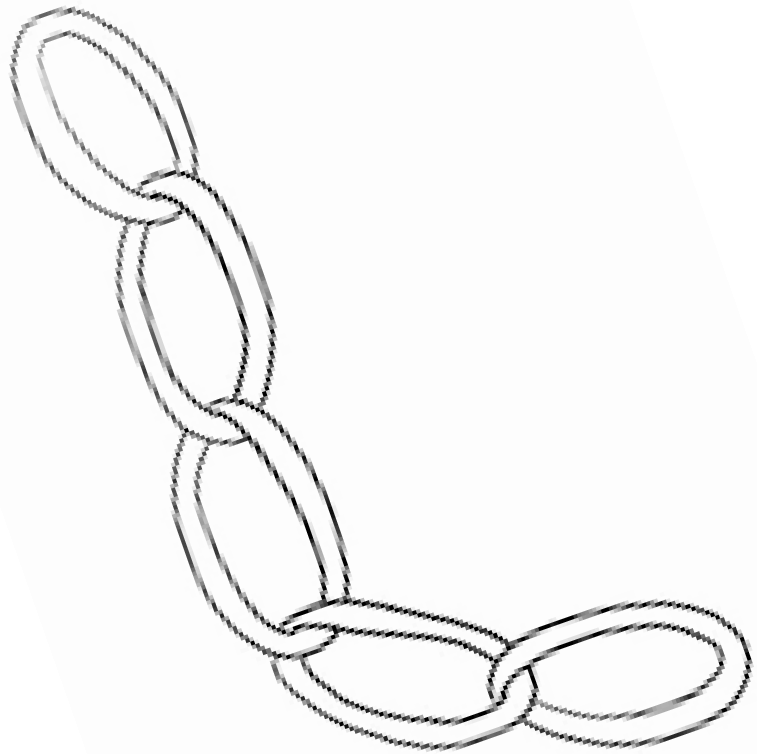
2: Natural Resources Conservation Service, National Design, Construction, and Soil Mechanics Center, Fort Worth, Texas
3: U.S. Forest Service, National Stream and Aquatic Ecology Center, Fort Collins, Colorado


Channel migration zone
Bridge embankments
constrict river
Diversion
Sediment
Floodplain encroachment
lateral migration blocked
Cattle in river,
bank erosion
Blocked fish
passage
Canal diversion
Channelized reach
Suspended
pipeline
crossing
Rip rapped bank
Levee
Roadway encroachment
in riparian area and
embankment armoring

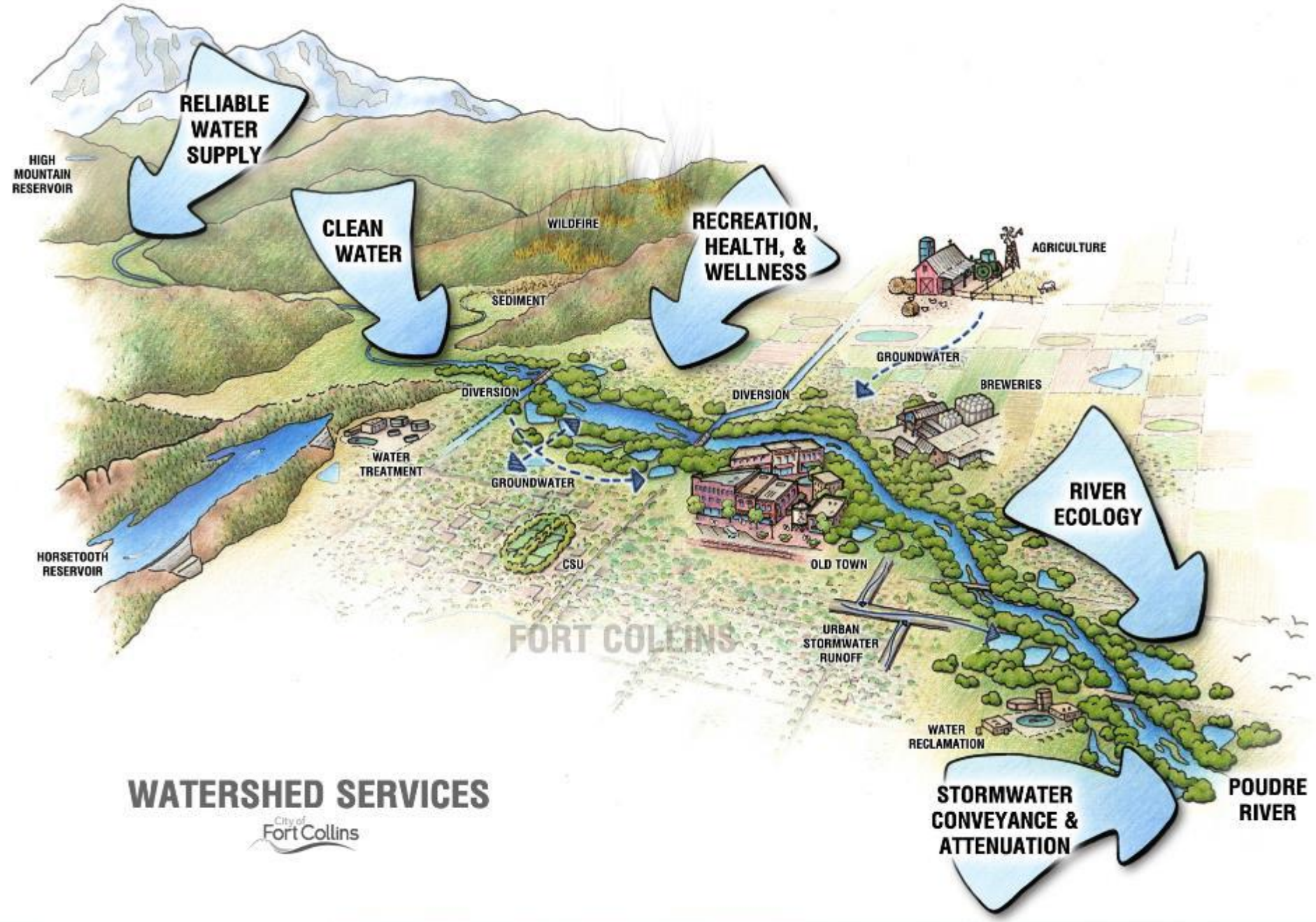

Bridge embankments provide space for lateral migration
Channel migration zone
Flood flow culverts
Pipeline crossing buried with setback for scour and lateral migration
Fish passage created with rock ramp
Natural lateral migration into riparian zone
Rock ramp
Canal diversion
Cattle excluded from riparian area
Riparian Restoration
Levees and bank armoring removed
Riprap removed bioengineered bank and riparian re-forestation
Roadway set back from river riprap embankments bioengineered

Considering the links on your chain



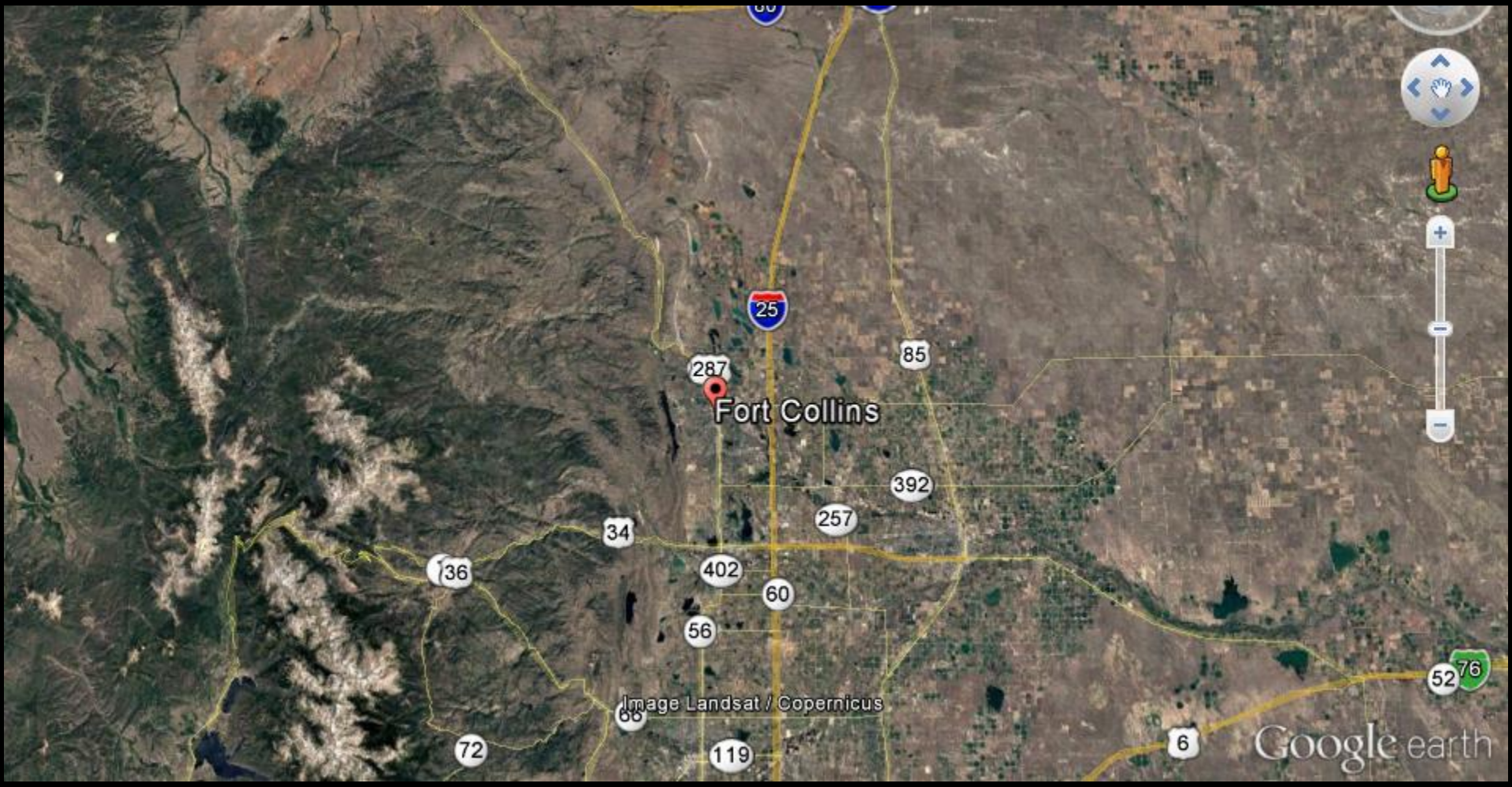
Scales

- Site considerations
- Reach consideration
- Neighboring reaches
- Watershed context



WATERSHED SERVICES

City of Fort Collins


25
287
Fort Collins
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392
257
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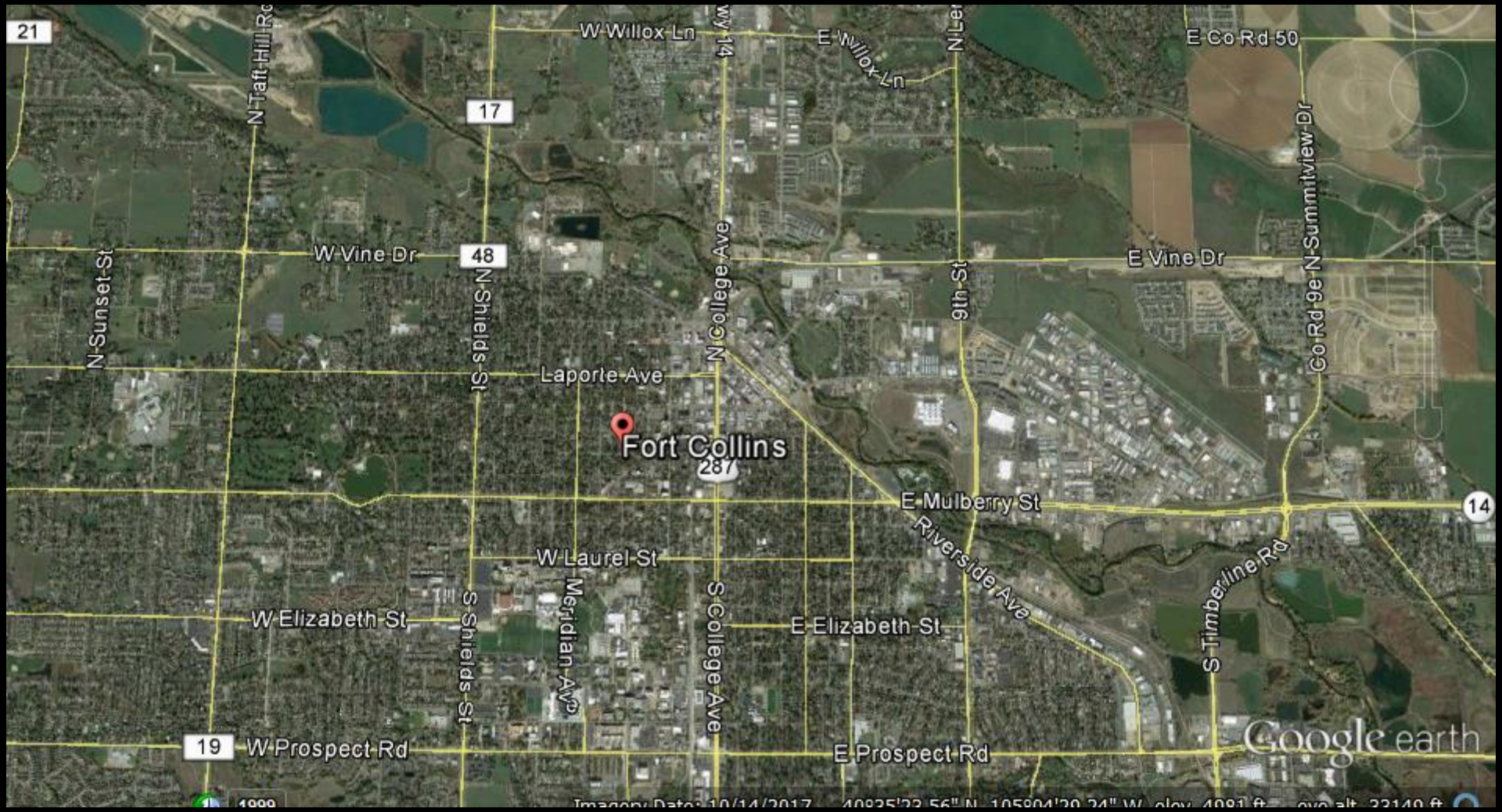
Image Landsat / Copernicus
Google earth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W Willox Ln
E Willox Ln
N Lemay Ave
E Co Rd 50
17
N College Ave
N Summitview Dr
W Vine Dr
48
N Shields St
9th St
E Vine Dr
N Sunset St
Co Rd 9e
Laporte Ave
Fort Collins
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S Timberline Rd
S Shields St
Meridian Ave
S College Ave
W Elizabeth St
E Elizabeth St
19
W Prospect Rd
E Prospect Rd
Google earth


Ackerman Ct
N Shields St
Poudre Trail
Google earth


Hemlock St
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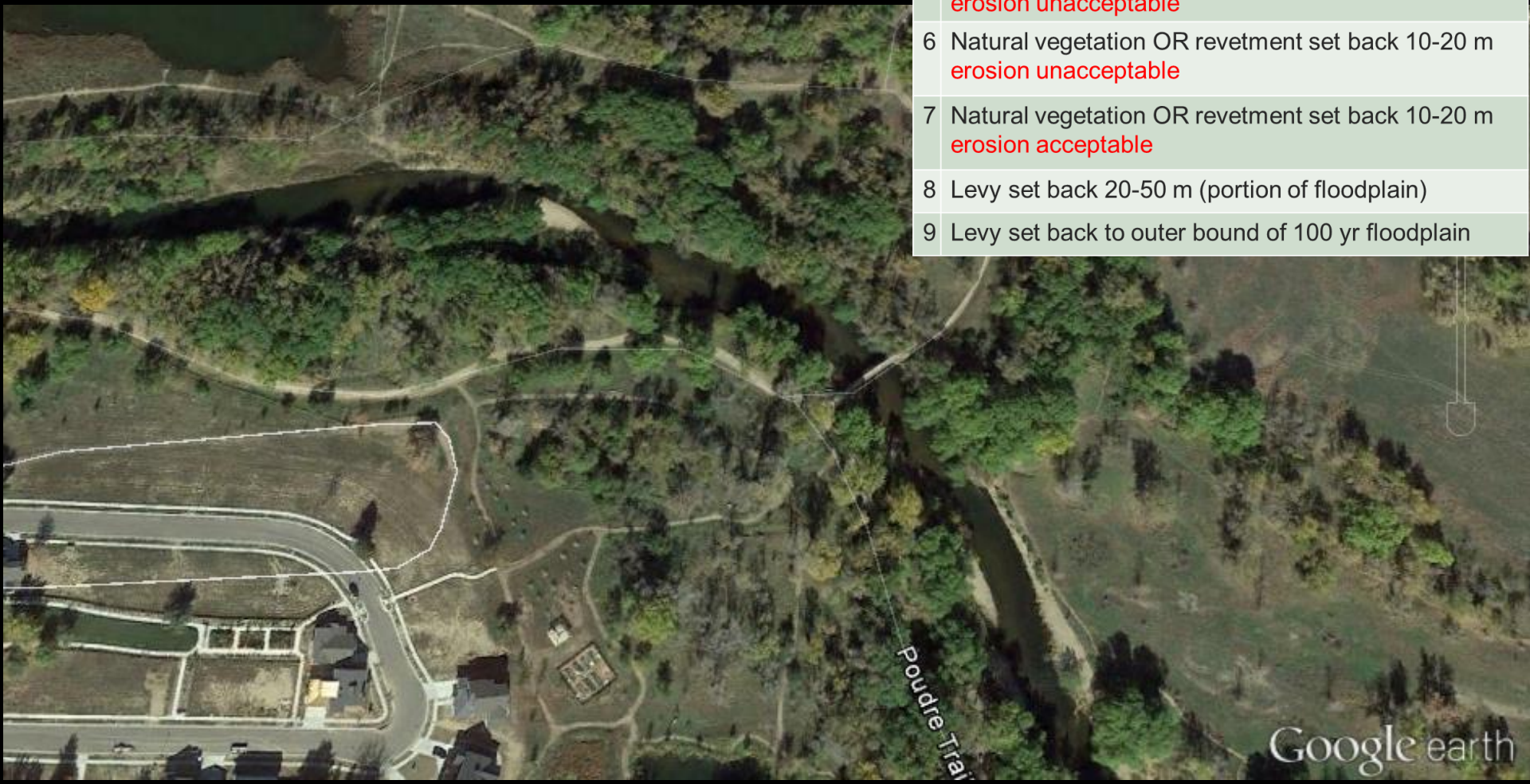

Hickory Trail
Google earth

Hickory Trail
N Mason St
Alpine St
W Hwy 14
N College Ave
Google earth


E Vine Dr
Hickory Trail
14
College Ave
Poudre Trail
Google earth


Buckingham St
Linden St
Poudre Trail
Pine St
Google earth


E Lincoln Ave
1st St
2nd St
Lincoln Ave
14
Riverside Ave
Peterson St
Google earth


14
Smith St
Google earth


Poudre Trail
S Lemay Ave
Service Road 1
14
E Mulberry St
W Hwy 14
Frontage Rd S
Riverside Ave
E Myrtle St
Endicott St
Google earth

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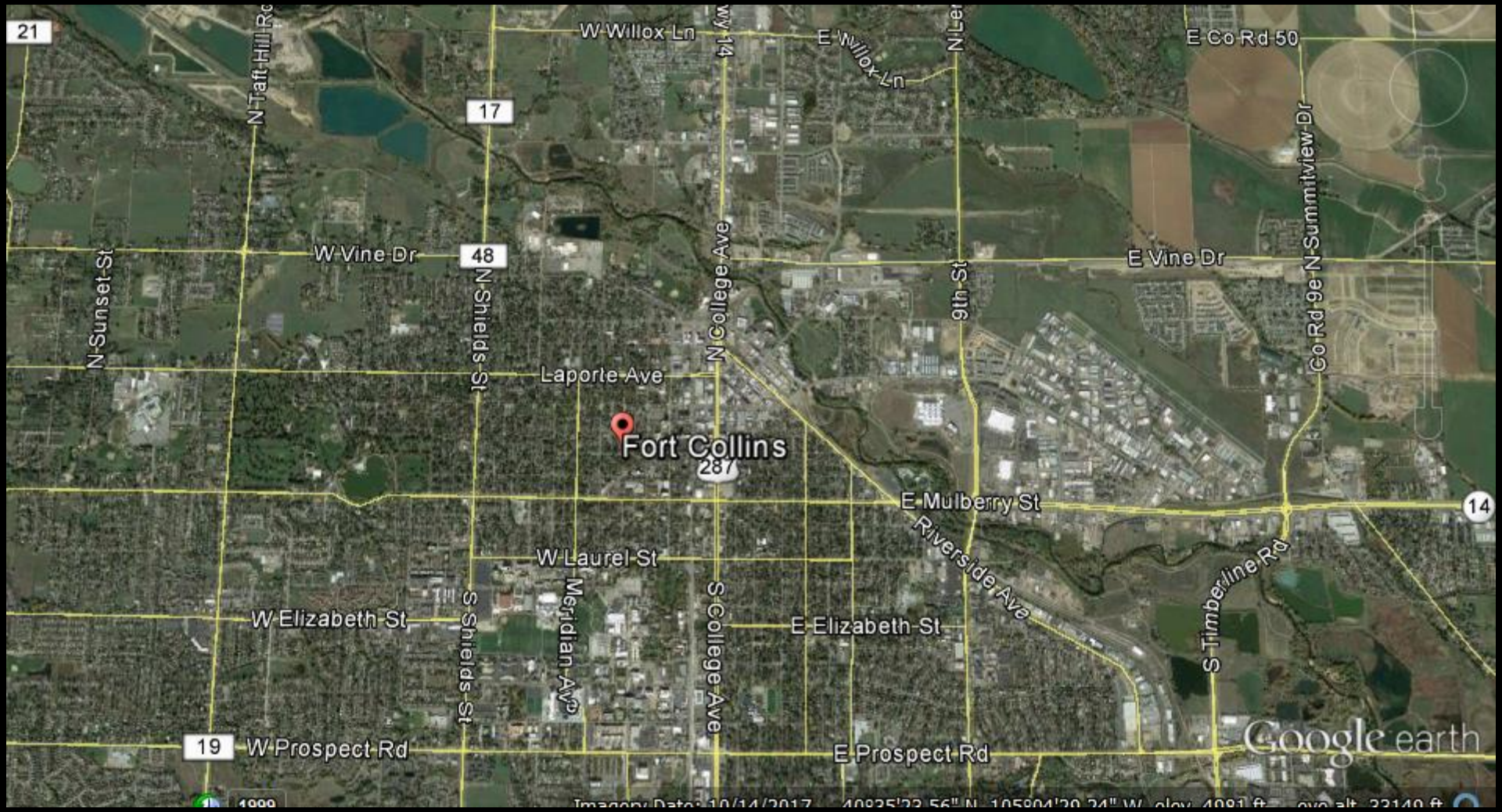
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Google earth

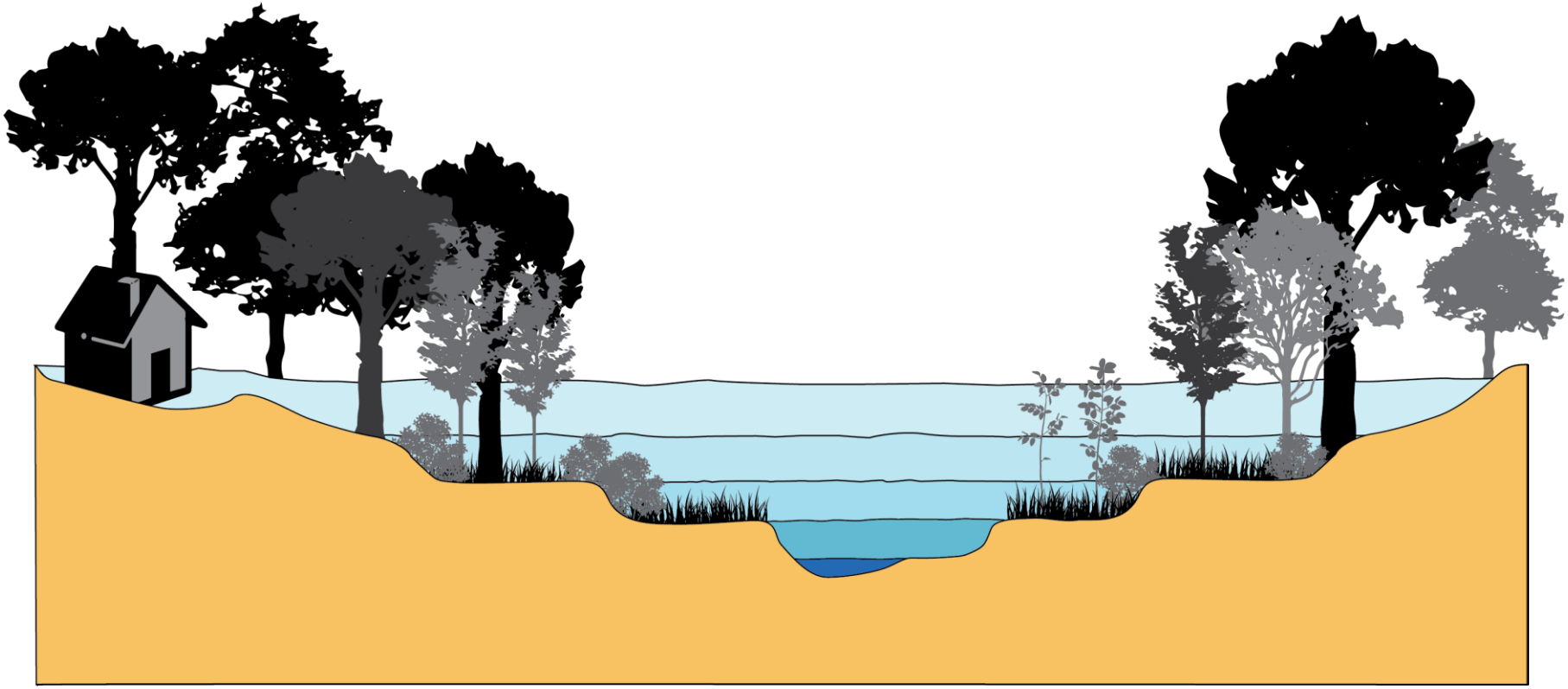
So if the river cannot manage its own resources (river freedom) then we must do it

What does it take to optimize resilience without lateral migration

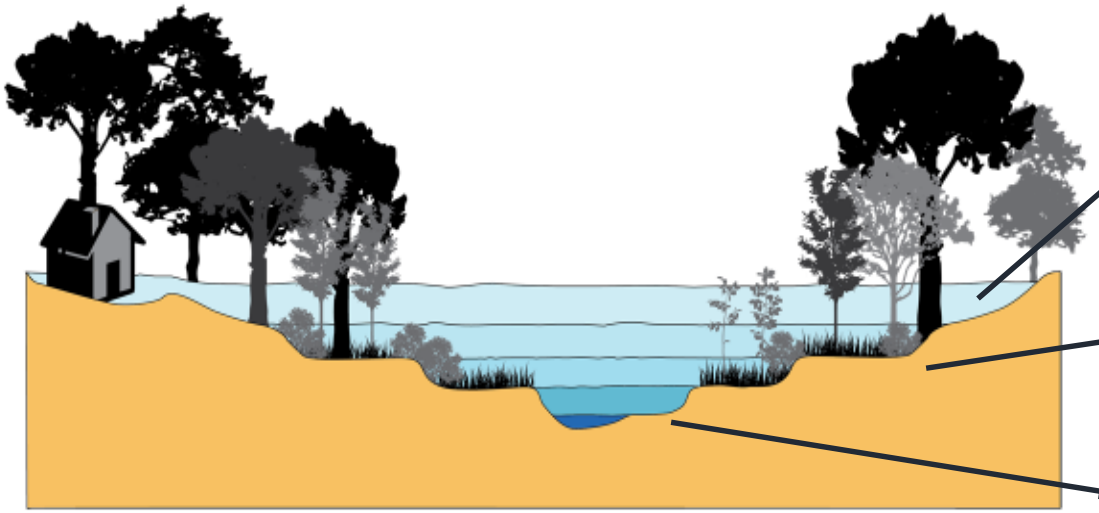
Arrested evolution?

Static geomorphically?

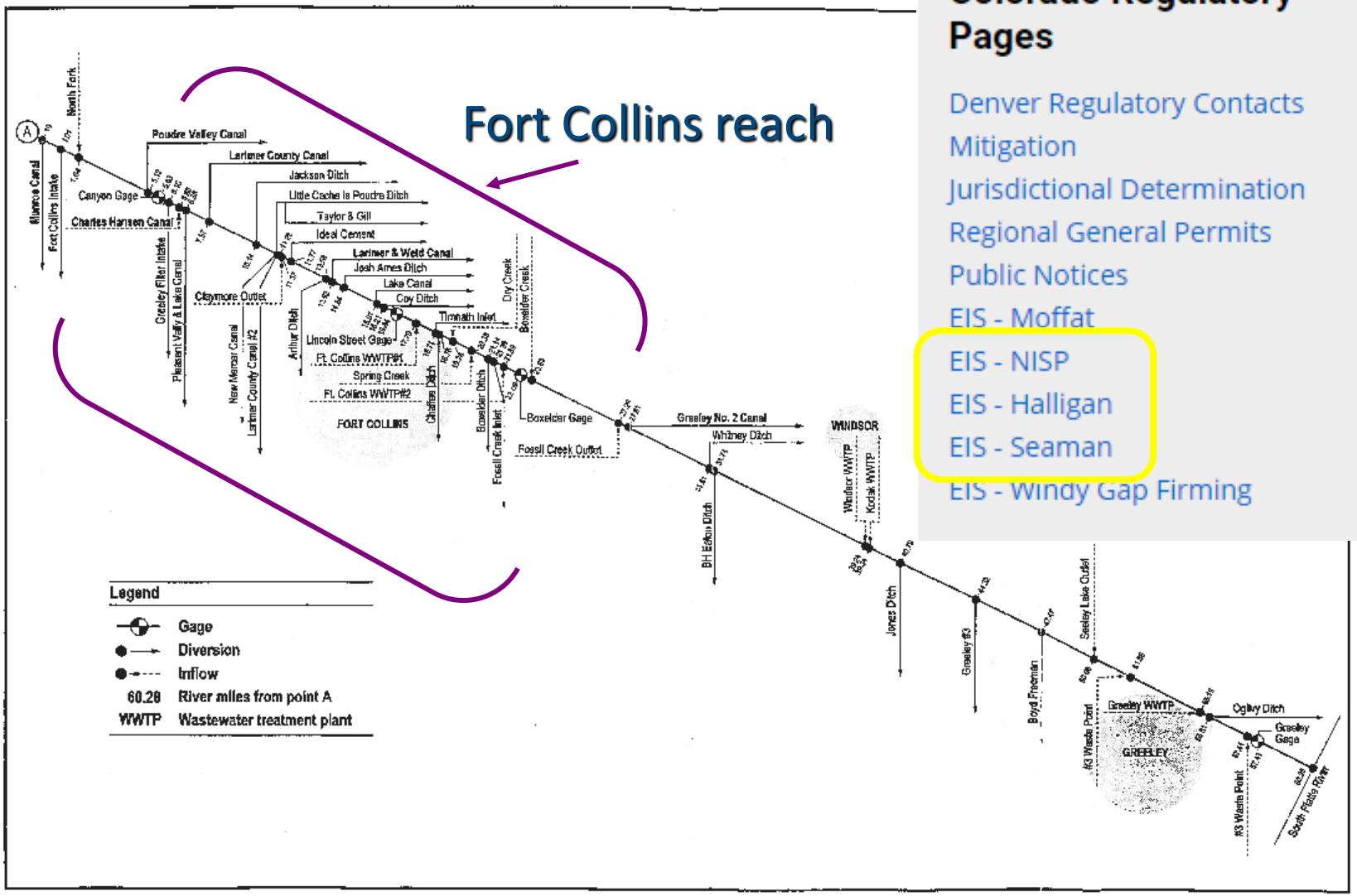
Not really



Min. flow	Lowest flows, thalweg
1.5 - 2	Bank full/channel forming flows, “the river”
2 - 5	Spring flows, active riparian habitat
5 - 20	Mature riparian forest
20 - 50 -100	Floodway/floodplain



20-101	Floodplain managers
2-5	Open space programs
5-20	Riparian ecologists
	Land owners
Min.	Water quality
1-2 year	Fish biologists
	Aquatic Entomologists



Colorado Regulatory Pages

- Denver Regulatory Contacts
- Mitigation
- Jurisdictional Determination
- Regional General Permits
- Public Notices
- EIS - Moffat
- EIS - NISP
- EIS - Halligan
- EIS - Seaman
- EIS - Windy Gap Firming

Longitudinal fragmentation

Degrees of Freedom

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- Degrees of freedom
- Links on your chain
- Matching flow corridors with flows, teams
- Identifying opportunities and locations for stepping towards freedom
- Culture shift, how can we catalyze this conversation?