Structure	Name	Location	Priority Group
1	Community Ditch	39.932, -105.281	1
2	Davidson Ditch	39.939, -105.23	3
3	Goodhue Ditch	39.951, -105.242	1
4	S Boulder Bear Cr Ditch	39.972, -105.223	3
5	Dry Creek No 2 Ditch	39.956, -105.238	3 (off-line)
6	Marshallville Ditch	39.959, -105.233	2
7	Schearer Ditch	39.968, -105.227	3
8	S Boulder Canon Ditch	39.953, -105.242	3
9	McGinn Ditch	39.981, -105.221	3
10	New Dry Cr Carrier Ditch	39.986, -105.221	1
11	Howard Ditch	39.989, -105.22	2
12	East Boulder Ditch	39.996, -105.216	1
13	Hunter/Hine Ditch	40.004, -105.216	3
14	Legget-Valmont Inlet D	40.016, -105.214	1
15-18	Series of concrete weirs and pipe crossings	40.022, -105.216	3
19	KOA Inlet	40.026, -105.217	3
20	KOA Outlet	40.029, -105.218	2
21	Butte Mill Ditch Confluence	40.031, -105.218	2

Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan Phase I
Final Report - April 30, 2020

A. Reach Map

Note: on this map Priority 3 and 4 structures were combined into the "green" coded priorities

Lower South Boulder Creek

Diversion Structure Summary

Structures - Priority Group

1 2 3 Lower South Boulder Creek

0 2,000 4,000 Feet

N

March 2020

Sources: Boulder County, CDSS, ESRI, HERE, Garmin, Intermap, USGS

Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan Phase I
Final Report

B: SUMMARY OF FINDINGS AND RECOMMENDATIONS

Communications Plan

1. Status
   A) Complete
   B) Reviewed and approved by Steering Committee
   C) Will Begin Roll-out in Q4 2019 (limited roll out via Steering Committee and Advisors in Q2 2019)
2. Findings
   A) Project has better understanding of the stakeholder groups
   B) Municipal partners are in good position to help provide background on key relationships / points of and facilitate introductions
3. Phase II / Next Steps:
   A) Execute Communications Plan across targeted groups, in order of degree of impact and direct participation in final solutions, are as follows:
      (a) Steering Committee (Direct Project Partners): City of Boulder – Water Utilities Division, City of Boulder – Open Space & Mountain Parks, City of Lafayette – Public Works, and Denver Water ***(began March 2019 – on-going Phases 1&2)***
      (b) Core (Directly Affected) Stakeholders: High Priority Infrastructure Owners (Ditch Companies and Commercial Entities), High Priority Water Rights Owners (Other Private, Industrial, Commercial and Municipal Entities), and Immediately Proximate Land Owners (Industrial) ***(limited communications for Phase 1 and extending and expanding into Phase 2)***
      (c) Secondary (Indirectly Affected) Stakeholders: Other Infrastructure Owners (Ditch Companies and Commercial Entities), Other Water Rights Owners (Other Private, Industrial, Commercial and Municipal Entities), Proximate Private Landowners ***(2020 – Phase 2)***
      (d) Other Related Stakeholders: Conservation / Advocacy / Recreational Groups with a Boulder Watershed Mission, Other Adjacent Private Landowners ***(2020 – Phase 2)***
      (e) General Public as Stakeholder ***(2020 – Phase 2)***
      (f) Advisors stakeholder group: Colorado Water Conservation Board, Colorado Parks & Wildlife, District Water Commissioner, and the Metro and South Platte Basin Roundtables
         - Communication on-going with CWCB, CPW, and the District Water Commissioner (began in March)
         - Update the Basin Roundtables (Nov Q4 – Jan Q4)
         - SBC SMP overview posted to the CWCB sponsored SMP Resource Guide (River Networks) (May 2019) / Final Report May 2020
   B) Communication Plan as "Living Document" – Add to / Update On-Going (2020 forward)

Data Inventory

1. Status
   A) Inventory of Existing Data / Information Complete and Cataloged
   B) Identification of Remaining Data / Criteria Gaps Completed Relative to RHA Needs; in General:
      (a) Lack of some Historical Data – dry up locations, flow gauge data at needed level of detail, limited location testing, unclear state standards
      (b) Lack of some Objective Measures – professional judgment to be applied
2. Findings:
   A) Project team has a better understanding how this data will be used for:
      (a) Ongoing improvement and monitoring
      (b) The foundation of the River Health Assessment Methodology
      (c) Input for infrastructure modifications
   B) The Steering Committee and their staffs agreed on the RHA methodology components and data sources (July 2019), and provided final comments (October 2019)

C) Specific Data Gap Recommendations
   (a) Phase I Gaps list completed – establishes scope of Phase II (primarily RHA driven)
3. Phase II / Next Steps:
   A) Consensus kick off meeting
   B) Close data / information gaps
   C) RHA and Infrastructure inputs

Flow Analysis

1. Status
   A) Complete
   B) Historical Flow Data Collected
   C) DNR / CPW Historical Flow Analysis (sustainable, functioning) Documented
   D) In-Stream Flow Right in Process (between Boulder and CWCB)
   E) R2X Data Collected at 4 Sample Locations and Analyzed
   F) Received Cross Section Information from DHI hydraulic model – Analysis Completed in September
2. Findings
   A) Historical Flows from multiple State and Municipal studies are within reasonable statistical range.
   B) This creates a good data set for minimum flow targets
   C) Limitations / Gaps: See Data Inventory – Lack of historical data and objective measures
      (a) Data is not at the sub-reach level, nor was it consistently collected for this reach over history.
      (b) Gauges were blown out in 2013 flood and only one replaced so far, creating another histrionic data gap
3. Phase II / Next Steps
   A) Consensus kick off meeting
   B) Complete point flow analysis for project reach
   C) Develop highest practical flow scenario
   D) Assess flow parameters as part of RHA

River Health Assessment Methodology

1. Status
   A) Matrix of RHA Categories and Components Complete
   B) Data Sources Identified - ~80% Complete (remaining to be closed in Phase II – see above)
   C) Assessment Criteria - ~80% Complete (remaining to be closed in Phase II – see above)
2. Findings
   A) Limitations / Gaps need to be filled to be able to complete RHA: See Data Inventory – Lack of historical data and objective measures
   B) Three levels of assessment identified – base case, Environmental Pool benefit, highest practical benefit
3. Phase II / Next Steps
   A) Close Data / Criteria Gaps required for RHA (see Data Analysis) and Adding Recreational Category (State Water Plan Goals)
   B) Consensus kick off meeting to finalize Methodology
   C) Conduct RHA across the three assessment levels (base, EP benefit, highest practical benefit (i.e., self-defined “reference reach” exercise based on professional judgment)
   D) Performing the River Health Assessment – Biological, Hydrological and Geomorphological through minimum three iterations – desktop with data; field observations to update data; desktop with full data set; repeat as needed
   E) Confirming In-Stream Flow Targets (Environmental Pool and Highest Practical Levels) will be a key input
   F) Defining monitoring requirements, and associated benefits

Structures Assessment Methodology

1. Status
   A) Structures Documentation Completed by Colorado School of Mines Student Team, and Reviewed and Confirmed by Project Team
   B) Structures Assessment and Prioritization is Complete
   C) Final Assessment / Priorities completed
2. Findings
   A) Phase I Confirmed / Updated Previous Physical Structures Inventory Prepared by BFC in 2018
   B) Phase I raised questions regarding how Far to Go in Defining / Creating Preliminary Engineering Design for Priority 1 Structures
   C) 21 Structures Identified, Cataloged and Assessed for Low-Flow Capability, Channel Connectivity / Fish Passage, Operational Efficiency and Proximate Habitat Improvement
   D) Five structures ("Priority 1") inhibit low flow passage and administration by district water commissioner. There are also opportunities for channel connectivity / passage, habitat improvement and operational efficiency improvements
      i. FRICo ("Community Ditch") Check Structure (Mouth of Eldorado Canyon) -High Complexity
      ii. Goodhue Ditch (Upstream of HWY 93) – Low Complexity
      iii. New Dry Creek Carrier Ditch (Downstream of South Boulder Road) – High Complexity
      iv. East Boulder Ditch (Upstream of Baseline Road) - Preliminary Engineering Design Existing – Moderate to High Complexity
      v. Leggett Inlet / Jones-Donnelly Diversion (Downstream of Arapahoe Road) – Moderate Complexity
   E) Four Structures ("Priority 2") represent opportunities for channel connectivity / passage, habitat improvement and operational efficiency improvements
      i. Marshallville Ditch
      ii. Howard Ditch
      iii. KOA Lake Outlet
      iv. Butte Mill Ditch
   F) Eleven Structures ("Priority 3") represent opportunities for habitat improvement and operational efficiency improvements improvement
      i. Davidson Ditch
      ii. Bear Creek Ditch
      iii. Dry Creek #2 Ditch
      iv. Shearer Ditch
      v. South Boulder Canon
      vi. McGinn Ditch
      vii. Hunter
      viii. KOA Inlet
      ix. to xii. Three (3) small concrete drop and 1 pipe obstructions between Leggett / Jones-Donnelly and KOA Lake inlet

3. Phase II / Next Steps
   A) Focus on Priority 1 Physical Infrastructure Modifications Requirements – Low-Flow Capability, Channel Connectivity / Fish Passage, Habitat Improvement and Operational Efficiency (see above list)
   B) Scope of work to include two, complex, Priority 1 structures (ex: New Dry Creek Carrier and East Boulder) taken to a ~20% preliminary design level to facilitate fast transition to a design-build project

C) Scope of work to include three, lower complexity, Priority 1 structures (ex: Goodhue, Leggett, FRICo / Community) taken to a ~10% preliminary design level to facilitate fast transition to a design-build project
D) Scope of work to include two, Priority 2 structures to level of engineering notes, rough drawings and photos (ex: Marshallville, Howard)

Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan Phase I
Final Report

C. Communications Plan

The Purpose of This Document

The purpose of this Communications Plan is to outline the process and messaging to engage the broad range of stakeholders. These stakeholders are either directly or indirectly impacted by recommendations from the Phase I SMP. The communication plan will also support associated design / build / implementation projects that are recommended by and spin out of the over SMP process.

Most of the work in the SMP Phase I was focused on identifying stakeholder groups, developing an inventory of existing data / information sources, selecting assessment methodologies, cataloging physical infrastructure within the stretch, and performing preliminary assessments of physical structures and flow requirements. As such, there is not much to communicate as there are few actionable recommendations resulting from the SMP Phase I work. During the SMP Phase I we did developed preliminary recommendations / priorities for physical infrastructure modifications. Specifically, Xcel Energy participated in the Colorado School of Mines student design project for East Boulder Ditch, and discussions regarding land access around Leggett / Jones-Donnelly. We reached out to Eldorado Artesian Water Company regarding private land access permission near the FRICo check structure. (see "Core Stakeholders" in this document.)

As a result of the SMP Phase I, we are dividing the recommended next steps between the remaining SMP tasks (in a separate SMP Phase II grant application) and the engineering / design and structural tasks (in a separate Watershed Restoration (WSR) grant application). Execution of the Communications Plan beyond the SMP Phase I will support both projects.

Going forward we will move from the planning stage to the execution stage. For the SMP Phase II this will include: filling data gaps through field work and analysis, RHA assessment execution, and active stakeholder outreach. For the WSR Phase I project this will include operational and engineering design recommendations, and associated design-build projects going forward. As these concrete recommendations emerge, the Communications Plan will be executed in support of informing stakeholders, listening to needs and building consensus for action.

The Communications Plan is intended to the a "living" document. It will guide the work of Boulder Flycasters ("BFC") / Colorado Trout Unlimited ("CTU") and their consultant team, and evolve over time based recommended future projects, municipal partner guidance and feedback from the stakeholders.

The Stakeholders

The knowledge, input, and ideas of the people and organizations whom care about and know South Boulder Creek must be at the foundation of the SMP and associated implementation projects. Clearly there are many organizations and individuals that are stakeholders, ranging from those directly impacted by any SMP recommendations, to the general public that may only have a casual interest in the SMP. In Phase I we identified the following stakeholder cohorts:

- Steering Committee (Direct Project Partners)
- Core (Directly Effected) Stakeholders
- Secondary (Indirectly Effected) Stakeholders
- Other Related Stakeholders
- General Public as Stakeholder

There also organizations that are providing support, funding and expertise (collectively referred to as "Advisors") that need to be within the overall stakeholder set.

Steering Committee (Direct Project Partners)

The dedication and cooperation of a core group of water users / landowners is largely responsible for this project becoming a reality. This group of directly involved partners is known as the Steering Committee. The Steering Committee meets regularly and dives more deeply into the process and recommendations with the consultant team and BFC / CTU. The Steering Committee members also provide staff support for various tasks defined in the Scope of Work. In addition to providing information vital to the project, the Steering Committee works to refine ideas and converge or agree on specific actions or approaches. During Phase I, the Steering Committee was the most active stakeholder group and played a key role in guiding the project. We expect this group to continue forward into future Phases. It consists of the following individuals:

1. Joanna Bloom, Special Projects, City of Boulder Public Works Water Utility ("Boulder Water Utility")
2. Laila Parker, Source Water Administrator, Boulder Water Utility
3. Don D'Amico, Ecological Stewardship / Wetland Ecology, City of Boulder Open Space & Mountain Parks ("OSMP")
4. Melanie Asquith, City of Lafayette Water Dept Capital Projects and Engineering ("Lafayette Water Utility")
5. Travis Bray, Denver Water Gross Reservoir Expansion Project Office
6. Stephen Brant, Chair and Sponsor's Representative, BFC / CTU
7. Gary Swanson, BFC
8. Mike Lighthiser, Project Manager, Biohabitats, Inc.

Phase II Activity Per Person / Entity – Steering Committee Members (or their staffs)	Hours
One kick off meeting and three progress meetings (3 hours per meeting x 4 meetings)	12
Participation in Core Stakeholder meetings (2 hours)	2
Participation in Secondary Stakeholder meetings (2 hours)	2
Additional time assisting project – will vary from one member to another	varies
TOTAL ESTIMATED HOURS	16+

Examples of the type of assistance from this group may include the following items:

- Project Scope
- Assessment
- Recommendations
- Deliverables Execution/Advisory

Timing: Ongoing for project duration

Core (Directly Effected) Stakeholders

The Core Stakeholders group consists of high priority infrastructure owners (ditch companies and commercial entities), as well as high priority water rights owners (other private, industrial, commercial and municipal entities), and immediately proximate landowners (industrial) directly effected by SMP recommendations. We will engage these stakeholders early in Phase II. And then ramp up efforts to maintain regular contact. Since stakeholders are extremely busy and have limited available time in their respective schedules, meetings and other engagement efforts will likely be one entity / person at a time. We will work to have meetings with a larger group at key points in the process.

The owners of the seven (7) "high priority structures" are in this group. These are the structures culled from our structures assessment work in Phase I for recommended improvement projects in Phase II. Five (5) of these structures were identified as "Priority 1" structures, based on limited / no ability to allow low flow passage, and to support administration of flows by the District Water Commissioner. Another two (2) structures from the "Priority 2" group were added based on ability to significantly increase channel connectivity.

The structures that have been identified as high priority (proposed modifications) are as follows (in upstream to downstream order):

1. Community Ditch – Farmers Reservoir and Irrigation Company (FRICo)
    - Contact: Scott Edgar, 303-659-7373
    - Ditch Rider: Larry Lewis, 303-961-8046(c), 303-659-7373(o), larryfrico@wildblue.net
2. Goodhue Ditch
    - President: Melanie Asquith (City of Lafayette), 303-661-1279, melanie.asquith@cityoflafayette.com

- Secretary: Dmitry Tepo, 303-335-4607, dmitryt@louisvilleco.gov
- Ditch Rider: Larry Lewis, 303-961-8046 (c), 303-499-1249(o), larryfrico@wildblue.net

3. Marshallville Ditch
   - President: Tim Dufficy, tim@cdironworks.com
   - Head-gate Superintendent: Kristyna Shanahan, 303-570-3145, ranchersdaughter@msn.com
   - Secretary: Linda Biella, 303-460-9244, 303-818-4519, andersonbiella@comcast.net
4. New Dry Creek Carrier Ditch
   - President: C.D. Bodam, 303-444-5340 ext 113, cdb@RMSBoulder.com
   - Secretary: Melanie Asquith (City of Lafayette), 303-661-1279, melanie.asquith@cityoflafayette.com
   - Ditch Rider: Bob Juhl, 303-359-8284, boblj21@aol.com
5. Howard Ditch
   - President: Jeanette Hillary, 303-494-7718
   - Superintendent: Bob Juhl, 303-359-8284, boblj21@aol.com
6. East Boulder Ditch
   - Rich Belt, Water Resources Lead, Xcel Energy, 970-222-7681, richard.l.belt@xcelenergy.com
7. Leggett-Valmont Inlet D (Jones-Donnelly)
   - Rich Belt, Water Resources Lead, Xcel Energy, 970-222-7681, richard.l.belt@xcelenergy.com

In addition, the Core Stakeholders with high priority water rights, augmentation requirements, and / or immediately proximate private land ownership will include the following organizations due to their overall importance to the project:

- Boulder County – owns significant water rights in the reach, and associated with these structures
- City of Louisville – the Louisville water utility diverts water to their pipeline at the FRICo check structure
- Private Landowners immediately proximate to Marshallville Ditch
- Eldorado Artesian Water – owns land around and downstream of the FRICo check structure
  - Doug Larsen, President, 303-604-3012, doug@eldoradosprings.com

Phase II Activity Per Person / Entity	**Hours**
Engagement following initial assessment (2 hours per stakeholder x 11 stakeholders)	22
Regular contact through project (2 hours per stakeholder x 11 stakeholders)	22+
Meeting to review recommendations (2 hours per stakeholder x 11 stakeholders)	22
TOTAL ESTIMATED HOURS	66+

Examples of the type of input from this group may include the following items:

- Operational Needs (strengths, weaknesses, threats, opportunities)
- Recommendations Buy-In

Timing: Expect to reach out to Core Stakeholders early in the Phase II process. This should also be after the irrigation season when personnel may be more readily available.

Secondary (Indirectly Effected) Stakeholders

The Secondary Stakeholders group consists of other infrastructure owners (ditch companies and commercial entities), other water rights owners (other private, industrial, commercial and municipal entities), and other proximate private landowners within the stretch of SBC in the scope of this project, but indirectly impacted by any recommendations. We believe that engaging this group of stakeholders will be important to consolidate community consensus. We will inform / educate and solicit feedback from this group. This group will consist of individuals yet to be determined from the following categories:

1. Remaining Ditch Companies within lower SBC stretch of SMP
    - Davidson Ditch
    - Bear Creek Ditch
    - Dry Creek #2 Ditch
    - Shearer Ditch
    - McGinn Ditch
    - South Boulder Canon Ditch
    - Hunter Hine (in-stream pipeline to private pond / land owner)
    - KOA Lake Inlet
    - KOA Lake Outlet
    - Butte Mill Ditch
2. Landowners Proximate to any Structural Changes (examples)
    - Prado Neighborhood (between Eldorado Springs and CO HWY 93) – proximate to Goodhue Ditch
    - Commercial entities near Leggett-Valmont / Jones-Donnelly
3. Any Significant Water Rights Owners / Operators not Represented by Ditch Companies (examples)
    - Eldorado Springs Local Improvement District – waste water treatment / return flows
    - Martin Marietta Aggregate Mining (KOA Lake outlet pumping station and Butte Mill)

Phase II Activities Per Person / Entity	Hours
Engagement at preliminary recommendations stage (2 hours per stakeholder x 14 stakeholders)	28
Final results reviews (1 hour per stakeholder x 14 stakeholders)	14
TOTAL ESTIMATED HOURS	42

Examples of the type of input from this group may include the following items:

- Project Objectives/Process
- Solicit Interest and Concerns
- Direct Results Communication

Timing: Q1 of CY 2020 once final project reports are completed.

Other Stakeholders

As this project progresses, it is likely that other conservation, advocacy, and / or recreational groups with a Boulder watershed mission, as well as, other adjacent private landowners will be important to building broader understanding and consensus. This group will consist of entities / individuals yet to be fully determined. We engaged some conservation groups in Phase I. These contacts were primarily status and information sharing, to date. We will engage these stakeholders directly regarding project objectives after funding for Phase II is secured. And solicit feedback during Phase II.

Phase II Activities Per Entity (estimated @ 8 entities)	Hours
Engagement at preliminary recommendations stage (2 hours per stakeholder x 8 stakeholders)	16
General communication over 18 months (2 hours per stakeholder x 8 stakeholders)	32
TOTAL ESTIMATED HOURS	48

Examples of the type of interaction from this group may include the following items:

- Direct Engagement/Communications of Project Results and Next Steps
- Solicitation of Interest and Concerns

Timing: Q2 of CY 2020 after Phase II funding

General Public

South Boulder Creek is a valuable asset not only to the stakeholders described above, but also to the larger community in this watershed. These creeks and riparian areas provide recreational opportunities to residents,

habitat for wildlife, ecosystem services like clean drinking water and flood attenuation, and many other important and treasured services. For this reason, the broader community voice must be a part of this SMP. However, Phase I, which is basically an assessment of existing conditions, is too early in the process to bring in the diverse opinions of the wider community. The SMP process will engage the broader community as needed during Phase II, before final decisions are made on future opportunities.

Phase II Activities Per Person / Entity	Hours
Indirect engagement through PR or web-based communications per group	1+
Individual contact during field visits	varies
TOTAL ESTIMATED HOURS	1+

Examples of the type of interaction from this group may include the following items:

- Indirect Communications of Results and Next Steps
- Process for Input

Timing: As needed and as requests received, or events unfold (ex: press contact, local municipality request, etc.). Proactive communications will require Phase II funding to be available to produce any meaningful, generally available results (ex: website). Final reports will be in the public domain once submitted to CWCB.

Advisors

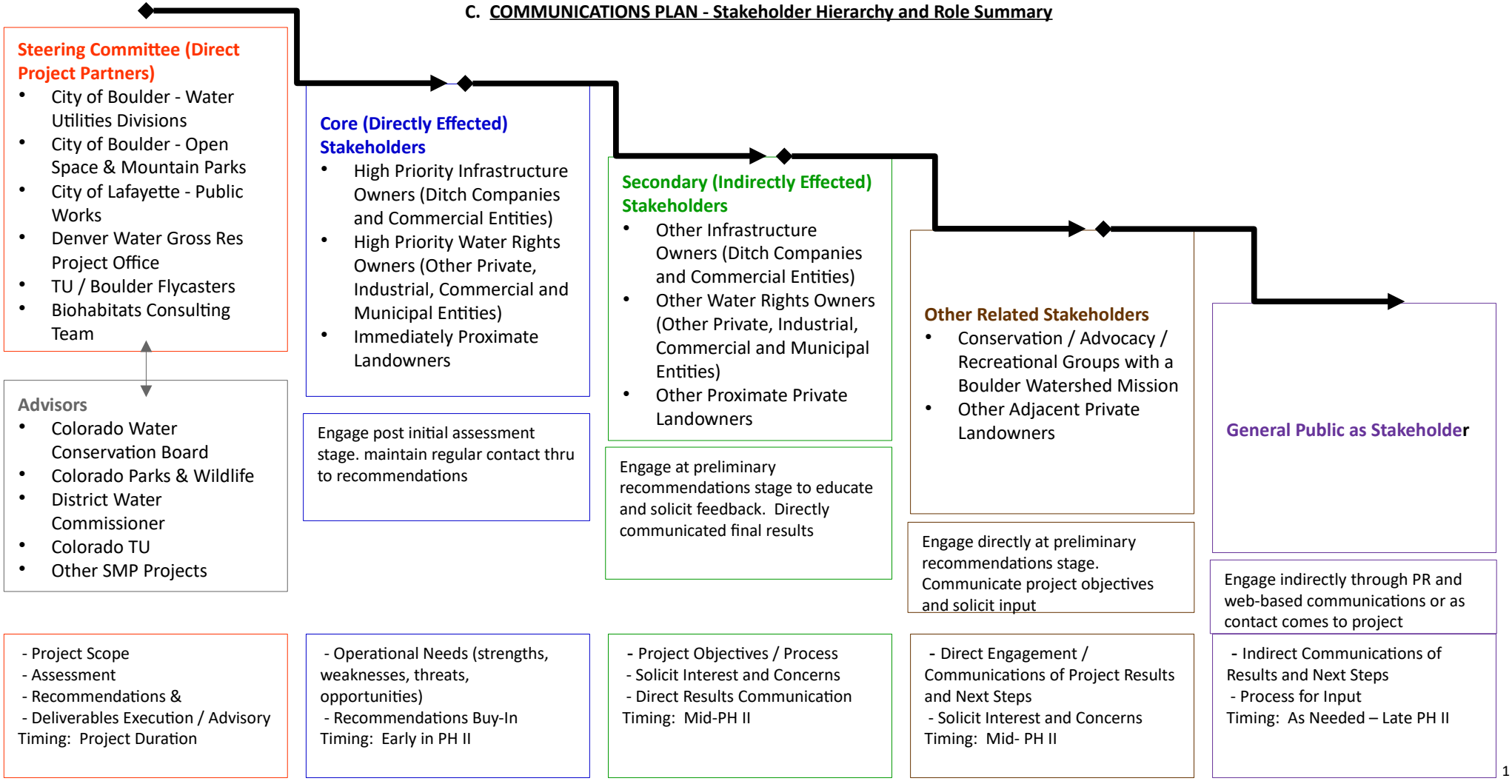
Due to their existing authority or position, a small group will play the role of project Advisors. This group will consist of representatives from state agencies (Colorado Parks & Wildlife (CPW) and Colorado Water Conservation Board (CWCB – also is major granter for this project)), as well as the District 6 Water Commissioner and other select stakeholders:

- Bob Carlson, District 6 Water Commissioner (engaged)
- Linda Bassi, Colorado Water Conservation Board (engaged)
- Chris Sturm, Colorado Water Conservation Board (engaged
- Katie Birch, Colorado Parks & Wildlife (engaged)
- Amy Willhite, City of Boulder OSMP (engaged)
- Dave Nickum, Colorado Trout Unlimited (engaged)

The time commitment of the advisors will vary depending on the needs of the project.

Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan Phase I
Final Report - April 30, 2020

C. COMMUNICATIONS PLAN - Stakeholder Hierarchy and Role Summary



Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan Phase I
Final Report – April 30, 2020
C. COMMUNICATIONS PLAN - Stakeholder Hierarchy and Role Summary

Steering Committee

- **Joanna Bloom - BWUD**
- **Laila Parker - BWUD**
- **Don D'Amico – BOSMP**
- **Melanie Asquith - LPW**
- **Travis Bray - DW-GRPO**
- **Stephen Brant. Chair and Sponsors Representative - TU/BFC**
- **Gary Swanson – TU/BFC**
- **Mike Lighthiser – Project Manager - BiohabitatS**

Core (Directly Effected) Stakeholders

- FRICo / Community Ditch
- Goodhue Ditch
- Marshallville Ditch
- New Dry Creek Carrier Ditch
- Howard Ditch
- East Boulder Ditch
- Leggett Inlet / Jones-Donnelly - Xcel Energy
- Boulder County - Ditch Owner / Water Rights
- Eldorado Artesian Water Company - landowner / augmentation requirements
- City of Louisville – municipal water utility
- Marshallville Ditch - immediately proximate landowners

Secondary (Indirectly Effected) Stakeholders

- Remaining Ditch Companies on SMP Reach (10 from field assessment)
- Other Landowners Proximate to Any Structural Changes:
  - Prado Neighborhood – near Goodhue
  - Commercial Entities – near Leggett Inlet
- Other Significant Water Rights Owners not Represented by Ditch Companies:
  - Eldorado Springs Local Improvement District – Waste Water Treatment
  - Martin Marietta Aggregate Mining

Other Related Stakeholders

- Conservation / Advocacy / Recreational Groups with a Boulder Watershed Mission (TBD)
- Other Adjacent Private Landowners (TBD)

General Public as Stakeholder

Advisors

- Chris Sturm – Colorado Water Conservation Board
- Linda Bassi - Colorado Water Conservation Board
- Katie Birch - Colorado Parks & Wildlife
- Bob Carlson - District Water Commissioner
- Amy Willhite, City of Boulder OSMP
- David Nickum - Colorado TU
- Other Select Stakeholders (as appropriate)

Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan Phase I
Final Report
D: River Health Assessment Methodology / REV 2.2

Data Category	RHA Component	Measurement Type	Data Source & Notes	Uncertainty, Data & Information Gaps	Criteria (Draft)
HYDROLOGY	FLOW REGIME	Compare ratio of existing vs. natural conditions for following items: -Mean Annual Q -Mean Aug Q -Mean Sept Q -Mean Jan Q -Mean Annual Peak Daily Q (NEED DAILY FLOWS) -7-Day Min. (NEED DAILY FLOWS)	Lower SBC flow from StateMod Current flow data from USGS and UDFCD gauges New data collection from Boulder flow gauge at S. Boulder Road, and new staff gauges at Dry Creek Carrier and Leggett	Few gauges below Eldorado Springs with limited length of record (mostly post-flood) Monitoring locations up stream of the lower stretch of limited value due to large diversion points in lower stretch StateMod flow provides both existing and natural, but as monthly (not daily) averages – extra work required to estimate daily flows	<10% change is highly functioning For low flows: Environmental Pool 2010 IGA flow agreements set minimum "acceptable" threshold and CPW biological recommendations set higher threshold >20% change is significant >50% change is non-functioning
	FLOW REGIME	Dry up locations	StateMod Stakeholder observations Known locations below structures that sweep creek (Water Commissioner)	Data may be spotty and mainly observational in nature	Occurrences could be used to modify result of earlier flow regime category (above)
WATER QUALITY	WATER QUALITY – aquatic habitat	Dissolved Oxygen: Sampling requires that a DO logger be deployed for at	Boulder Water Quality Lab data from 10/2013 to 12/2018 – annual	Sampling protocols need to be followed to be compatible with scoring criteria; they	Dissolved Oxygen: >9 mg/l high functioning 8-9 mg/l functioning

Data Category	RHA Component	Measurement Type	Data Source & Notes	Uncertainty, Data & Information Gaps	Criteria (Draft)
		least one week during the summer months of July or August recording at least daily measurements between one and three in the afternoon Temperature: Daily maximum (DM) = highest 2-hour average temperature recorded during a given 24-hour period during months of July and August with a maximum sampling interval of 30 minutes Maximum Weekly (MWAT) = largest weekly average temperature in months of July and August; weekly average is average of daily average temperatures over a 7-day consecutive period	testing at site upstream of US36 crossing TU started collecting air and water temperature data at 4 locations along Lower SBC in March 2018 using data loggers; DO to be added in late 2019; 5th location desired near FRICo structure, but permission needed from landowner	are not currently being followed. Data will be available at 4 (maybe 5) locations along lower reach.	7-8 mg/l part functioning 6-7 mg/l low functioning <6 mg/l not functioning Temperature: Cold and warm stream habitat delineated by South Boulder Rd *(from pg 333 of CDPHE Regulation No. 38)* Cold stream: DM – threshold 23.9C MWAT – Optimum 16.6 Threshold 18.3 Warm stream: DM – threshold 28.6C MWAT – Optimum 22.5 Threshold 27.5
	WATER QUALITY – metals	Metals: CDPHE identified issues with Copper	According to REGULATION #93 – COLORADO'S SECTION 303(D)	Exact location and frequency of measurements are not clear.	High functioning: not applicable Functioning: not listed on 303D

Data Category	RHA Component	Measurement Type	Data Source & Notes	Uncertainty, Data & Information Gaps	Criteria (Draft)
		(dissolved) and Arsenic (total) in reach between Gross Reservoir and South Boulder Road	LIST OF IMPAIRED WATERS AND MONITORING AND EVALUATION LIST 5 CCR 1002-93 Lower SBC is divided as follows: COSPBO05b_B – Outlet of Gross Reservoir to South Boulder Road COSPBO05_A – South Boulder Road to confluence with Boulder Creek Also need to check with Boulder Water Quality Lab	State limits and monitoring criteria are difficult to follow – need to learn more.	Partly functioning: 303D for monitoring and evaluation Low functioning: 303D for TMDL Not Functioning: not applicable Arsenic (total chronic) threshold = 0.02 ug/L Copper (dissolved)
LANDSCAPE	BUFFER CAPACITY	System's ability to buffer stream and riparian function (laterally)	Aerial photography, Field observation	Need to set distance from riparian zone that will be assessed – was 200 m for Yampa (bigger system) and define "high-intensity" uses	Negligible – no appreciable land use change Mild – high-intensity land uses<10% Significant – high-intensity uses 10-40% Severe – 40-75% Profound - >75%
	TERRESTRIAL CONNECTIVITY	Impairment to migration and dispersal of terrestrial organisms into and out of the reach	Aerial photos, Field observation, mapping	Need to determine habitat connectivity envelope; Yampa used 500 meters out from the riparian zone	Percent of habitat loss (isolated): <10% 10-25% 25-50% 50-75%

Data Category	RHA Component	Measurement Type	Data Source & Notes	Uncertainty, Data & Information Gaps	Criteria (Draft)
		based on the loss of habitat and dispersal/migration barriers within a habitat connectivity envelope			>75%
	AQUATIC CONNECTIVITY	Impairment of migration/dispersal to adjacent stream reaches	Aerial photos/map with structures Field observations, mapping	Rather than arbitrary distance criteria, could we use the number of reaches separating barrier and location under study?	Negligible – no significant barriers throughout entire system Mild – impermeable barriers 10 miles away or just minor barriers Significant – Impermeable barriers 5 miles away or multiple minor barriers in reach or adjacent reaches Severe – Impermeable barriers or severe impediments in reach or adjacent reaches Profound – isolated reach
HYDROLOGY/RIPARIAN ATTRIBUTES	FLOODPLAIN CONNECTIVITY (moved from Hydrology to Riparian Attributes)	Compare peak flows for 1.01-, 1.5-, 2-, and 5-year flow events for existing vs natural conditions	Pre-1936 Eldorado Gage data for natural conditions – can apply to entire reach Existing peak flows dependent on upstream	Existing conditions downstream of Eldorado Gage not readily available – peak flows will need to be estimated from results of hydrologic analysis	Grade function level based on percent change from natural. For example: <10% 10-20% 20-33% 33-50%

Data Category	RHA Component	Measurement Type	Data Source & Notes	Uncertainty, Data & Information Gaps	Criteria (Draft)
			structures	Natural condition channel and floodplain elevations not available – will not bother with quantifying floodplain changes. "Landscape" parameters will help account for changes in floodplain.	>50%
RIPARIAN ATTRIBUTES	RIPARIAN CONDITION	Assess woody vegetation extent/succession, wetland extent/quality, rare and protected species, invasive species.	Field observation Aerial imagery	Existing data does not consistently cover entire reach. Depends on professional judgment	Level of degradation: Negligible Mild Significant Severe Profound
	ORGANIC MATERIAL	Wood & Detritus	Field observation	No reference condition – based on professional opinion	Estimated decrease from natural: <10% - no real change 10-25% - minimum change 25-50% - significantly limited 50-80% - seriously limited >80% - nonexistent
GEOMORPHOLOGY	MORPHOLOGY	Dimension	Width/Depth ratio is key parameter. Cross section data from various sources incl. hydraulic model. Field observation.	Don't have natural condition for comparison – use professional judgment	Exact criteria TBD. Use different ranges of W/D for negligible, mild, significant, severe, and profound degradation level
		Profile	Presence and	Need to refine	No structures in reach

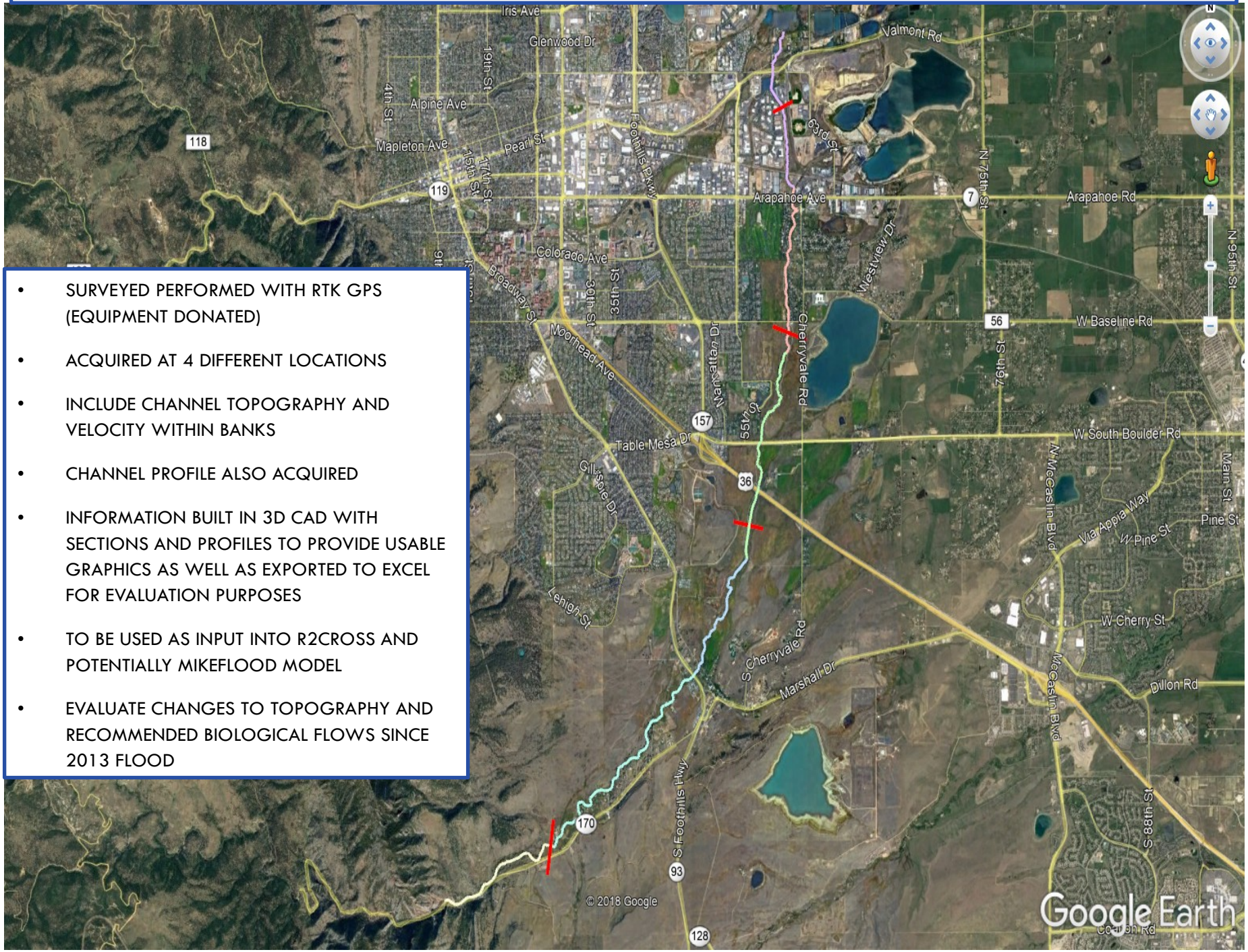
Data Category	RHA Component	Measurement Type	Data Source & Notes	Uncertainty, Data & Information Gaps	Criteria (Draft)
			extent of grade control structures	criteria	– negligible One structure upstream only – mild One structure downstream – significant Multiple structures – severe Structure causes permanent ponding – profound
	RESILIENCY	Resistance – extent of woody vegetation along bank	Field observations	Professional judgment	TBD
		Equilibrium – floodplain connectivity	Frequency of overbank flow	Need hydraulic model	Negligible – overbank flow at or below 1.01-year flow Mild – overbank flow between 1.01- and 2-year flow Significant – overbank flow between 2- and 5-year flow Severe – overbank flow between 5- and 10-year flow Profound – overbank flow > 10-year flow
	PHYSICAL STRUCTURE	Macro- and Micro-habita	Field Assessment – method developed by Ashley	Professional judgment	Rating of 1-5 based on partitioning analysis, with 5 being high-functioning and 1 being low functioning.

Data Category	RHA Component	Measurement Type	Data Source & Notes	Uncertainty, Data & Information Gaps	Criteria (Draft)
RECREATIONAL	Hiking / Running Biking Boating Fishing Open Space/Park Other	Number of Recreational Users by Type	City of Boulder OSMP	Information may be focused in protected open space/parks and not available for other areas along reach.	Trend lines

OTHER NOTES:

1. EPA Rapid BIO Assessment Tool – might be a good source for additional methodology details
2. Mile High Flood Control District – identified needed future projects within the watershed – especially downstream of Arapahoe Avenue

COLORADO TROUT UNLIMITED AND BOULDER FLYCASTERS
SOUTH BOULDER CREEK STREAM MANAGEMENT PLAN PHASE I
FINAL REPORT
E: CROSS SECTION SURVEY LOCATIONS MAP



- SURVEYED PERFORMED WITH RTK GPS (EQUIPMENT DONATED)
- ACQUIRED AT 4 DIFFERENT LOCATIONS
- INCLUDE CHANNEL TOPOGRAPHY AND VELOCITY WITHIN BANKS
- CHANNEL PROFILE ALSO ACQUIRED
- INFORMATION BUILT IN 3D CAD WITH SECTIONS AND PROFILES TO PROVIDE USABLE GRAPHICS AS WELL AS EXPORTED TO EXCEL FOR EVALUATION PURPOSES
- TO BE USED AS INPUT INTO R2CROSS AND POTENTIALLY MIKEFLOOD MODEL
- EVALUATE CHANGES TO TOPOGRAPHY AND RECOMMENDED BIOLOGICAL FLOWS SINCE 2013 FLOOD

Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan Phase I
Final Report

E: Flow Assessment

Overview

Minimum flows necessary to support fish populations have been evaluated using R2Cross methods several different times over the last 40 years. Examples of these efforts include CDOW's work that led to in-stream flow recommendations in 1980 and Hydrosphere's 1994 re-analysis of the CDOW data along with newer information from a 1992 study. As part of Phase I of the South Boulder Creek Stream Management Plan (SBC SMP), there was interest in checking how those past results might compare to more recent conditions, particularly considering that the channel experienced a significant flood event in 2013. This analysis was meant to be a check on past results, not a re-analysis to update or replace past results.

Methods

During the spring of 2019, the consultant team for the SBC SMP performed cross sectional surveys at four locations along South Boulder Creek using RTK GPS equipment with sub-centimeter accuracy and a USGS wading rod with velocimeter. This information provided the cross-sectional area and velocity to allow calculation of the flow rate on that day for each cross-section location. The team also surveyed the channel's profile. The USGS wading rod and velocimeter data were entered and evaluated in Excel, and cross sections and profiles developed in a computer-aided drafting program. Following previous studies, the lowest flow to meet two of the parameters (depth, wetted perimeter, and velocity) was considered the winter minimum while the lowest flow to meet three of the parameters was considered the summer minimum. We grouped results by location, with South Boulder Road forming the border for the upper and lower reaches, as defined in the earlier studies. In developing findings we are comparing measurements to CDOW established criteria for depth, wetted perimeter, and velocity.

Results

The table below, provided by the City of Boulder, compares past studies. We added the bottom row showing results from the SMP. Considering the variability inherent with R2Cross, particularly the influence of local cross section dimensions and discharge at the time of the survey, and the fact that the methodology has evolved over the years, the estimated flows from the different studies are very similar.

Stream Flow Studies, Recommendations and Targets *(see notes below; all values in cfs)*		**SUMMER** (May – Sept)		**WINTER** (Oct – Apr)	
		UPPER	**LOWER**	**UPPER**	**LOWER**
(1)	Range of instream flows indicated by CDOW R2 Cross studies.	22 - 38	1.6 - 5.8	4.5 - 6.3	1.5 - 2.5
(2)	1982 CDOW Instream Flow Recommendations	15	NA	8	NA
(3)	1992 Preliminary CDOW Minimum Flow Recommendations	17	4	9	2
(4)	CWCB Instream Flow Right	15	NA	2	NA
(5)	Gross Environmental Pool IGA average year target flows	10	4	7	2.5
(6)	2019 SMP Phase I R2 Cross Assessment	10.9 - 16.6	2.3	4.6 - 8.0	2.0

Notes for Table:

(1) Results of CDOW R2 Cross analysis of South Boulder Creek at two Upper Reach locations: the Dunn Property (1976), and 200 yards above South Boulder Road (1980); and two Lower Reach locations: below South Boulder Road (1980), and 200 yards upstream of Baseline Road (1980). Summer flows meet all three CDOW-established criteria of average depth, wetted perimeter and average velocity. Winter flows meet two of the three criteria.

(2) South Boulder Creek Stream Flow Report by Rex Taliaferro, November 10, 1982. These were the CDOW's flow recommendations to the CWCB in support of the CWCB's ISF appropriation in Case No. 80CW379.

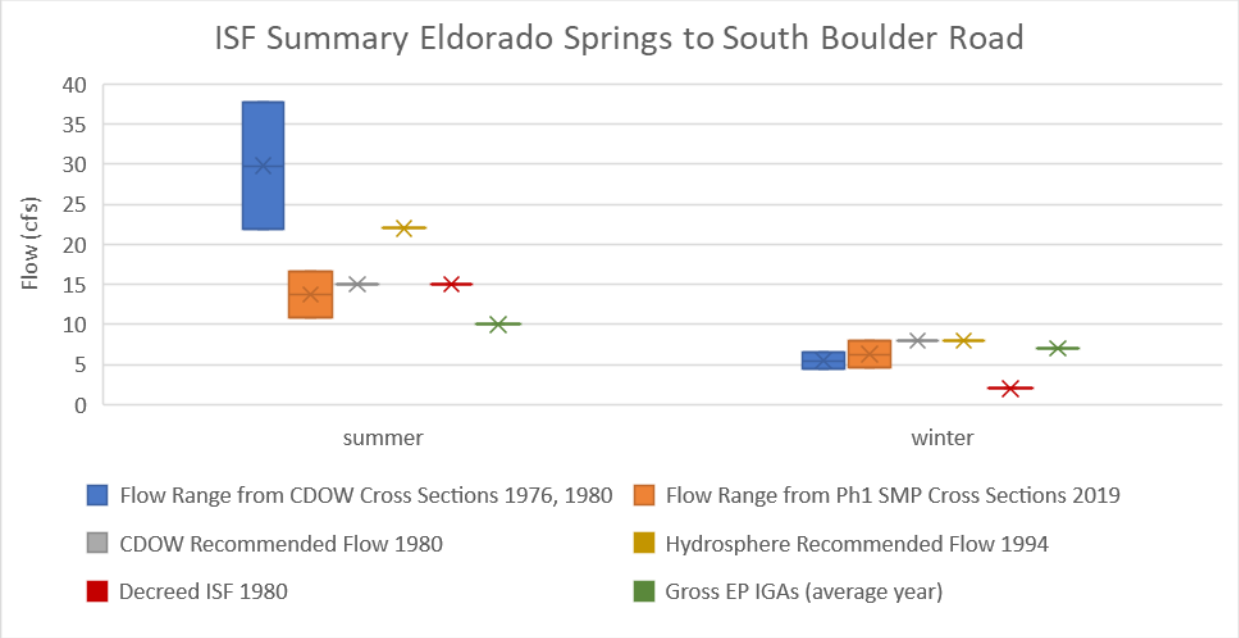
(3) Preliminary minimum instream flow recommendations provided by Jay Skinner and Greg Policky to Robert Weaver on April 2, 1992 as input to the South Boulder Creek Instream Flow Enhancement Study, prepared by Hydrosphere Resource Consultant. Inc., June 29, 1994.

(4) CWCB appropriated instream flow rights for South Boulder Creek between Gross Dam and South Boulder Road, Case No. 80CW379. The 2 cfs ISF right during the winter season was due to limited water availability. Further, this ISF right is very junior and not administered (i.e. offers no protection)

(5) 2010 IGA Gross Environmental Pool target flows.

(6) New results estimated from cross sections measured during the summer of 2019 as part of the South Boulder Creek Stream Management Plan (Phase I) by Biohabitats, Wright Water Engineers, and GEI Consultants.

The graph below shows results for the upper reach. The largest scatter is in the summer flows ranging from 10 to 38 cfs. The values estimated for the lower reach (not shown) were even closer to one another.



Conclusion

These results suggest that current creek conditions indicate similar low-flow ranges as past work used to inform flow targets in the 2010 IGAs between Denver, Boulder and Lafayette.

Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan Phase I
Final Report

F: Data Inventory

(Public and Project Derived Information Sources to Support Phase I - Current Available Data)

Description
Boulder Water Utility biological and chemical testing in SBC
Reference Site testing on South Boulder Creek 2008 to 2018
Denver Water - South Boulder Creek – Flow and Chemical Testing Data
Data collected from above and below Gross Reservoir
Lafayette Water Utility biological and chemical testing in SBC
Lafayette Water Quality Report 2018
Boulder Water Utility and OSMP Studies and Reports related to South Boulder Creek:
CWCB / City of Boulder – In-Stream Flow Right Use in SBC, 3/20-21/2019
City of Boulder WRAB In-Stream Flow Rights on SBC Update, 10/15/2018
Boulder City Council – Irrigation Ditch Overview - overview of irrigation ditches in Boulder, including a summary of their ownership and management structure, operation and maintenance practices and property rights 7/12/2018
South Boulder Creek Native Fish Species – List from OSMP 2018
Survey of Fishes and Habitat of South Boulder Creek, Colorado, within City of Boulder Open Space and Mountain Parks Property, 12/29/2016
Final South Boulder Creek Major Drainage-way Plan – Alternatives Analysis Report – Urban Drainage and Flood Control District, 08/2015 (summarizes many other listed studies)
South Boulder Creek Flood Mitigation Plan 2015 CH2MHILL
City of Boulder Wetlands Maps City of Boulder, GIS Mapping Services
City of Boulder Habitat Areas City of Boulder, GIS Mapping Services
Critical Facilities City of Boulder, GIS Mapping Services
Storm and Sanitary Sewer System Maps City of Boulder , GIS Mapping Services
City of Boulder UTILITIES - 2013-2018 Capital Improvement Program 2013 memo
South Boulder Reconnaissance Study 2010 USACE
The Potential Consequences of Climate Change for Boulder Colorado's Water Supplies 2/3/2009
US-36 Corridor EIS 2009 CDOT
South Boulder Creek Risk Assessment 2009 HDR Engineering, Inc.
Aerial Photography 2008 DRCOG
South Boulder Creek Hydraulics Report 2008 HDR Engineering, Inc.
South Boulder Creek Climatology/Hydrology Report February 2007 HDR Engineering, Inc.
City of Boulder Stormwater Master Plan 2007 HDR Engineering, Inc.
1' Interval Topographic Map 2003 Merrick and Company
Structure Field Surveys 2003 Merrick and Company
South Boulder Creek Phase A 2001 Taggert Engineering Inc.
WRIR Chapter 1: Comprehensive water quality of the Boulder Creek Watershed, Colorado, during high-flow and low-flow conditions, 2000
Fishes, Macro Invertebrates, and Habitat of South Boulder Creek, Colorado, within City of Boulder Open Space Property, 1/31/1996
University of Colorado Relevant Studies and Reports
South Campus Conceptual Master Plan CU – Facilities Management

Boulder County Relevant Studies and Reports related to South Boulder Creek:

Boulder County Wetlands Maps Boulder County , Geographic Information Services

Boulder County Habitat Areas Boulder County , Geographic Information Services

Denver Water Gross Reservoir Expansion Project relevant information from permit documents

Attachment E to EIS and Army Corp of Engineers by Denver Water: Final Mitigation Plan for the Moffat Collection System Project, CORPS File # NWO-2002-8072-DEN

Environmental Protection Agency

Army Core of Engineers

Federal Energy Regulatory Commission

National Forest Service

CDPHE – 410 Permit – Regulation 82 Requirements 6/23/2016

CDPHE / CWCD - Rationale for Conditional 401 Certification of the Moffat Collection System Project

CDPHE / CWCD - Appendix A: Assessment of the Narrative Temperature Standard in South Boulder Creek below Gross Reservoir

CDPHE / CWCD - APPENDIX B: Guidance for Voluntary Pilot Projects

Denver Water Expansion Project Brochure

Denver Water - South Boulder Creek – Mitigation and Enhancement monitoring obligations (list from DW 2019)

Environmental Pool IGA between Denver Water, Boulder and Lafayette

South Boulder Creek Offer of Settlement Agreement (IGA) between Denver Water and City of Boulder Related to Gross Reservoir Expansion Hydrology and FERC Permitting, for Creation of a 2,500 AF Environmental Pool, 1998

Boulder City Council – Motion to Approve IGA with Denver Water for Environmental Pool with attachments - A Draft Intergovernmental Agreement Between the City And County of Denver, the City of Boulder, and the City of Lafayette for an Environmental Pool in Gross Reservoir; B - Draft Intergovernmental Agreement Between the City of Lafayette and the City of Boulder Regarding the Operation of the Environmental Pool in Gross Reservoir; C - Draft of the City of Boulder Comments to the Corps on the Moffat Expansion Project Draft EIS 2/16/2010

IGA Between Denver Water and the Cities of Boulder and Lafayette for the creation of an Environmental Pool in an enlarged Gross Reservoir 2/24/2010

Gross Reservoir Enlargement Update to Boulder City Council Regarding Environmental Pool and Associated IGA, 8/10/2016

Boulder City Council Memo - Gross Reservoir Enlargement - Project Update 08/16/2016

G: Structures Assessment Summary

The infrastructure inventory includes twenty-one (21) structures; eighteen (18) of which are creek spanning. Fourteen (14) of the eighteen (18) are ditch head gates and accompanying diversion structures, three (3) are small concrete drop structures, and one (1) is a pipeline. There are two (2) with side-channel / return-channels serving ditch head-gates with no in-stream structures. There is one (1) pipe in the channel diverting water to a pond on private property.

Our consultants developed an infrastructure assessment score card that incorporated the priorities for structure modification from the 2010 IGA to allow for low flow passage and administrations, improvement opportunities important to BFC / TU, and factors from the consultant's experience. This produced a priority ranking by structure for the team to consider. Based on this information and further discussions with our Steering Committee, we simplified this to four primary criteria as follows below (in order of importance):

1. Ability to pass and administer low flows,
2. Potential for channel connectivity to enhance aquatic organism passage,
3. Habitat improvement proximate to the structure, and
4. Water use / operational efficiency potential.

We then scored each structure against the above criteria, with low flow passage / administration being heavily weighted. Recommendations for improvement (if any) for each structure were then described based on the evaluation process. The outcome guided our recommendations for Phase II preliminary engineering design on the highest priority structures.

Priority 1 Structures – primary criteria: ability to pass and administer low flows

Phase I findings generally agree with the highest priorities expressed by the City of Boulder and the Water Commissioner. Structures the City listed as high priority to accommodate in-stream low flows, include: FRICo Check Structure (Community Ditch), New Dry Creek Carrier Ditch, East Boulder Ditch and Leggett / Jones-Donnelly Inlet. Our objective continues to try and leverage any targeted investment (i.e., low flow modifications) to also improve other SBC aspects, including channel connectivity / fish passage, habitat improvement, and water use / operational efficiency of or near those same structures. Of the above four high priority structures for low flow modification, New Dry Creek Carrier Ditch and East Boulder Ditch are in locations that provide great opportunities to also address connectivity, habitat restoration, and improved efficiency. Phase I work also identified Goodhue Ditch as a structure that needs work to effectively administer low flows, as well as a candidate for other improvements. Goodhue is a barrier to channel connectivity, could benefit from habitat improvement, and the structure could also be a candidate for more efficient water use / operations. Phase I work revealed that the FRICo Check Structure (Community Ditch) and Leggett /

Jones-Donnelly Inlet structures, are not good candidates for channel connectivity, habitat improvement or efficiency due to a combination of location and complexity. Additionally, Leggett / Jones-Donnelly Inlet acts as a barrier to undesirable species migrating further up stream. (see detail "scoring" from Assessment Tasks).

Priority 2 Structures – no barriers to low flow passage / administration; primary criteria: channel connectivity

Phase I work found that four (4) Priority 2 structures are barriers to channel connectivity in key locations, and are also candidates for habitat improvement, and / or operational improvements (Marshallville Ditch, Howard Ditch, KOA Lake Outlet, Butte Mill Ditch). Of these structures, Marshallville Ditch and Howard Ditch present the best opportunities for improved connectivity. And all could benefit from habitat and efficiency improvements.

Priority 3 Structures – no barriers to low flow passage / administration and no important channel connectivity opportunity; primary criteria: habitat improvement

Priority 3 structures will be further evaluated in Phase II based on additional habitat improvement derived from the River Health Assessment.

Conclusion

After grouping the structures based on the above assessment criteria, we then looked across Priority groups to identify the structures for emphasis in Phase II. We identified seven (7) structures from the Priority 1 (5 structures) and Priority 2 (2 structures) groups as the highest priorities for modification (*see above). With low flow capabilities and aquatic organism passage as our top two criteria, the proposed modifications would not only allow for administration and passage of low flows, but also reconnect ~ 7 miles of this reach, and allow access for sport fish, native fish, and other aquatic life to move freely. This would also be an opportunity to increase the overall habitat quality.

GEI Consultants

Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan Phase I
Final Report
G: Structures – Preliminary Evaluation
Scoring

	IGA Rank	Ecological Benefits					Additional Considerations							
	Priority Structure (Listed in IGAs for low flow modification)	Partial vs total barrier to aquatic passage	Length of reconnected stream	Trout Present	Habitat Quality in Vicinity of Diversion	Invasive Fish below diversion	Diversion with high maintenance or repair needs TBD	Stream stability benefits TBD	Simplicity of modification or removal TBD	Availability of Funding TBD	Ditch & land owner participation TBD	Cost		
Criteria Weighting (5=Highest, 1=Lowest)	*5*	*3*	*4*	*1*	*3*	*3*	*2*	*1*	*2*	*3*	*3*	*2*		
Structures	**Each structure is scored individually for the criteria listed above with 3=Highest / Most, 1=Lowest / Least.**												**Score**	**Ranking**
Leggett-Valmont Inlet Ditch / Jones-Donnelly	3	3	3	1	1	3	0	0	0	0	0	3	55	1
East Boulder Ditch	3	3	3	2	2	1	0	0	0	0	0	3	53	2
New Dry Creek Carrier Ditch	3	3	3	2	1	1	0	0	0	0	0	3	50	3
Community Ditch	3	3	1	3	1	1	0	0	0	0	0	3	43	4
Goodhue Ditch	2	3	2	3	2	1	0	0	0	0	0	1	41	5
Butte Mill Ditch Confluence	2	3	2	2	1	1	0	0	0	0	0	2	39	6
Howard Ditch	1	2	3	2	2	1	0	0	0	0	0	1	36	7
Marshalville Ditch	1	2	3	3	1	1	0	0	0	0	0	1	34	8
South Boulder Cañon Ditch	2	1	1	3	3	1	0	0	0	0	0	1	34	8
Davidson Ditch	1	2	1	3	3	1	0	0	0	0	0	0	30	10
KOA inlet	1	2	1	2	1	3	0	0	0	0	0	0	29	11
KOA outlet (also Martin Marietta Pumping Station)	1	3	1	2	1	1	0	0	0	0	0	1	28	12
Schearer Ditch	1	1	1	3	3	1	0	0	0	0	0	0	27	13
McGinn Ditch	1	1	1	3	3	1	0	0	0	0	0	0	27	13
Sewer Pipe Crossing	1	3	1	1	1	1	0	0	0	0	0	0	25	15
Flood Control Channel near Stazio (3 concrete weirs)	1	3	1	1	1	1	0	0	0	0	0	0	25	15
South Boulder Bear Creek Ditch	1	1	1	1	2	1	0	0	0	0	0	0	22	17
Dry Creek #2 Ditch	1	1	1	1	2	1	0	0	0	0	0	0	22	17
Hunter/Hine Ditch	1	1	1	2	1	1	0	0	0	0	0	0	20	19

The following tabs list 19 structures that the Colorado School of Mines Eldorado Engineering Team have identified. The structures are numbered in order starting at the most western location (FRICO) and then succeeding downstream in order. Each structure has then been assessed on five criteria that will help the team evaluate its potential for redesign. The criteria are listed below:

Structural Integirty / Age
Fish Passage Need
Aesthetics
Feasibility by Cost
Impacts to Ecology and Habitat Health

Each Structure will receive a rating of GREEN, YELLOW, or RED for each of the categories listed above on their score card. Green shall indicate that the category is "good" and improvements will not be necessary. Red indicates that the item is either missing or in poor condition and presents a large opportunity for improvements. For cost, red shall indicate low cost and redesign potential while green is high cost. This maintains that the most red categories are the best for redesign.

This rating will contribute to the overall assessment of South Boulder Creek (SBC)

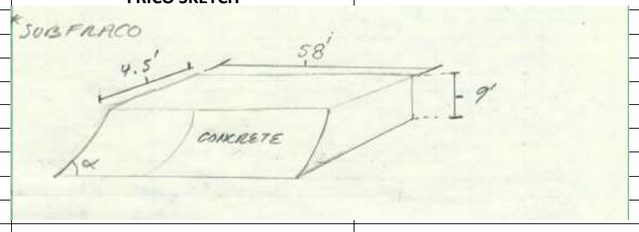
NOTE: This report was prepared by senior engineering students from the Colorado School of Mines, as part of the school's Capstone Senior Design Project program. Boulder Flycasters and Colorado Trout Unlimited worked with this program to provide a meaningful, in-the-field project for these students to experience just prior to graduation. The student team collected and documented valuable field data in support of the overall structures assessment for the South Boulder Creek SMP Phase I project. Due to staff availability constraints, these findings and data were not independently verified by our municipal partners. Some of the data areas, specifically regarding structure ownership and decreed water rights were not independently verified by the project team. However, that data was not used in any of the Phase I assessment results. We used other data sources for these areas. Data regarding physical description, location and opportunities for improvement was verified by the project team, and used to inform our overall structures assessment findings and recommendations.

Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 1 - Community Ditch	39°55.941'N, -105°16.858'W	FARMERS RESERVOIR & IRRIGATION COMPANY Priority Date: 12/19/1900	Total Decreed Rate: 3162.225	See FRICO sketch	The ability of flow to get over concrete weir, gate from FRICO Ditch closed, height difference from creek level to ditch, all flow to SBC must pass throgh structure (no natural	Good	Explore Fish Passage- more water needed in upper part of SBC directly below diversion, there is an apparent need for natural stream habitat to connect the easta nd west sides of SBC

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Description	
- Built in 1880	-FRICO 3rd oldest Water Rights owner
- Has gates for water and silt contents	-Silt never removed
- Artisan Water owns land around creek	-Louisville pulls all water from FRICO ditch
to creek	past ditch
- No fish passage	-Potentially need to set up measurment devices in outflow
- Louisville pulls water from ditch with pipe	-Gates Mechanically assisted
- Lafayette pulls water from ditch	-Pipes below ditch return water that Eldo (potentially hot springs) uses to creek
- New meter present on top	-FRICO can take all water in low flow
- Gate and componets are composed of Concrete and Steel	

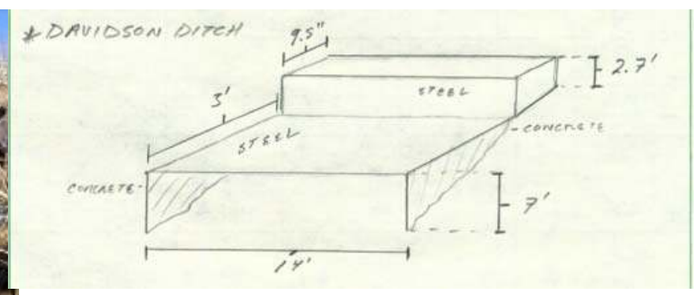
FRICO SKETCH



Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 2 - Davidson Ditch	39°56.318'N, -105°15.583'W	Davidson Ditch Company, City of Lafayette	Total Decreed Rate: 359.7665	See Sketch	Concrete Weir backs up water to pool in front of ditch gate, rebar intake delivers water back to SBC but also serves as a sink for sediment and debris	Good	Fish Passage would be needed here, more flow directed in main stream path, not in intake structure

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Description	
- Has monitoring station	-Has main gate & bypass
- Corregated steel pipe	-bypass goes to unkown location
- Weir for creek	-gate not mechanically assisted
- Available to create head pressure	-fish can't make it up to FRICO in low flow
- Large steel headgate	-Potential fish passage but must maintain proper head pressure
- Has bypass surrounded by rebar	-fish passage may not be desirable: might leave fish stranded in low flow
	-Monitoring station downstream ditch
Split in creek	
eadgate exposed to wear due to age	- Concrete component shows no cracks
rank operated	- No fish passage

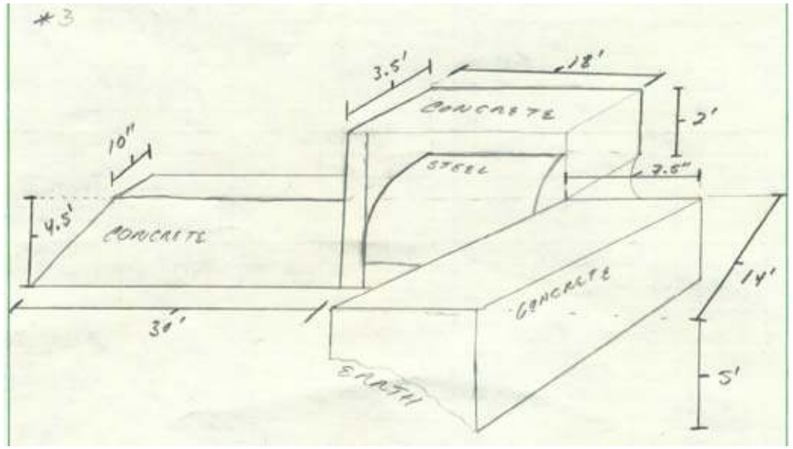


Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 4 - Goodhue Ditch	39°57.065' N, -105°14.526' W	BOULDER COUNTY PARKS & OPEN SPACE DEPT, City of Lafayette	Total Decreed Rate: 549.2881	See Sketch	Flow has potential clearance of about a foot from main steel gate	Fair	Fish Passage possible

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Pictures:

Description	
s monitoring station	-Gate not mechanically assisted
rge concrete weir with headwall	
aller headgate for ditch	-Potentially make head wall smaller
ncrete footing is eroding	-decent flow
rge crack in weir	-weir at end of gate
ll seems structurally sound	- Structure is composed of mainly concrete with steel parts
h can get through but no designated passage	- Ditch has pinch point



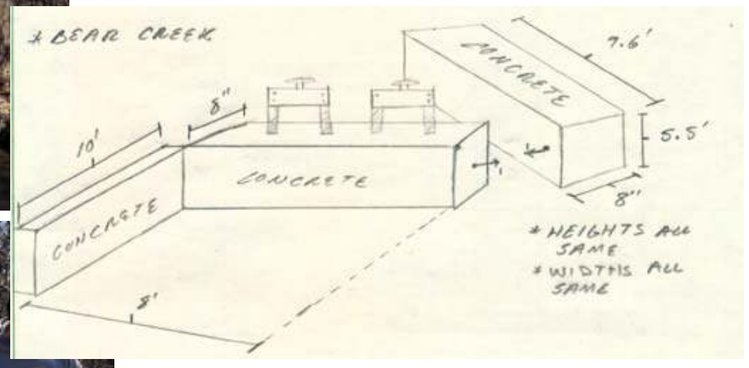
Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 5 - Bear Creek Ditch	39°57.203' N, -105°14.502' W	S BO + BEAR CK DITCH	Total Decreed Rate: 263.4811	See Sketch	Passage contains heavy debris from sedimentation	Fair	Fish passage most likely not desired. Good pooling area at gate. A lot of silt and debris build up

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Description	
- Diversion using land	-Diversion uses rocks
- Creates channel to ditch	-Natural diversion
- Owned by Lafayette	

Pictures:

BEAR CREEK SKETCH

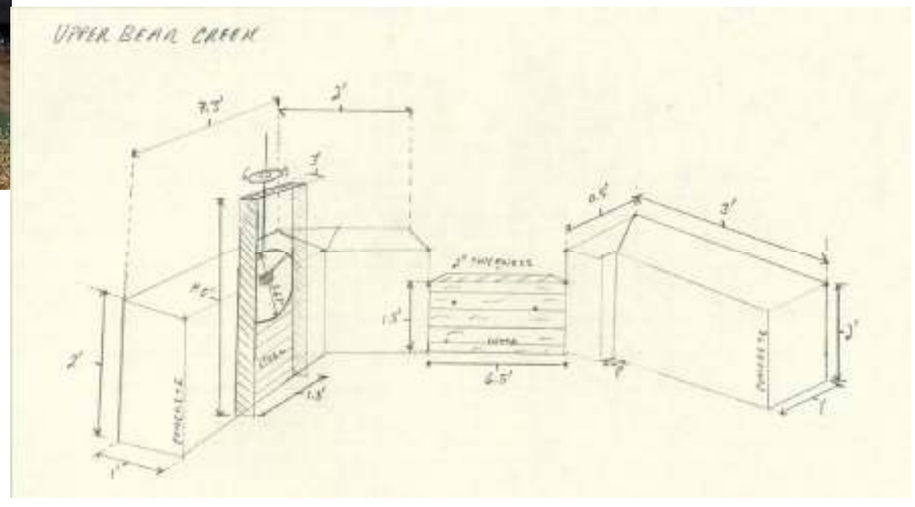


Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 6 - Upper Bear Creek Ditch	39°57.232' N, -105°14.472' W	TBD- TU	TBD- TU	See Sketch	Overcome heavy organic debris	Fair	Probably no fish passage wanted

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Description	
- Small conrete structure	-ditch is a primary water source for Lafayette
- 2 steel gates into ditch	-water leaking through gate
-gate not mechanically assisted	-no fish passage needed
-stream that goes to Laf has another monitoring station	-Overall goal to make easy fishing spots
- Structure is in ditch, not main channel	-water infiltrating groundwater after ditch to return to South Boulder Creek
- Concrete narrows channel	-monitoring station below
- Concrete seems to be in acceptable conditions	- Has second structure down the ditch but is out of scope
- Steel components seem in new conditions	

Pictures:



Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 8-MARSHALLVILLE Ditch	39°57.578'N, -105°13.938' W	MARSHALVILLE DITCH CO	Decreed Rate: 52.734	See Sketch	N/A	Good	N/A

We still have not granted access to this structure

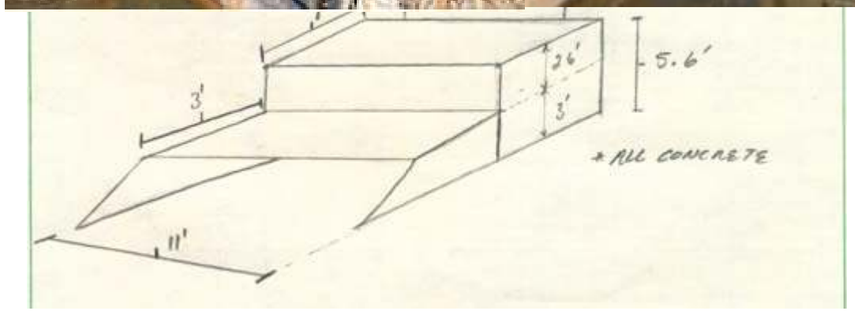
Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Description	
- Rock Diversion	- Life confirmed
- Small Concrete with steel headgates	- Gate under diversion
- Has monitoring station	- Monotoring station
- Private property	

Structure Number	GPS Location	Water Rights	Relative	Structure Dimensions	Approximate Flow/ Barriers to	Soil Stability	Potential
SBCS 9- SHEARER	105°13.628'W	VLEET, L W VAN	Total decreed	See Sketch	The ability of flow to get over	Fair	

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Description	
- Diversion structure into	-treated poorly
- 2 Concrete arms into creek	-smaller structure
- Ditch off to side	-small diversion to
- One gate	-bad water
- Leaking	-wild flower ranch
- Wood paneln one side	-boulder shares
- Also Leaking	-water leaking
ish passage	-potentially leaking
crete looks good	-confirmed life
lflower Ranch	-gate not

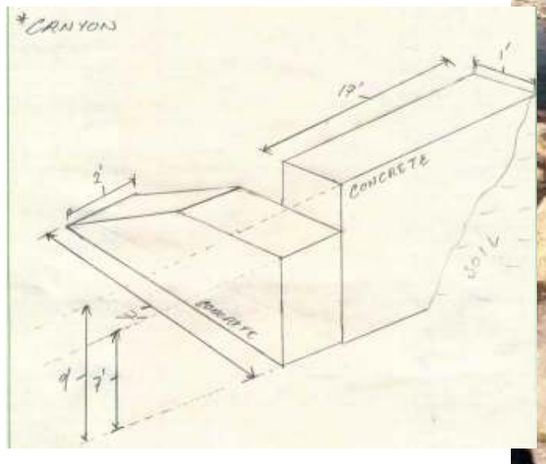


Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 10- CANYON Ditch	39°58.340'N, -105°13.396'W	S BO CANON DITCH CO	Total Decreed Rate:	See Sketch	None	Good	Good fish passage here

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Description	
HAS FISH PASSAGE	- Structure is relatively large
Low flow channel of rocks	-weir diversion
Ditch to side	-return gate leaking
Structure rebuilt recently	- Pool at bottom for fish
2 gates on concrete face	-meets env standard (5-7 cfs)
Rocks in channel	-not restorative flow however
Large pool downstream from hat	-Boulder road is division btw/cold (5 cfs) and warm (3 cfs) water fisheries
Gate at top of passage	-pool system rn w/rocks
- Electric monitoring station	-potentail leaks on main strucutre
- Concrete appears to be in fair conditions	-monitoring system w/ALERT (can upload data online)
- Rocks placed to improve structure	-gate not mechanically assisted

Pictures:

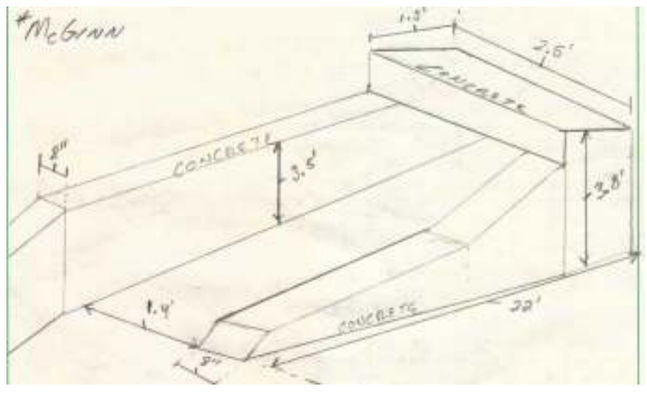


Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 11- MCGINN	39°58.851'N, -105°13.263'W	MC GINN DITCH CO	Total decreed rate: 10.892	See Sketch	N/A	Good	Great fish passage

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Description	
- Man made fish passage	- Concrete looks good
- Low flow channel	-leaks in return strucutre
- Small weir into steps	-mainstructure doesn't leak
- All new concrete	-monitoring station
- Headgate for fish	-gate not mechanically assisted
- Seperate headgate for d	- Concrete blocks to create channel in ditch

Pictures:

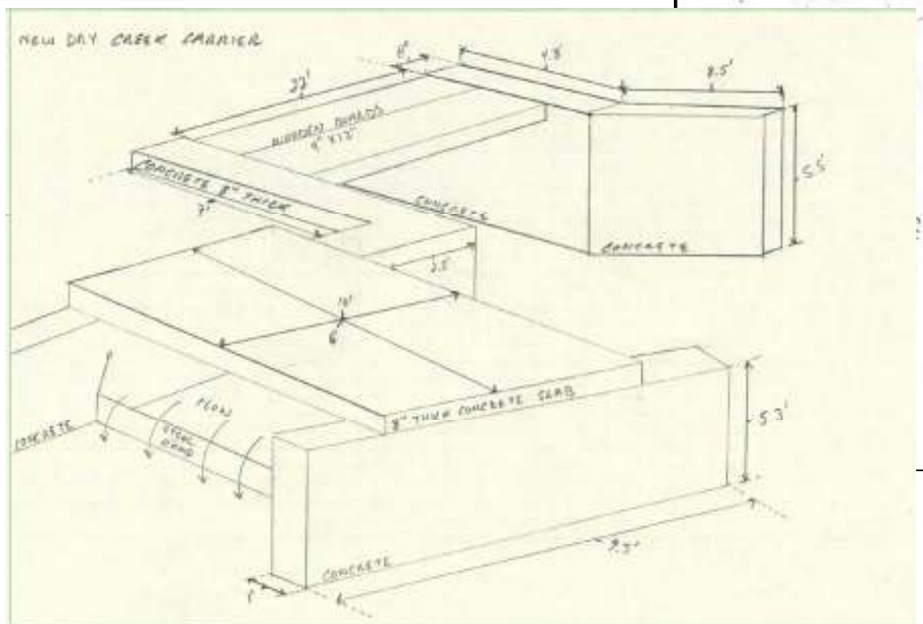


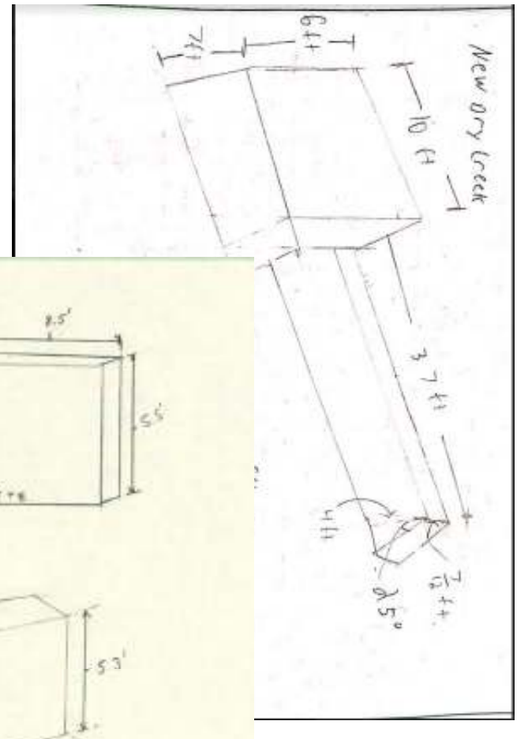
Structure Number	GPS Location	Water Rights	Relative	Structure Dimensions	Approximate Flow/ Barriers	Soil Stability	Potential Habitat
SBCS 12- NEW DRY	39°59.166'N, -	City of Lafayette	Total	See Sketch	Odd angle that the water	Fair	No fish passage present. Poor

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Pictures:

Description	
- Large weir to SBC	-potential habitat improvement
- No fish passage	-one of most formindable to low
- Large steel door into ditch	-gate not mechanically assisted
- Concrete in fair conditions	-leaking through passage to South
- Large door into creek next	-Other passage takes water to
ight next to boulder road	-Marks fishery transistion
o diversion, flow just	-wall blocks low flow
eed special tool to	-no fishing after this until KOA

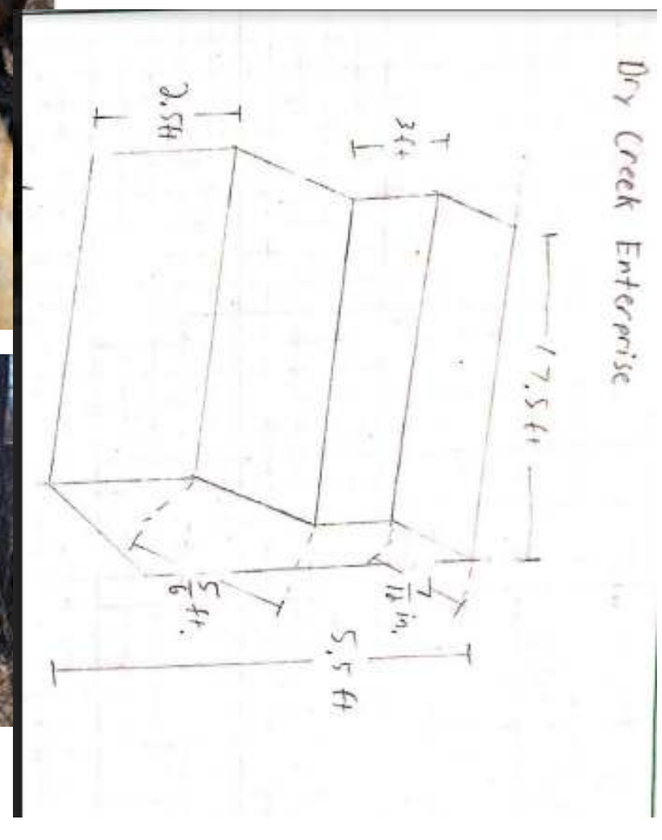




Structure Number	GPS Location	Water Rights Owner	Relative	Structure Dimensions	Approximate Flow/	Soil Stability	Potential Habitat Improvements
SBCS 13-	n/a	ENTERPRISE DITCH	Total Decreed	See Sketch	Big debris blockage	Fair	No fish passage most liekly

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

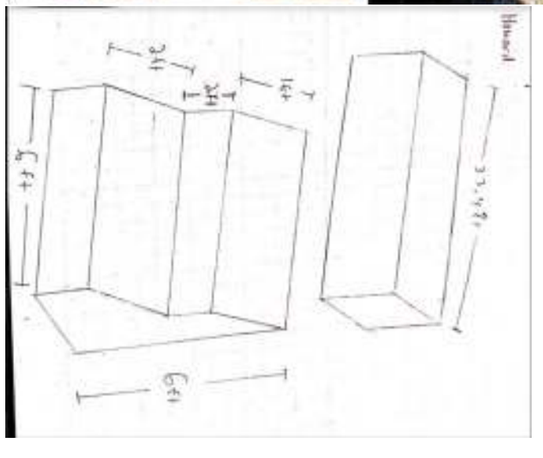
Description	
- 4 gates to enterprise	-4 gates
- Wood blockage to DCD	---1 gate clogged
- Sits at seperation of the	-probably want to work on this
- Concrete ok	-board and sandbags toi stop
- Located in the ditch	-gate not mechanically assisted
- Downstream from	-non operable monitoring station
-splits downstream	



Structure Number	GPS Location	Water Rights	Relative	Structure Dimensions	Approximate Flow/ Barriers to	Soil Stability	Potential
SBCS 14- HOWARD	39°59.298'N, -	HOWARD	Total	See Sketch	no fish passage and large	Good	Fish passage

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Description	
- One for most senior water rights	-two planks of wood are weirs
- Small wier into rocks	-one plank had huge hole in it
- Small headgate to ditch off on	-plenty of flow
- No diversion, just off to side	-leaks on east county diversion
- No fish passage	-gate not mechanically assisted
- Concrete looks old	-monitoring station
- Damaged from floods	-theditchproject.org shows
- Cracks and missing pieces	- Has monitoring station
- Couple wood planks in weir	- Silt backup
aking	

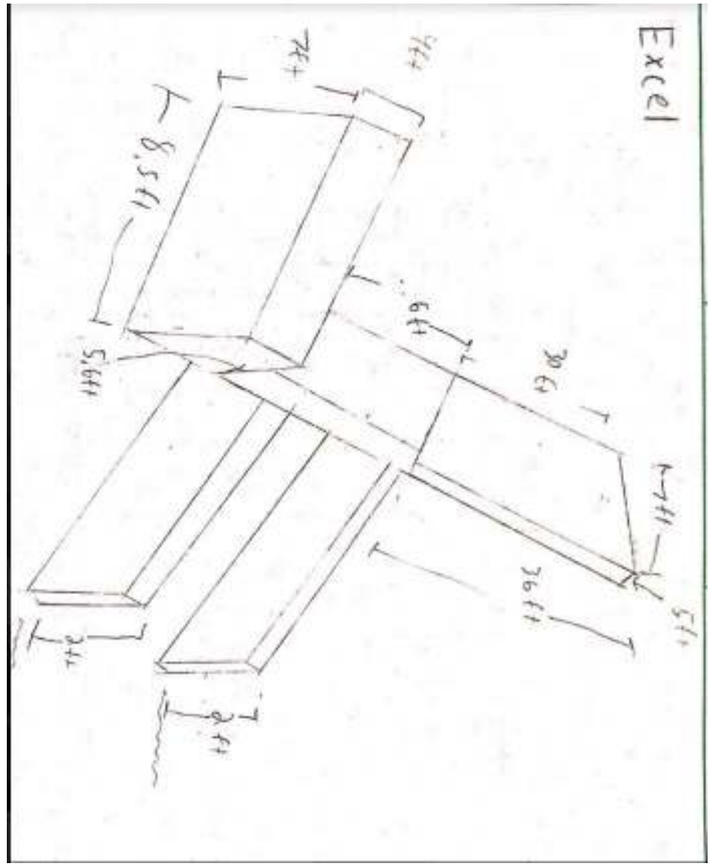


Structure Number	GPS Location	Water Rights	Relative	Structure Dimensions	Approximate Flow/ Barriers to	Soil Stability	Potential Habitat
SBCS 15- E. BOULDER	39°59.788'N, -	Ditch Compa	decreed rate10	See Sketch	Yes, major sand build-up and	Fair	Fish passage and a

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

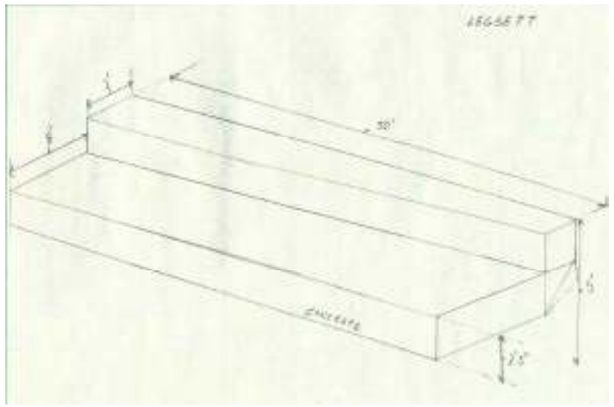
Description	
- Boulder wants to redesign	-excel owns
- Move upstream 100 feet	-current plans for fish passage would
- Put in fish passage	-gate not mechanically assisted
- Owned by excel	-water goes over weir in hig flow
- Large weir pushes water into	-measuring stating in low flow
- Foundation looks eroded	---big ol rocks interfere with
- Has a conceptual design for	-potential habitat improvement
steel headgates into ditch	---large soot buildup from flood event
as monitoring station	---lot of debris downstream from
abitat improvements	-metal on dam rusted
rea damaged by floods	-2 gates in diversion
arge door down to SBC	-targetted for fish pissage
ater eating into weir	-next strucutre of any size at leggett
	-Then next is at small dam

Pictures:



Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	tructure Dimension	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements	Description	
SBCS 15- Leggett	40°00.951'N, -105°12.858'W	Public Service Company of Colorado (Xcel	TBD	See sketch	Lots of trash, solids, dirt accumulation from slowing down of creek, Massive intake into leggett structure, little to no flow observed most the time	Fair	Cleaning out area, fish passage, keeping invasives out of creek	James:	Sam:

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

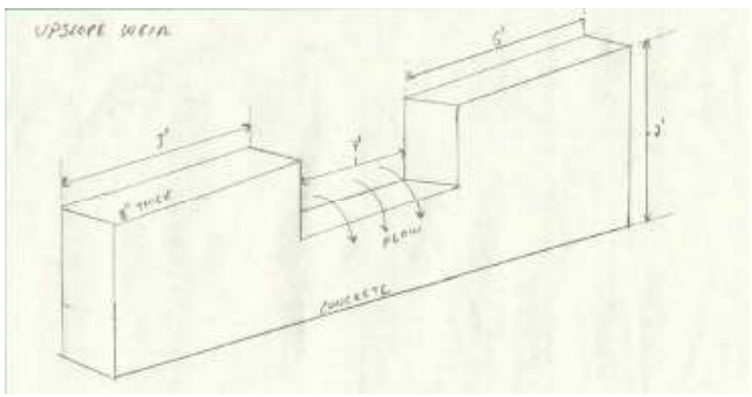


James:
-Huge concrete structure
-Massive weir on NW side
-9 steel gates on east side
-4 more steel gates to the north
-Large concrete crack by weir
-Gates create large holding pond
-Newer concrete by gates
-Gates look new
-Gates are hydraulic powered
-TU has data logger down stream

Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 16- Upslope Weir	40°01.168'N, -105°12.940'W	Boulder?	tbd	See sketch	N/A other than weir	Good	Fish passage in low flow, aesthetics

Descriptions	
James	
-Small concrete weir	
-Half is open	
-Flow into rocks	
-Channeleized into ditch and smaller passage	
-Wall extends entire channel	

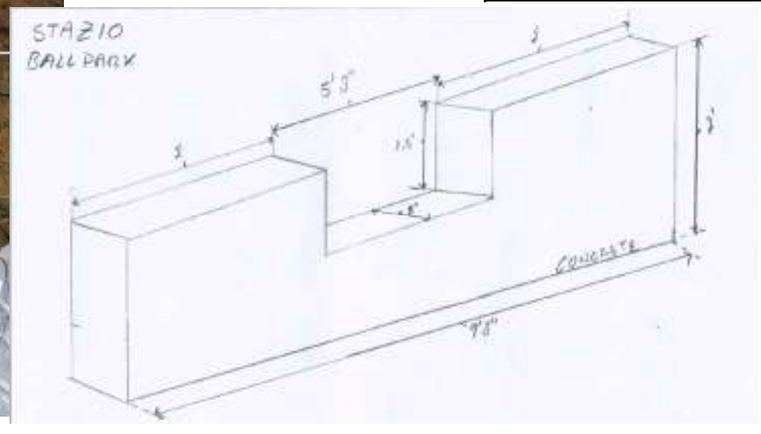
Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	



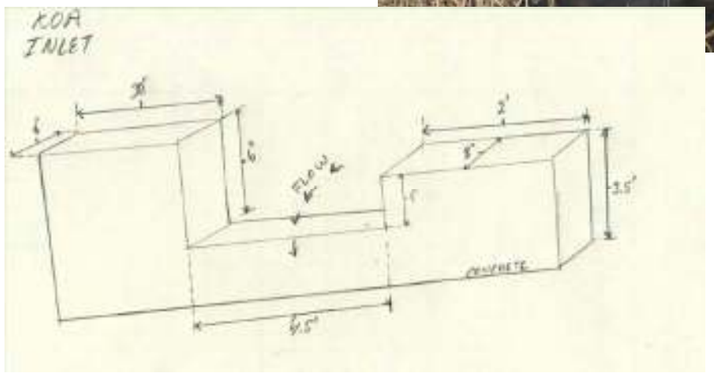
Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 17- Stazio Ballpark Weir	40°01.332'N, -105°12.954'W	Boulder County?	tbd	see sketch	Fish passage in low flow times, only a small opening for flow	decent	Improve aesthetics and fish passage

Descriptions	
James	
-Man made rocks lead to flow under bridge	
-Flow then goes to concrete wier	
-Large opening with wood board	
-Unclear why it exists	
-Very simple	
-Manmade pools	

Score Card	
Category	**Scoring**
Structural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	



Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 18-KOA Inlet Weir	40°01.552'N, -105°13.035'W	?	tbd	see sketch	only one inlet here along concrete weir	decent	Fish passage if needed, concrete aesthetics



Descriptions	
James:	
-Large concrete weir	
-Boat ramp 50' west	
-2 weirs	
-Large busted opening	
-Concrete in poor condition	
-No fish passage	
-Has staff gauge	
-Lots of sediment	

Score Card	
Category	**Scoring**
ructural Integrity	
Fish Passage	
Aesthetics	
Cost Feasibility	
Habitat Health	

Structure Number	GPS Location	Water Rights Owner and Date Associated	Relative Priorities and Flow (X cfs)	Structure Dimensions	Approximate Flow/ Barriers to Flow	Soil Stability	Potential Habitat Improvements
SBCS 19-KOA Outlet	40°01.725'N, -105°13.111'	Western Mobile - Boulder Inc. (1993)	11.2 acre-ft stored in lake	see sketch	Wooden weir is getting old	N/A all concrete	Better fish passage

Descriptions	
James:	
-Weir for overflow	
-Steel headgate for control of flow	
Wooden board next to headgate	
ce is problem in winter	
-Last structure befor confluence	
-Concrete looks ok	
-2 ramp arms lead to headgate	
ake owned by Boulder	
-Water owned by multiple groups	

Scoring