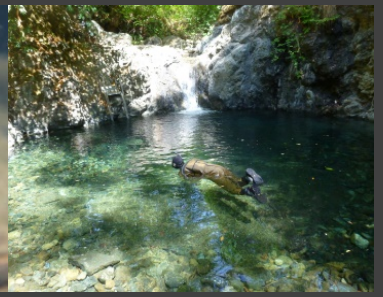
Utilizing Esri Field Apps for Conservation Monitoring

Andrew Bartshire – GIS Analyst, California Sea Grant

1. Overview of monitoring program
2. Move to digital data gathering
3. Utilizing Esri field apps
4. Sharing information
5. Use case: Wet/Dry mapping

Software: ArcGIS Enterprise 10.7.1, ArcGIS Online, Collector, Survey123, Ops. Dashboard, R-Shiny, PostgreSQL Enterprise Geodatabase

Russian River Salmon and Steelhead Monitoring Program



CALIFORNIA DEPARTMENT OF FISH & WILDLIFE

US Army Corps of Engineers

Sonoma Water

Sea Grant California

CA.GOV WCB State of California Wildlife Conservation Board

Russian River Watershed

- 45 miles north of San Francisco
- 1,485 sq. mi.
- 500+: 1-4km survey reaches
- Endangered coho salmon, threatened Chinook salmon and steelhead trout.

2020

RSI Phase 4 COHO SALMON AT YELLOWJACKET CREEK BEGINNING 6 FEB 2020

Date	Mortality Count	Life Stage	Flow Rate	Live Swim up count in basket		Temp	Gage Height	Notes:
6 FEB	23	egg	15+ gpm		normal swim up	10°C	0.94FT	4 alevin in the live cart. start @ 2:30pm
	0	alevin			deformed swim up			- hatch largely complete.
10 Feb	49	egg	15 gpm	2 (alevin)	normal swim up	9°C	0.98FT	- Daniel see text from dan for gage height on 2/6
	1	alevin		x	deformed swim up			
12 Feb	11	egg	15 gpm	18 (alevin)	normal swim up	9°C	0.88FT	start 8:40 End @ 9:21
	15	alevin		x	deformed swim up	x	x	
15 Feb	5	egg	15 gpm	14	normal swim up	9.	0.86FT	Start 12:00 END 12:35
	1	alevin			deformed swim up			
18 FEB	ø	egg	15 gpm	37	normal swim up	8°C	0.86FT	start 10:00
	2	alevin			deformed swim up			
20 FEB	1+1 = 2	egg	15 gpm	174	normal swim up	7° C	0.86FT	5+10+6+7+6+6+7+10+10+10 Dead 11 No Eggs Start 0900 Live Alevin
	1+6 = 7	alevin		174	deformed swim up			+14+9+8+11+5+8+6+6+7+≈30 = 174 Live End
24 FEB	111 : 4	egg	15 gpm	TMC	normal swim up	8°C	.86FT	
	1 : 11	alevin			deformed swim up			845 9:50
26 Feb		egg	30 SEC	TMC	normal swim up	12°C	.85	start 1:30
		alevin			deformed swim up			≈ 40 Dead
28 Feb	11	egg	15+ gpm	TMC	normal swim up	12°C	.85	Mortality in incubator - left there see photo
		alevin			deformed swim up			
2 MAR	6+8+5=19	egg	11 SEC AT STAND PIPE	≈ 25 GPM	normal swim up	9°C	.85	start 1300 1340
		alevin			deformed swim up			
4 MAR	11+8+3=22	egg	15 seconds AT STAND PIPE	≈ 20 gpm	normal swim up	10°C	.84	start 1000
		alevin			deformed swim up			
5 MAR	6+5+8=19	egg	21 seconds AT STAND PIPE	14 gpm	normal swim up	11.5°C	.84	
		alevin			deformed swim up			
9 MAR	4+1+1=6	egg	22.1 AT STAND PIPE	13.56 GPM	normal swim up	10°C	.83	start 1445 STOP 1521
		alevin			deformed swim up			
		egg			normal swim up			
		alevin			deformed swim up			
		egg			normal swim up			
		alevin			deformed swim up			

2/5/21 MO 22 seconds to fill 5-6g bucket

- sponges/brushes
- another bucket
- totes

pipe wrench

staff = 0.66 @ N 15:00

DataPlus CE 9:45

G_Cubic	115.4	N_Cubic	115.4
G_Scrib	95	N_Scrib	95

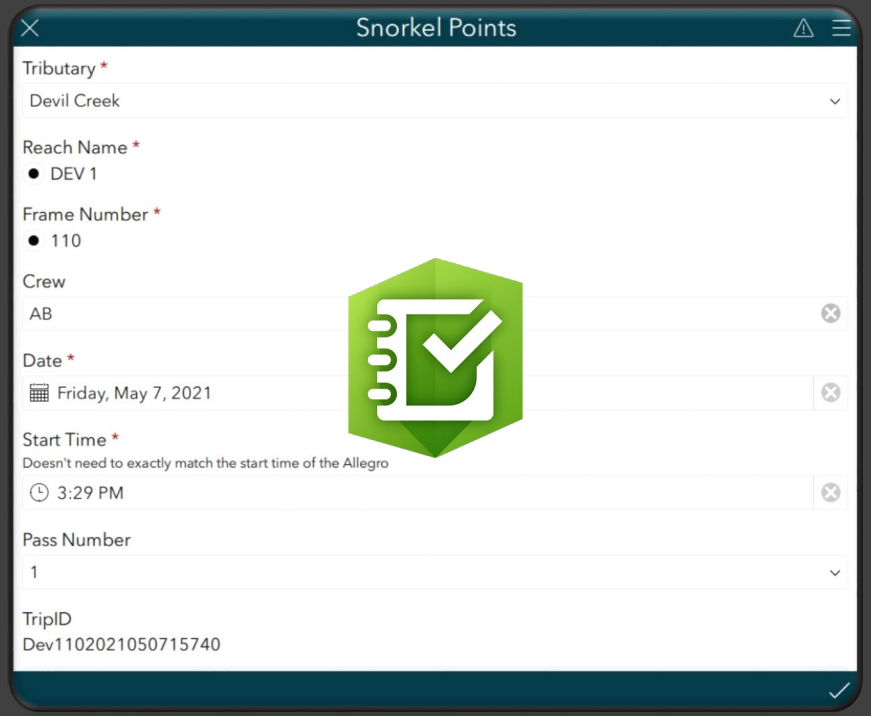
Lg#	Spec	Ln	D1	D2	LC1	LC2	LC3	DC1
5	DF	28	32	38	0	0	0	0
6	DF	22	10	12	0	0	0	0
7	DF	33	11	12	0	0	0	0
8	DF	44	12	14	0	0	0	0
9	DF	36	18	22	0	0	0	0
10	DF	44	18	19	0	0	0	0

F1-Help F4-Exit

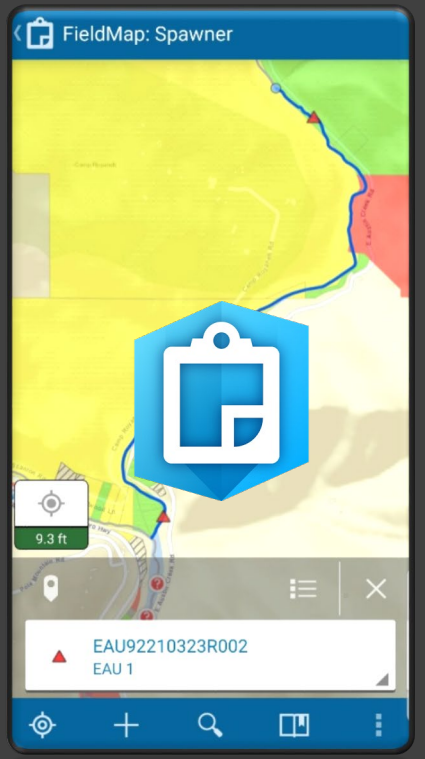
Menu

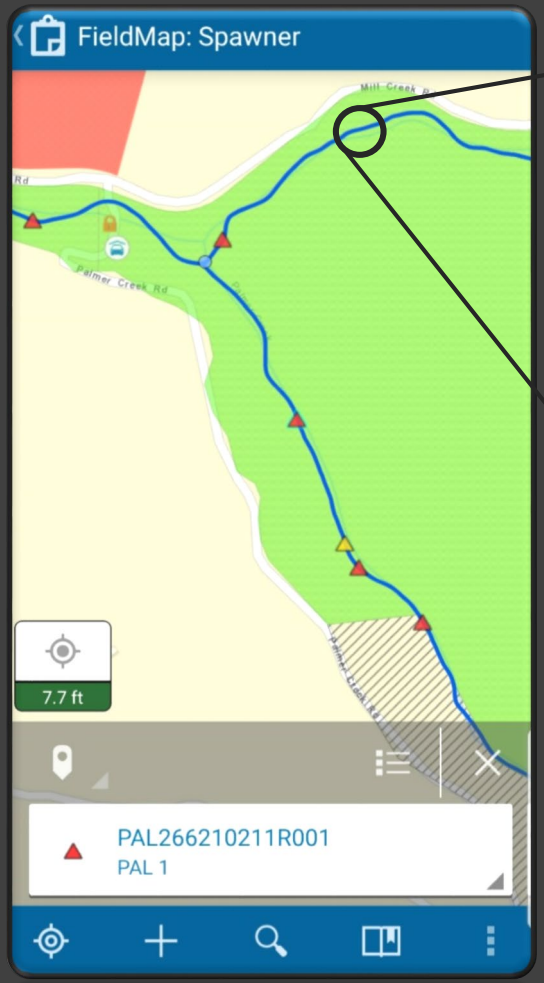
Juniper Systems Allegro 2 and DataPlus Pro

Survey123



Collector





PAL 1
Palmer Creek

Frame Order: 266.0
Reach Length: 2.90 km
4x4 required: Rain
Gate Code(s): PAL 1: 1077
Key required:
Subreach:

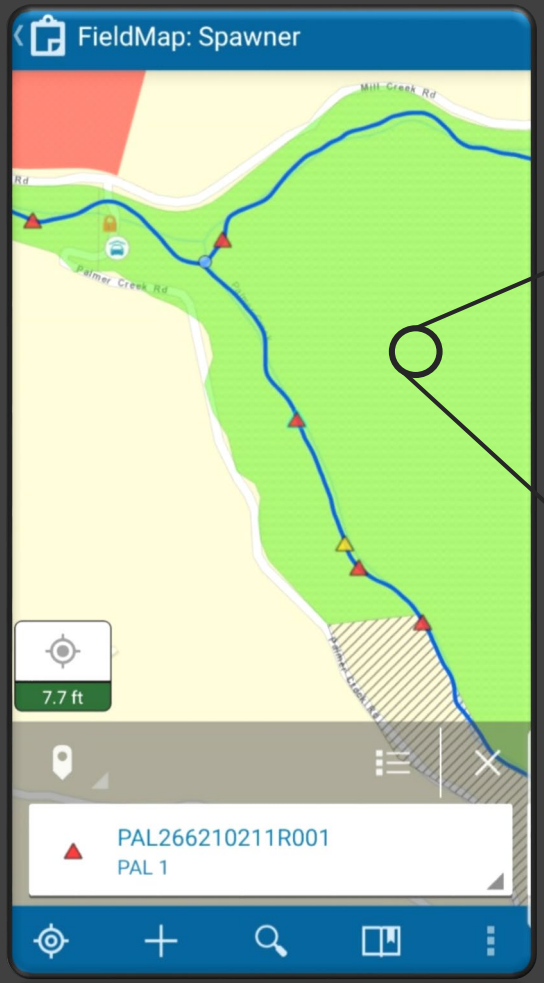
Directions:
101 north for 7.8 miles (Central Healdsburg) Go through roundabout to Westside road. Westside road for 1.3 miles. Turn Right onto Mill Creek Road for 4.9 miles. Turn left at Palmer Creek Rd.

Specifics to Top:
Drive 1.2 miles up Palmer Creek Rd. Park at the pullout before bridge over . Palmer is a dirt road. Please drive slowly, lights on and avoid making ruts in the road.

Specifics to Bottom:
Drive back down Palmer Road and park by mailboxes. Walk through green gate and start survey at confluence, passing 2 flatplate antennas on Palmer. Or park in pullout off Mill Creek Rd and walk trail down to confluence pool.

Additional Directions:
NEW FOR 2019-2020!! DO NOT DRIVE OVER BRIDGE NEAR TOP, supports are gone and it is not safe.

Reach Comments:
Make sure to not block any potential access for logging trucks which may be using that road. HARD HATS REQUIRED.

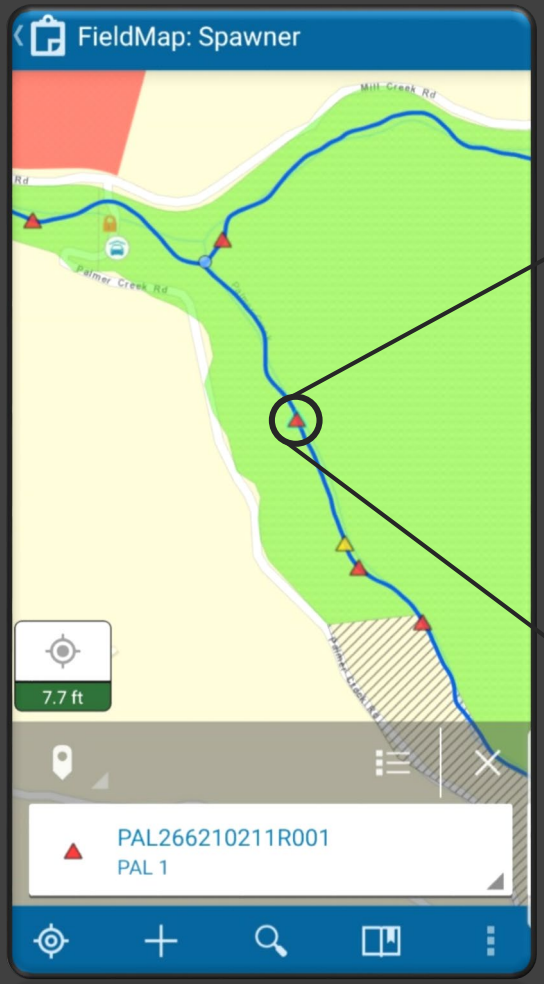


Joe Schmo (APN_Owner), Plain Jane (Owner)
Area: 3.51 acres

Create New Communication Record
APN: 111-050-015
Owner Name: Joe Schmo (APN_Owner), Plain Jane (Owner)
OwnerID: 1
Response: Yes
Response Comments: Please just notify me when your agents enter the property
Email address: Joe Schmo: joe19@gmail.com
Phone Number: Joe Schmo (707) 555-1997 , Plain Jane (707) 555-0332

Access Status: Expired

Last Communication:
Initials: ADJ
Date: 04/07/2021 8:00 PM
Comment: Emailed to notify about April 9 spawner survey



Details

PAL266210211R001
long:-122.94694623 lat:38.58252512

TRIBUTARY
PALMER CREEK

REACHNAME
PAL 1

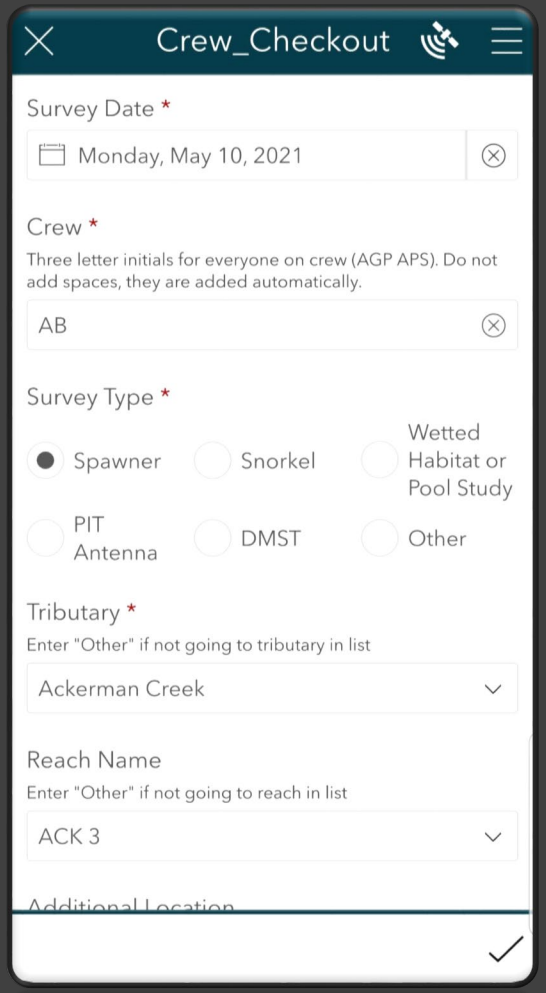
SPECIES
steelhead

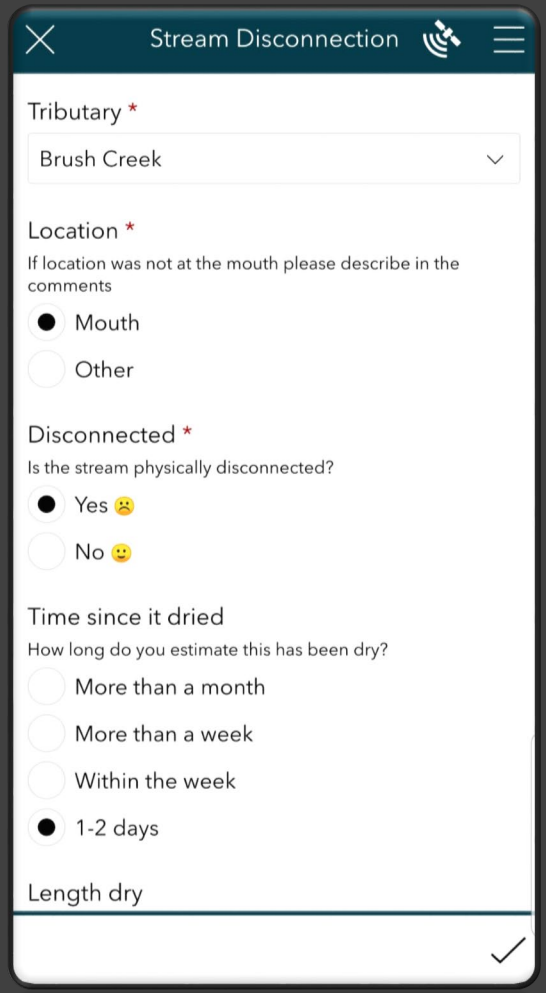
SPECIESCERTAINTY
2

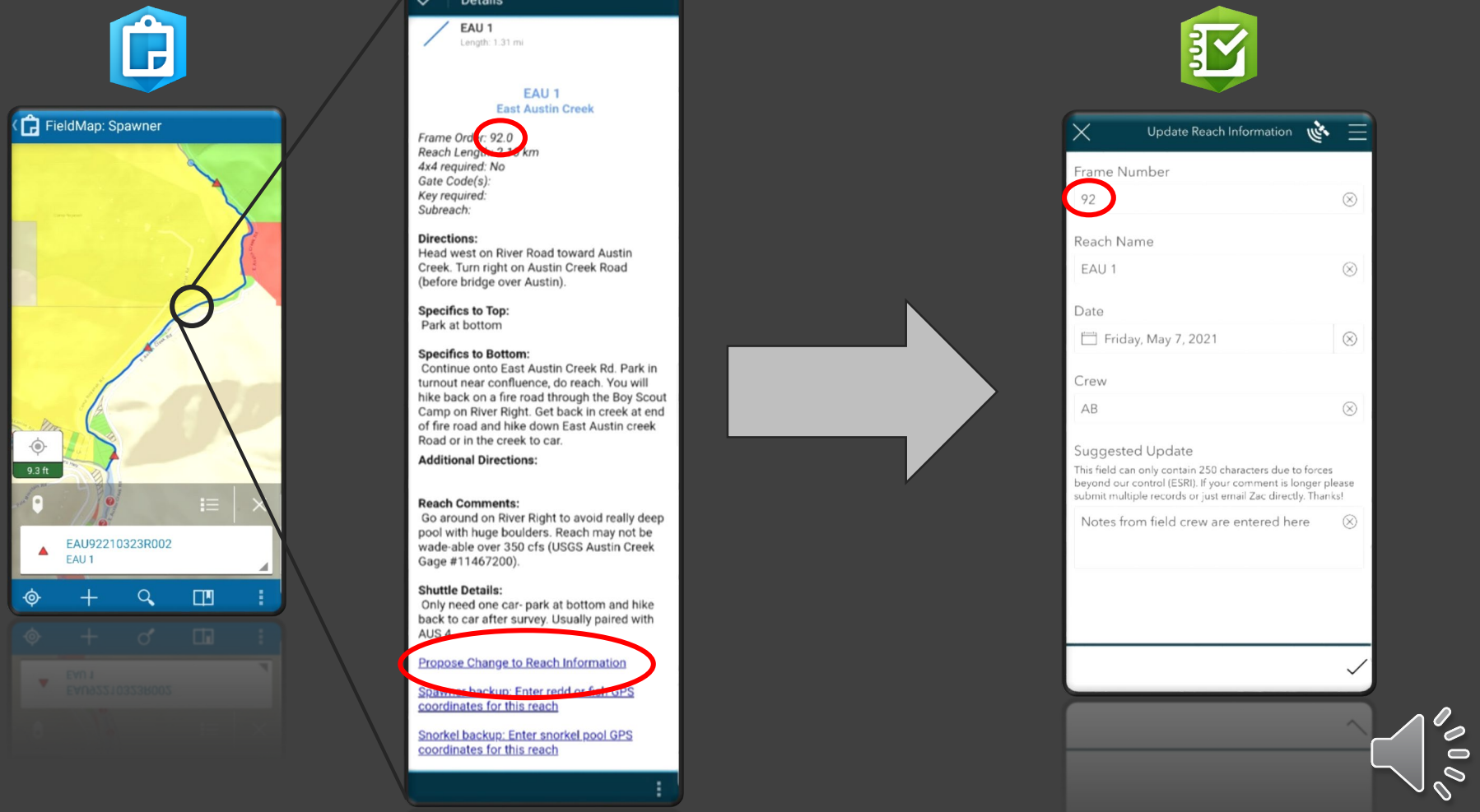
MAXREDDAGE
4

TOTALLENGTH
1.70

MAXWIDTH
0.80


Crew_Checkout
Survey Date *
Monday, May 10, 2021
Crew *
Three letter initials for everyone on crew (AGP APS). Do not add spaces, they are added automatically.
AB
Survey Type *
Spawner
Snorkel
Wetted Habitat or Pool Study
PIT Antenna
DMST
Other
Tributary *
Enter "Other" if not going to tributary in list
Ackerman Creek
Reach Name
Enter "Other" if not going to reach in list
ACK 3
Additional Location


Stream Disconnection
Tributary *
Brush Creek
Location *
If location was not at the mouth please describe in the comments
Mouth
Other
Disconnected *
Is the stream physically disconnected?
Yes
No
Time since it dried
How long do you estimate this has been dry?
More than a month
More than a week
Within the week
1-2 days
Length dry


FieldMap: Spawner
9.3 ft
EAU92210323R002
EAU 1
Details
EAU 1
Length: 1.31 mi
EAU 1
East Austin Creek
Frame Order: 92.0
Reach Length: 2.10 km
4x4 required: No
Gate Code(s):
Key required:
Subreach:
Directions:
Head west on River Road toward Austin Creek. Turn right on Austin Creek Road (before bridge over Austin).
Specifics to Top:
Park at bottom
Specifics to Bottom:
Continue onto East Austin Creek Rd. Park in turnout near confluence, do reach. You will hike back on a fire road through the Boy Scout Camp on River Right. Get back in creek at end of fire road and hike down East Austin creek Road or in the creek to car.
Additional Directions:
Reach Comments:
Go around on River Right to avoid really deep pool with huge boulders. Reach may not be wade-able over 350 cfs (USGS Austin Creek Gage #11467200).
Shuttle Details:
Only need one car- park at bottom and hike back to car after survey. Usually paired with AUS 4
Propose Change to Reach Information
Spawner backup: Enter redd or fish GPS coordinates for this reach
Snorkel backup: Enter snorkel pool GPS coordinates for this reach
Update Reach Information
Frame Number
92
Reach Name
EAU 1
Date
Friday, May 7, 2021
Crew
AB
Suggested Update
This field can only contain 250 characters due to forces beyond our control (ESRI). If your comment is longer please submit multiple records or just email Zac directly. Thanks!
Notes from field crew are entered here

Joe Schmo (APN_Owner), Plain Jane (Owner)
Area: 3.51 acres

Create New Communication Record
APN: 111-050-015
Owner Name: Joe Schmo (APN_Owner), Plain Jane (Owner)
OwnerID: 1
Response: Yes
Response Comments: Please just notify me when your agents enter the property
Email address: Joe Schmo: joe19@gmail.com
Phone Number: Joe Schmo (707) 555-1997 , Plain Jane (707) 555-0332

Access Status: Expired

Last Communication:
Initials: ADJ
Date: 04/07/2021 8:00 PM
Comment: Emailed to notify about April 9 spawner survey

Land Owner Communications

APN
Parcel APN From webmap
111-050-015

Communication Date?
Monday, May 10, 2021

Communication Type? *
In Person

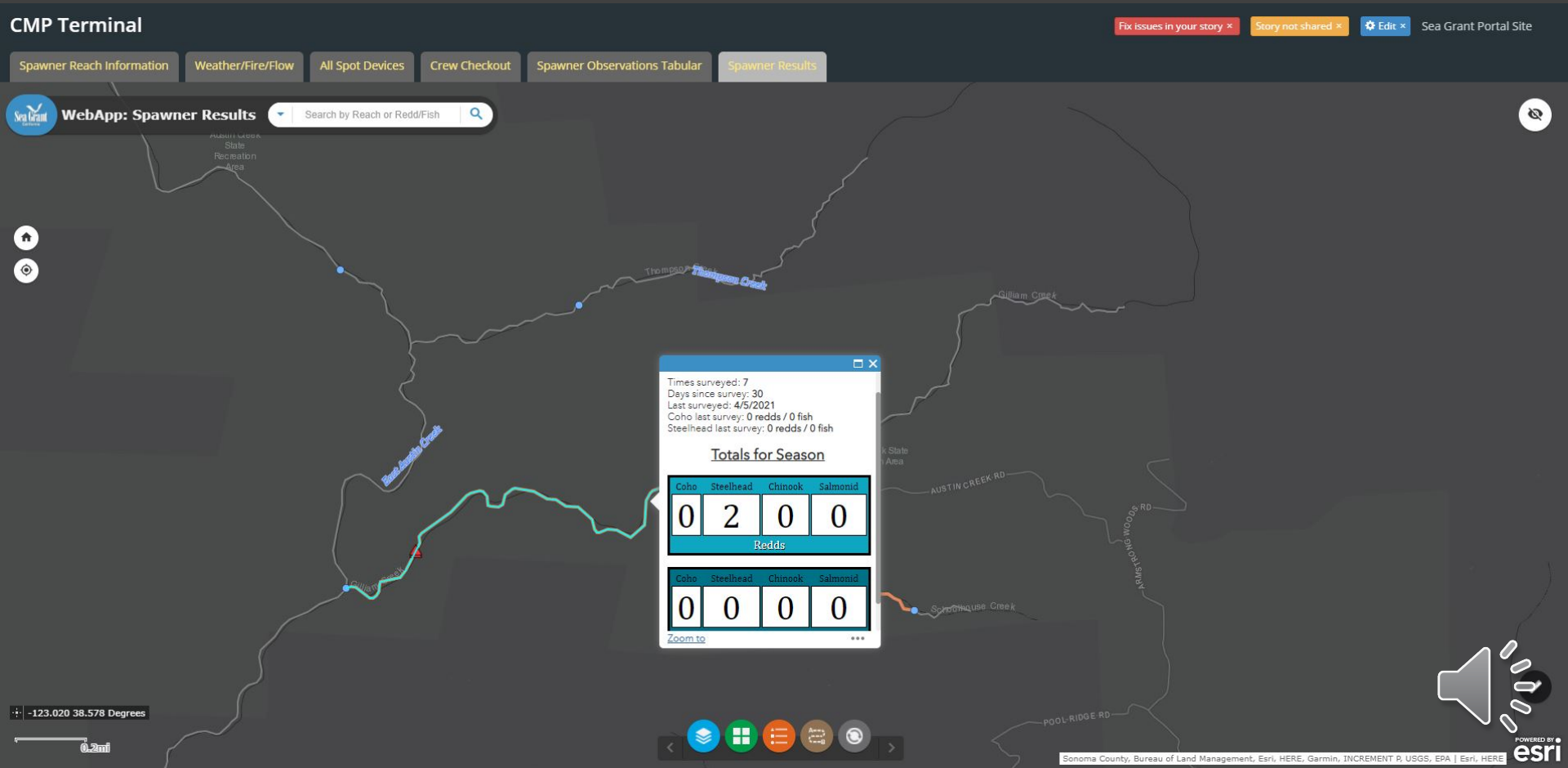
Your Initials *
AB

Your Agency *
Sea Grant

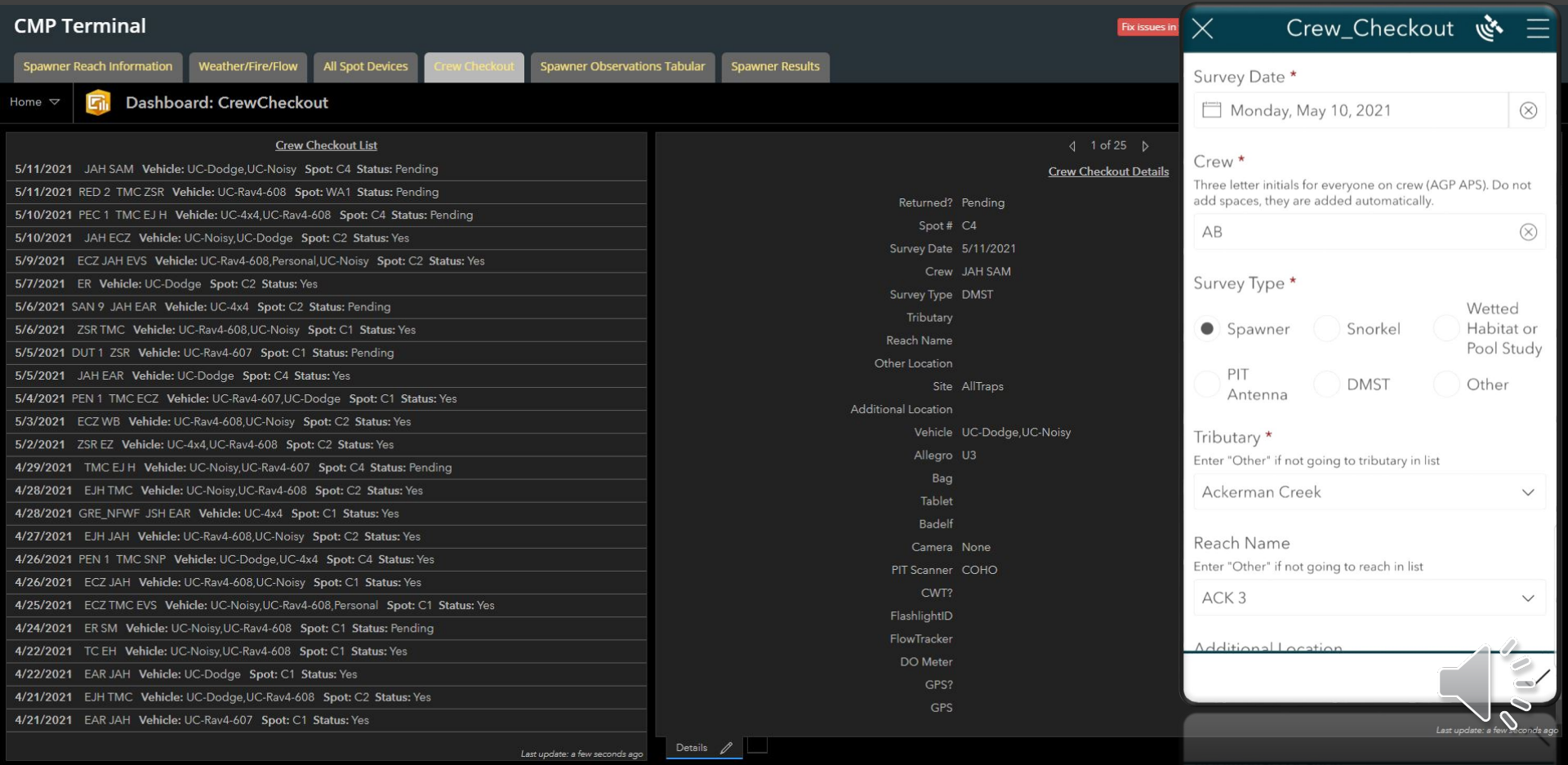
Contact *
If the parcel is currently a non-responder please fill out a new contact even if the person you spoke to is the same as the name in all caps. Thanks!
Joe Schmo

Sharing data using dashboards

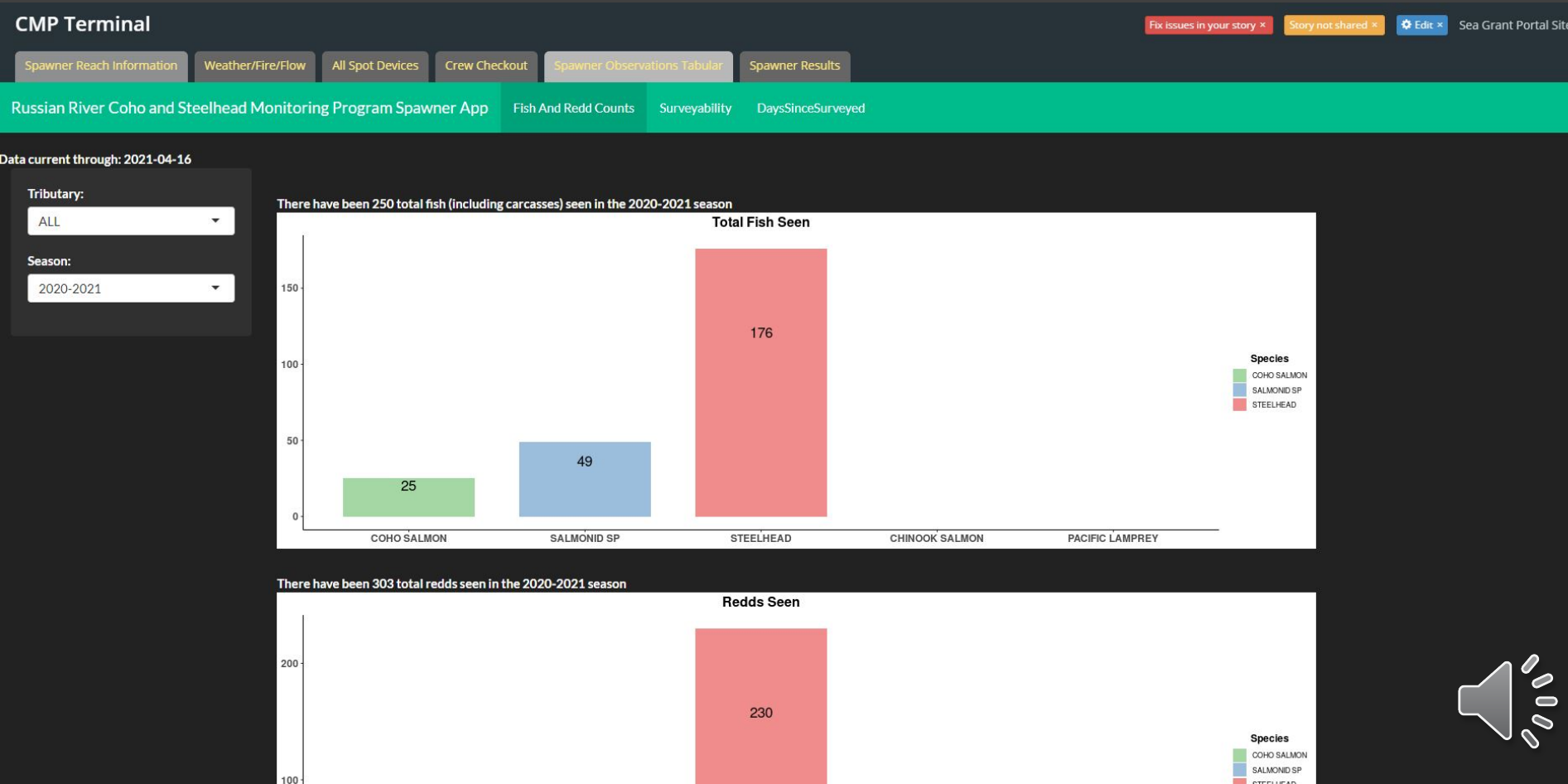
Dynamic pop-ups



Survey123 form data into Dashboards



Embedding R-Shiny into Dashboards

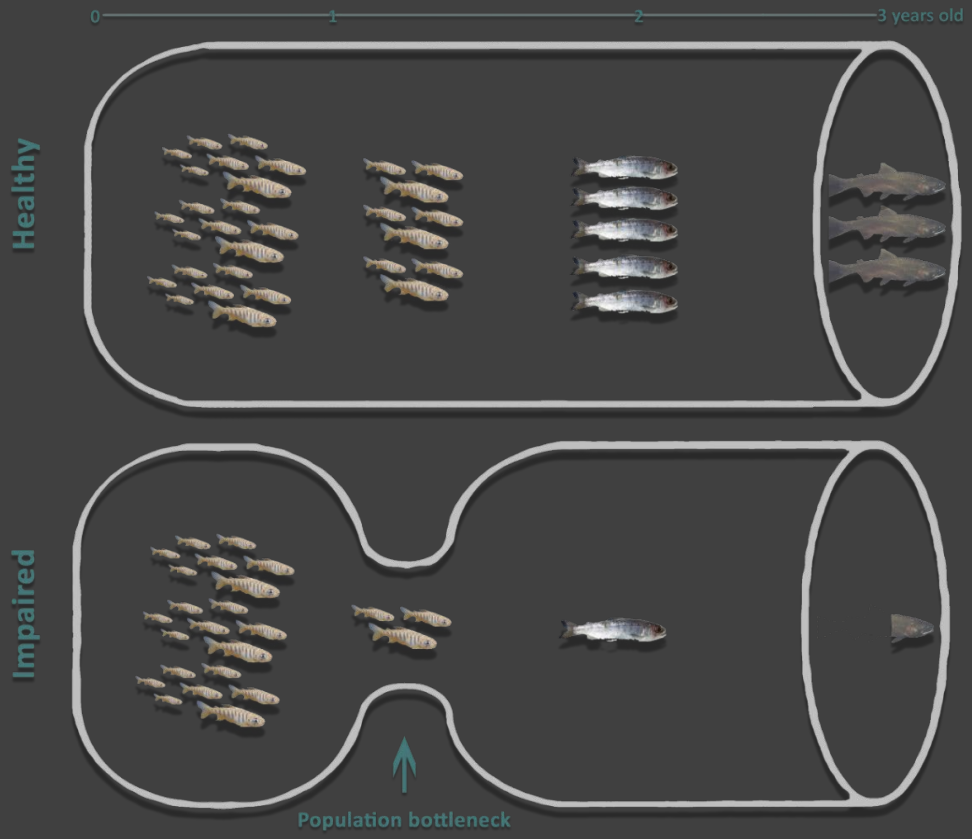


Use Case:
Wetted Habitat (Wet/Dry)

July 1

September 8

Identifying streamflow as bottleneck for survival:



Stream Surface Flow Conditions

Not Surveyed

Dry Stream Bed

Intermittent Conditions

Wet Stream

The evolution of technology:

Field: Take points at start of each wet/dry segment

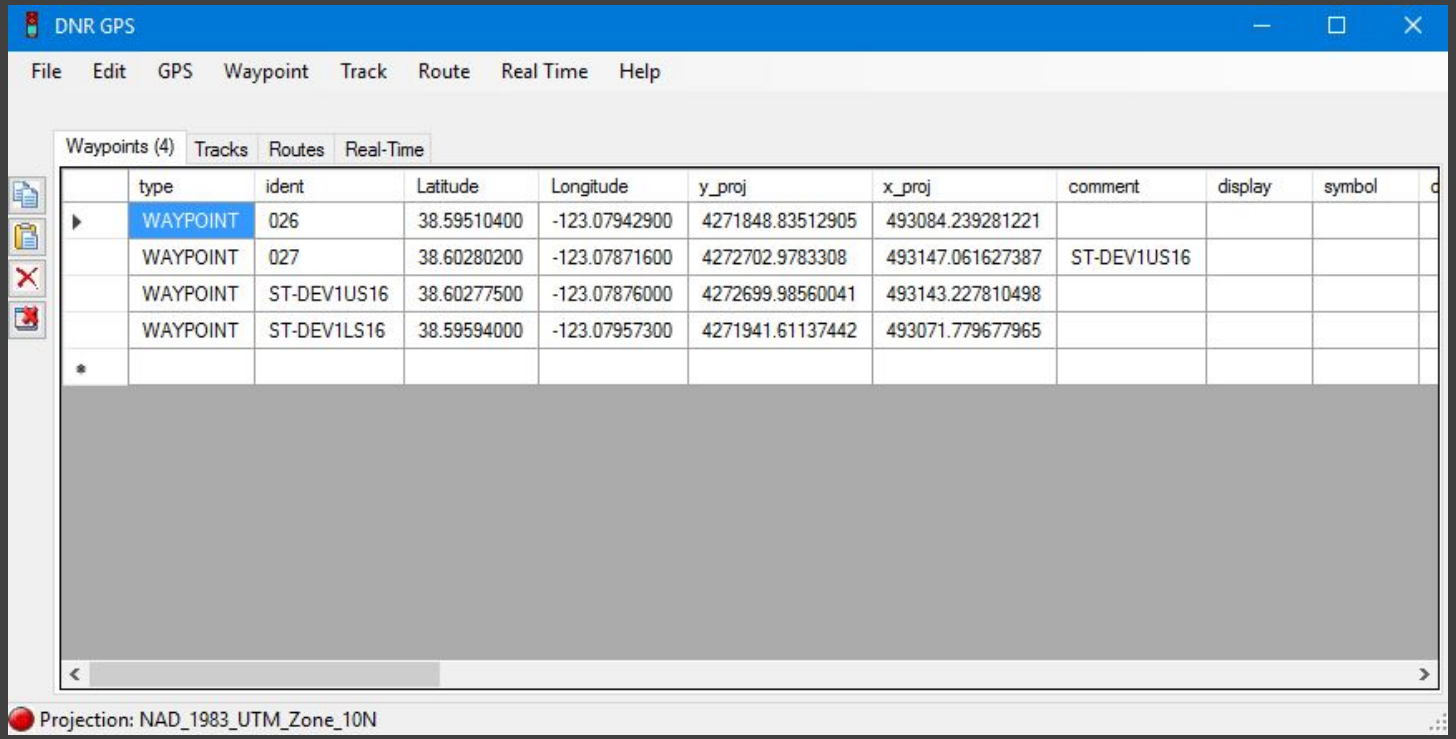
Office: Create lines from points

Pros:

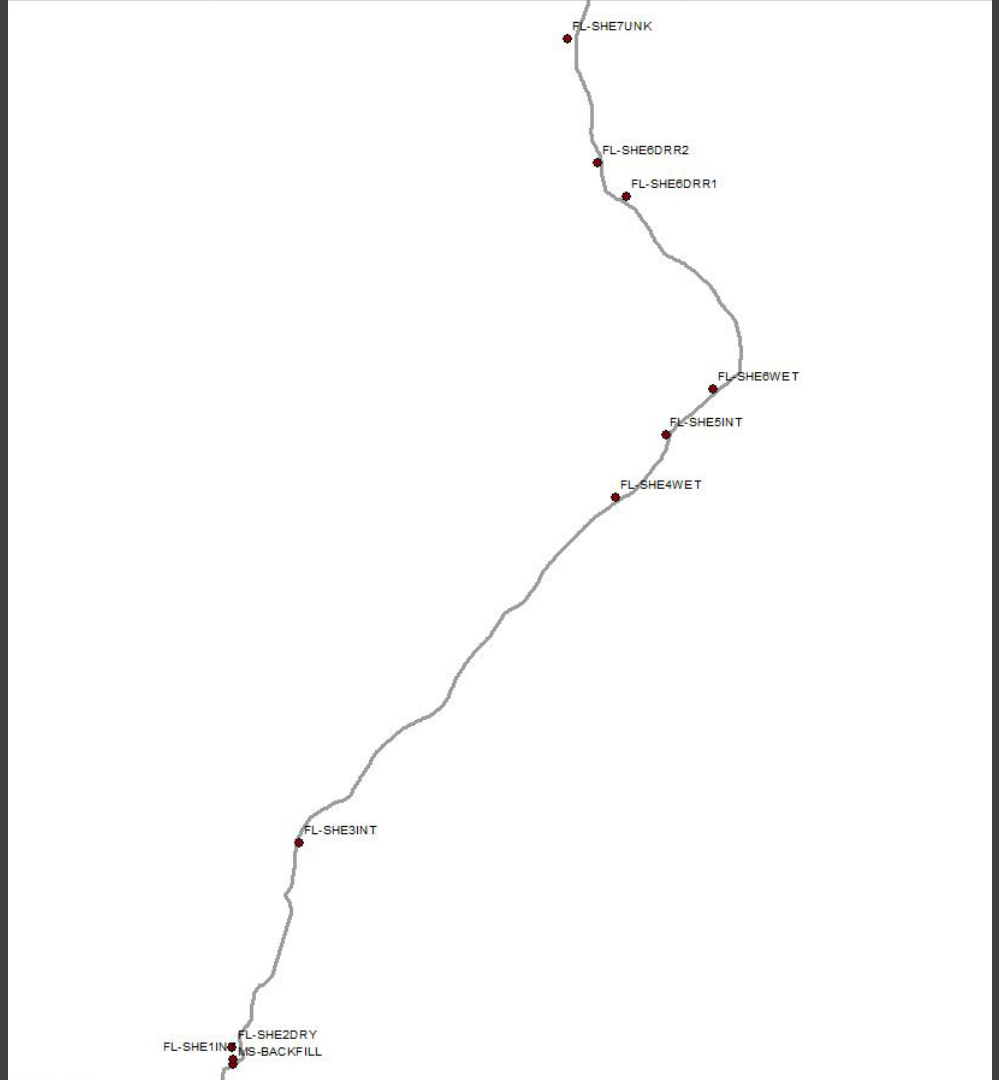
- Low cost
- Simple setup
- No additional software required

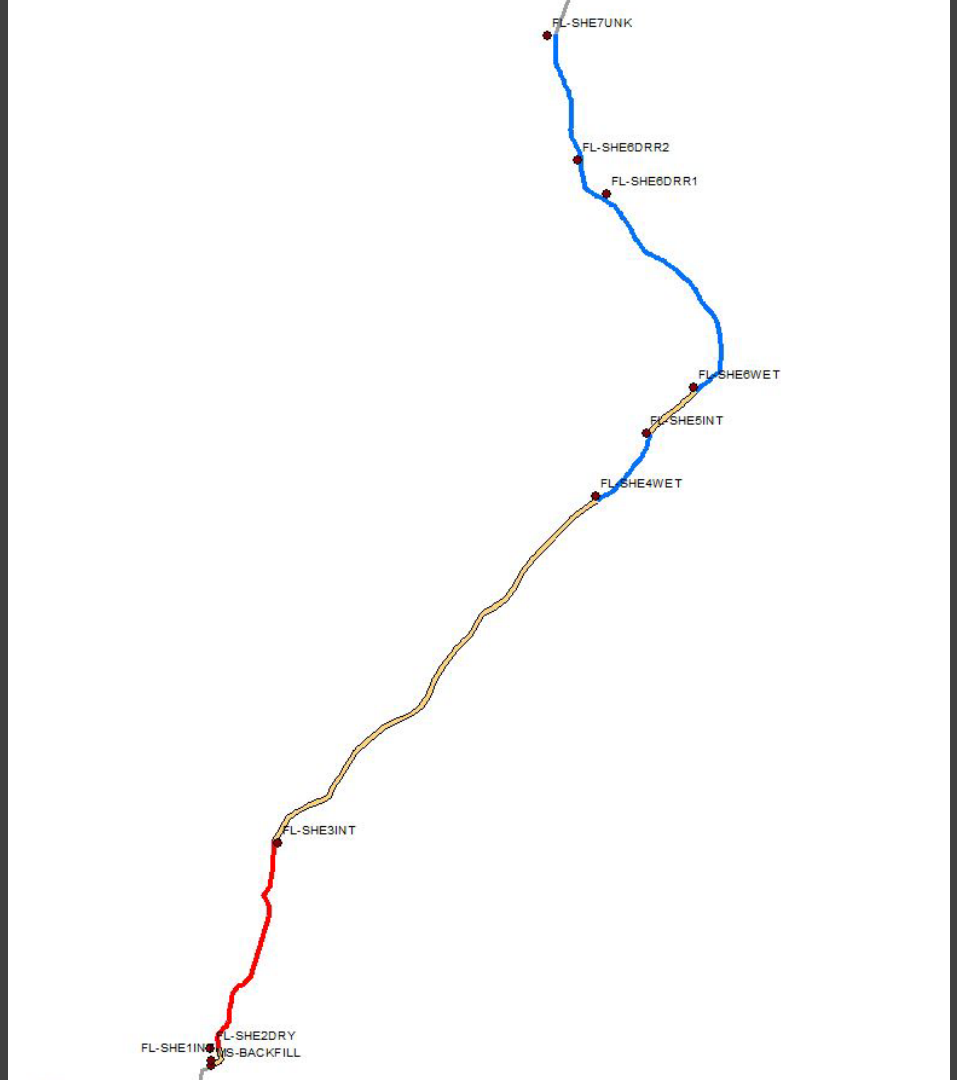
Cons:

- Limited resources available for field crew
- Low data integrity
- Time intensive to QAQC and manage data
- Slow turn around for results



DNR GPS: Minnesota Department of Natural Resources


FL-SHE7UNK
FL-SHE6DRR2
FL-SHE6DRR1
FL-SHE6WET
FL-SHE5INT
FL-SHE4WET
FL-SHE3INT
FL-SHE2DRY
FL-SHE1INT
MS-BACKFILL


FL-SHE7UNK
FL-SHE6DRR2
FL-SHE6DRR1
FL-SHE6WET
FL-SHE5INT
FL-SHE4WET
FL-SHE3INT
FL-SHE2DRY
FL-SHE1INT
MS-BACKFILL

The evolution of technology:

Field: Generate wet/dry lines as you hike through stream

Office: QAQC lines

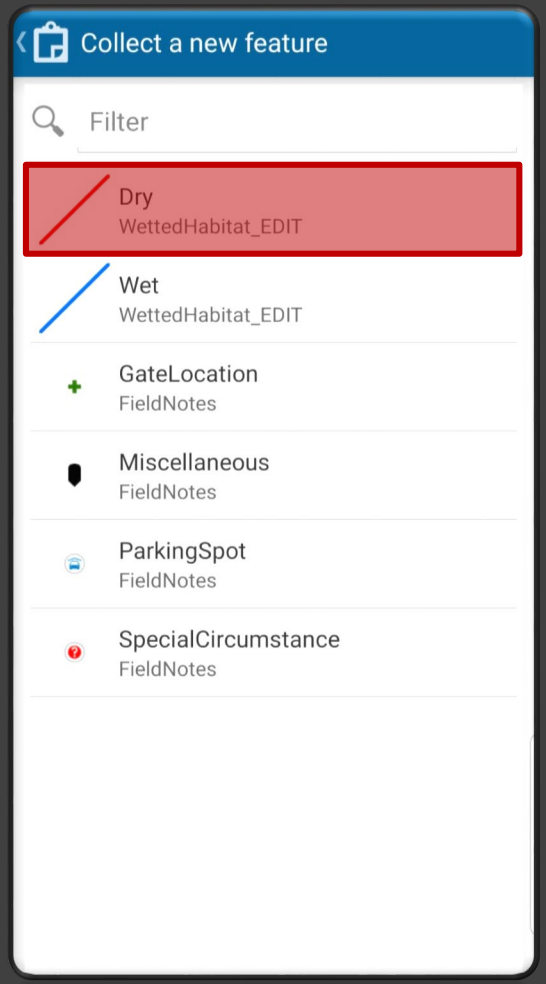
Pros:

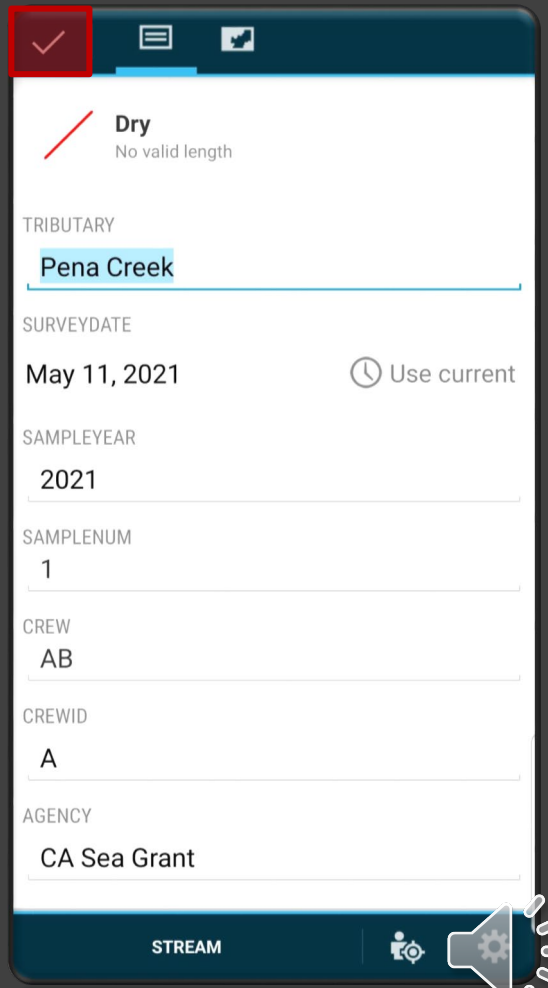
- User interface that enables QAQC in the field
- Familiar interface for most users
- Multiple form apps available simultaneously
- Quick turn around for results

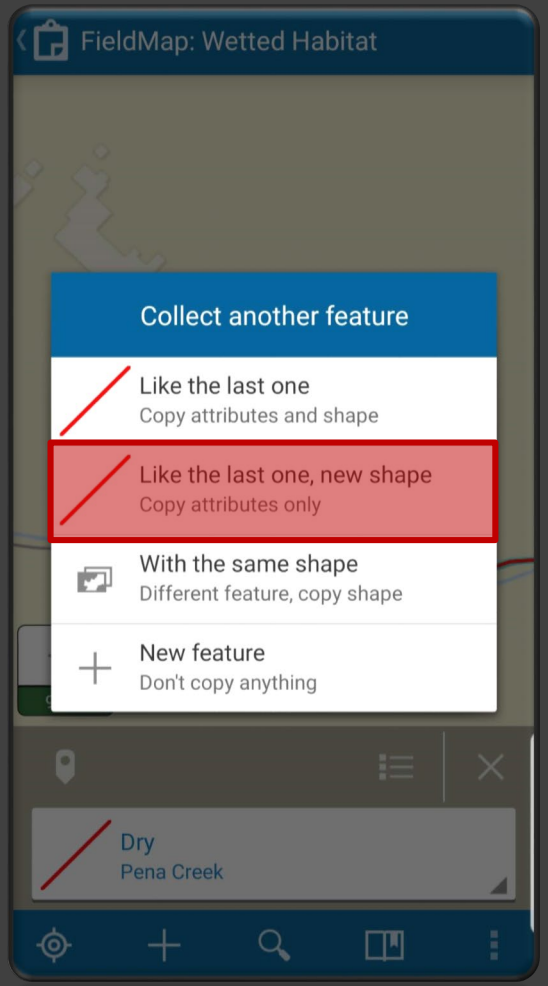
Cons:

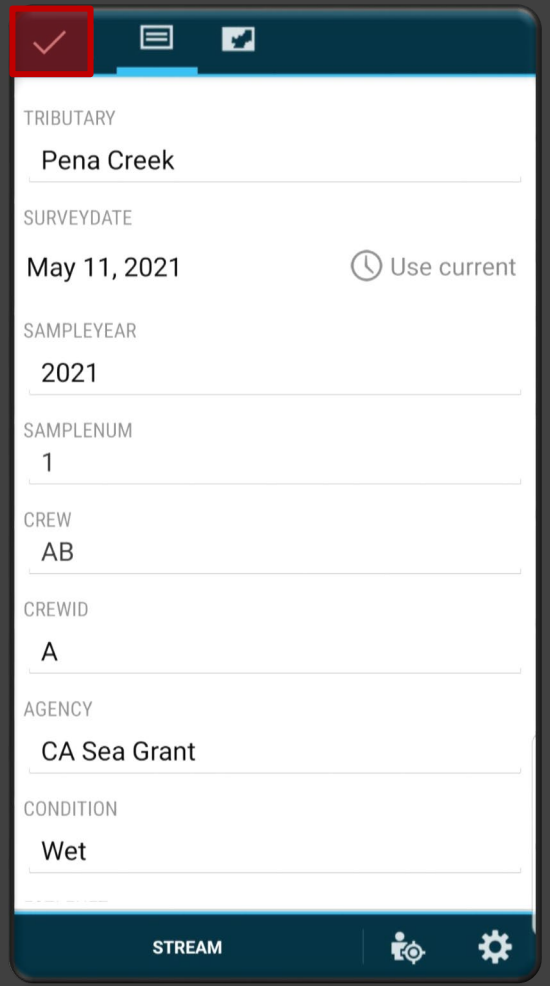
- Additional ESRI software and licensing required

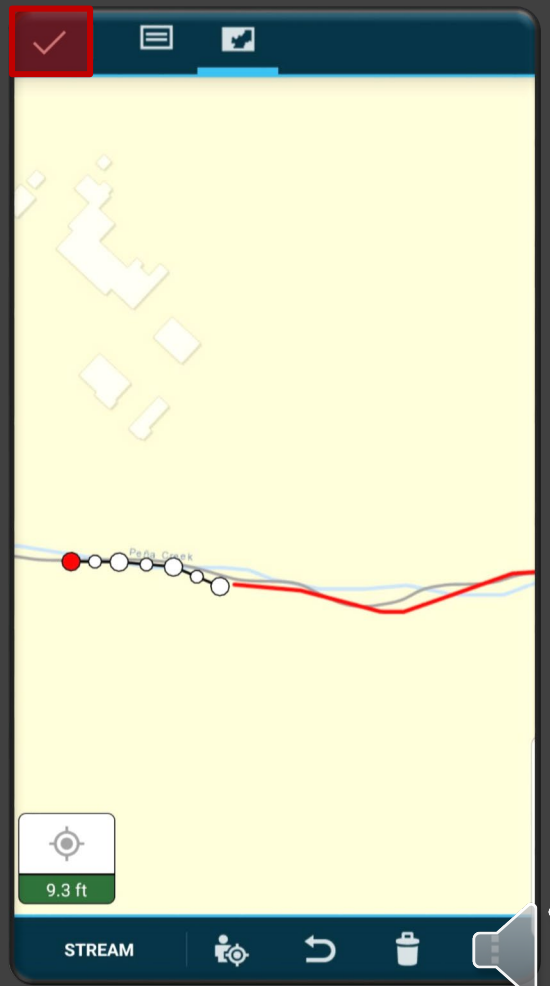
FieldMap: Wetted Habitat
Peña Creek
W Dry Creek Rd
9.3 ft


Collect a new feature
Filter
Dry
WettedHabitat_EDIT
Wet
WettedHabitat_EDIT
GateLocation
FieldNotes
Miscellaneous
FieldNotes
ParkingSpot
FieldNotes
SpecialCircumstance
FieldNotes

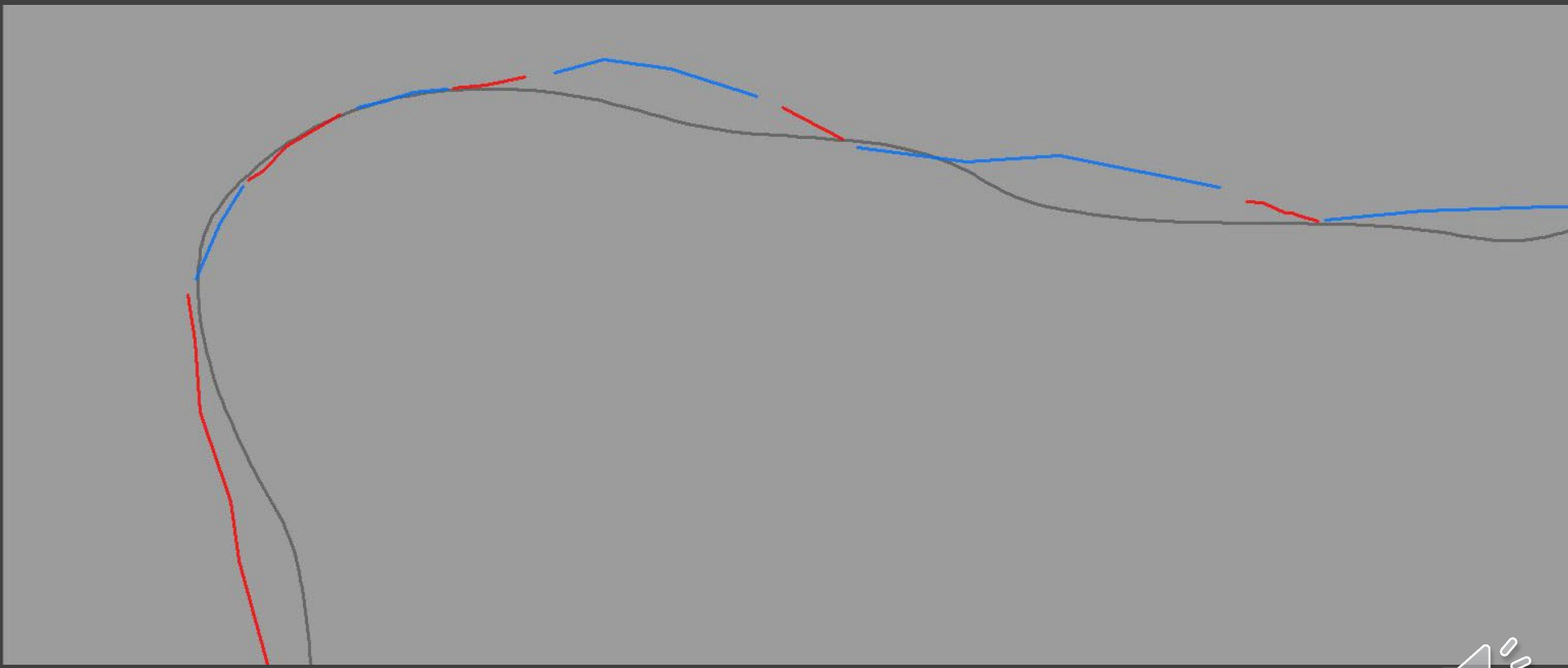

Dry
No valid length
TRIBUTARY
Pena Creek
SURVEYDATE
May 11, 2021
Use current
SAMPLEYEAR
2021
SAMPLENUM
1
CREW
AB
CREWID
A
AGENCY
CA Sea Grant
STREAM


FieldMap: Wetted Habitat
Collect another feature
Like the last one
Copy attributes and shape
Like the last one, new shape
Copy attributes only
With the same shape
Different feature, copy shape
New feature
Don't copy anything
Dry
Pena Creek


TRIBUTARY
Pena Creek
SURVEYDATE
May 11, 2021
Use current
SAMPLEYEAR
2021
SAMPLENUM
1
CREW
AB
CREWID
A
AGENCY
CA Sea Grant
CONDITION
Wet
STREAM


9.3 ft
STREAM

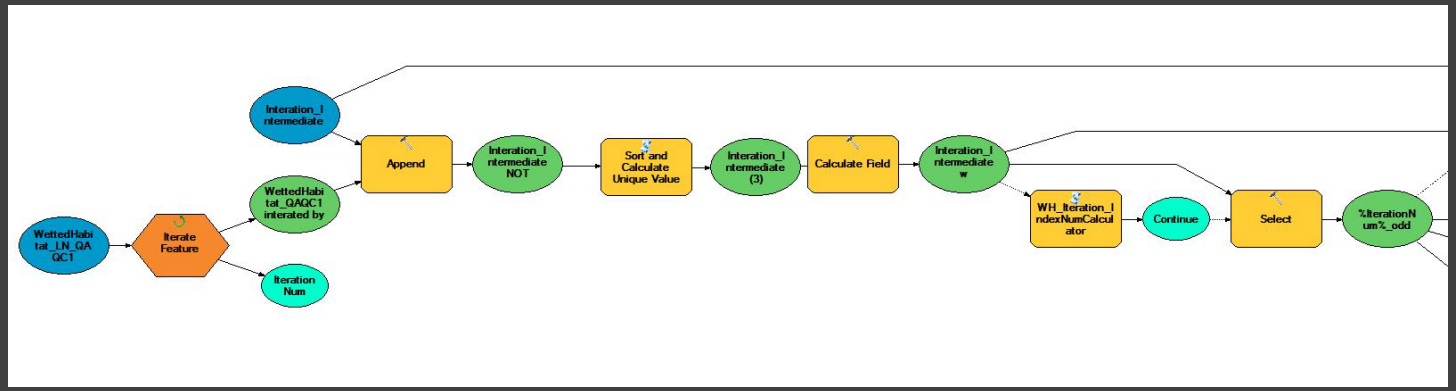
Raw lines

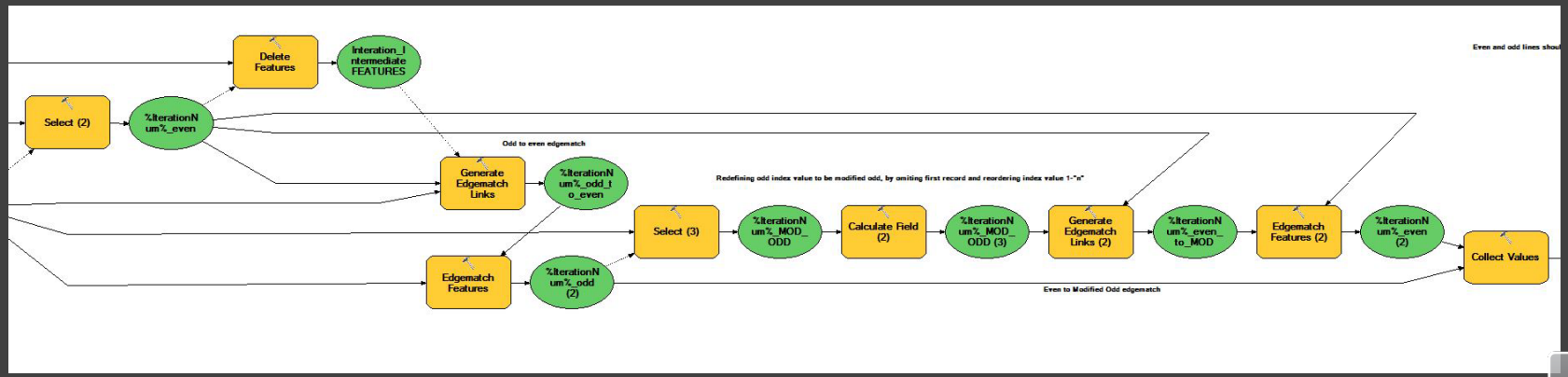


Using python to process data:

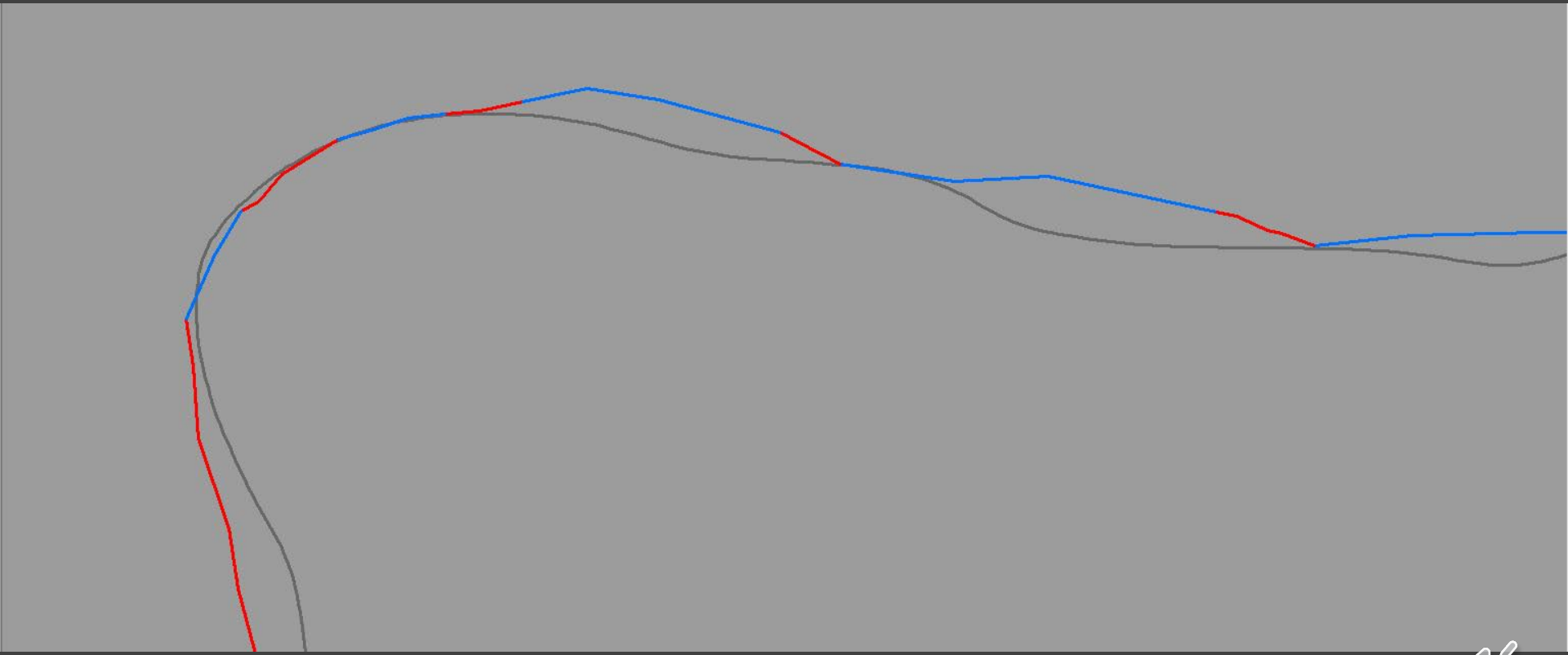
```python
import arcpy
import re
import time
from arcpy import env


tblAGOL = r"Database Connections\GIS_EDIT.sde\GIS_EDIT.UCCE.HYD_WETTED_HAB_LN"
tblNew = r"S:\Coho\GIS\Data\Working_Data_Drop\WettedHabitatTool\WettedHabitat_Working.gdb\Tool_Data\AGOL_Raw_WettedHabitat_LN"
tblQAQC1 = r"S:\Coho\GIS\Data\Working_Data_Drop\WettedHabitatTool\WettedHabitat_Working.gdb\Tool_Data\WettedHabitat_LN_QAQC1"
tblQAQC2 = r"S:\Coho\GIS\Data\Working_Data_Drop\WettedHabitatTool\WettedHabitat_Working.gdb\Tool_Data\WettedHabitat_LN_QAQC2"
tblQAQC3 = r"S:\Coho\GIS\Data\Working_Data_Drop\WettedHabitatTool\WettedHabitat_Working.gdb\Tool_Data\WettedHabitat_LN_QAQC3"
tblMaster = r"S:\Coho\GIS\Data\Base_Data\New_Master_Database.gdb\Reaches\Wetted_Habitat"

outputPath = r"S:/Coho/GIS/Data/Working_Data_Drop/WettedHabitatTool/WettedHabitat_Working.gdb/Archive/"
archivefile= "WH_Raw_LN_Archive_" + time.strftime("%Y_%m_%d")

env.workspace = r"S:/Coho/GIS/Data/Working_Data_Drop/WettedHabitatTool/WettedHabitat_Working.gdb/TEST/"
arcpy.env.overwriteOutput = True

def RecordCount(FC):
    result = arcpy.GetCount_management(FC) #counts number of records that are in feature class passed through function
    result = int(result.getOutput(0))
    return result

def FieldValueCheck(FC):
    go_nogo = "yes"
    cursor = arcpy.da.SearchCursor(tblAGOL, ["CrewID", "Tributary", "Agency", "SurveyDate"]) #checks these fields to make sure there are no "NONE" types
    for row in cursor:
        if (row[0] is None):
            arcpy.AddMessage("CrewID missing value")
            print "CrewID missing value"
            go_nogo = "no"
        elif (row[1] is None):
            arcpy.AddMessage("Tributary missing value")
            print "Tributary missing value"
            go_nogo = "no"
        elif (row[2] is None):
            arcpy.AddMessage("Agency missing value")
            print "Agency missing value"
            go_nogo = "no"
        elif (row[3] is None):
            arcpy.AddMessage("SurveyDate missing value")
            print "SurveyDate missing value"
            go_nogo = "no"
    del cursor

    return go_nogo



#### Schema test ####
Value_Check = FieldValueCheck(tblAGOL)
Raw_Check = RecordCount(tblNew)

precheck1 = arcpy.TestSchemaLock(tblQAQC1)
```

Integrating python scripts into model builder tools:

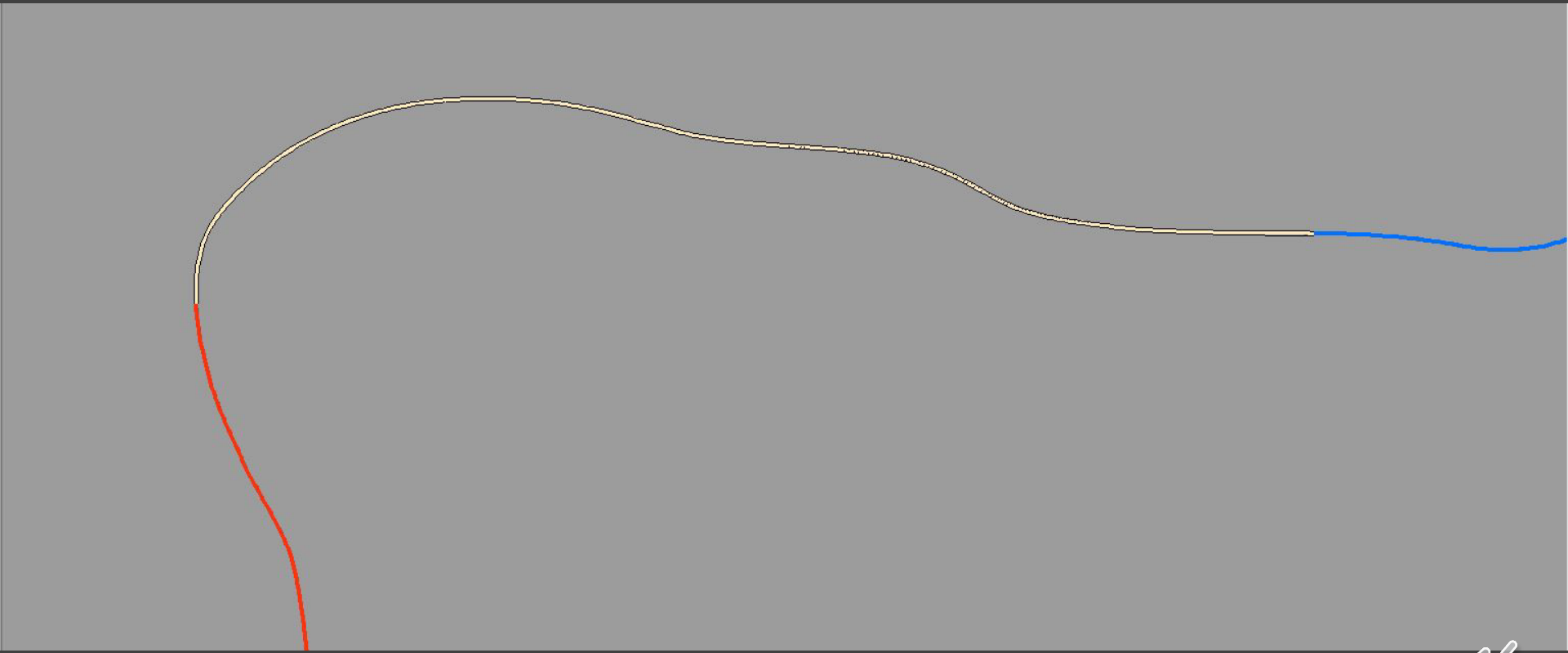




Modelbuilder tool output – First step



Modelbuilder tool output – Final



Summer Wetted Habitat Conditions

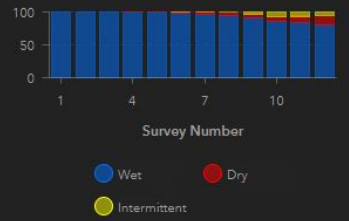
A Story Map

Mill Creek | Green Valley Creek | Dutch Bill Creek

Select a sample to filter the map

- Sample 5: 07/08 - 07/11
- Sample 6: 07/22 - 07/25
- Sample 7: 08/05 - 08/08
- Sample 8: 08/19 - 08/22
- Sample 9: 09/03 - 09/05
- Sample 10: 09/17 - 09/19
- Sample 11: 09/30 - 10/03
- Sample 12: 10/14 - 10/17

Season Overview



Season Overview | Survey Conditions

1 of 5

Streamflow

Flow Site: RR-FEL-001.26
Date: 9/19/2019
Measurement Value: 0.00 cfs
Crew: DS
Comments: Moved us 100m to ds end of bridge

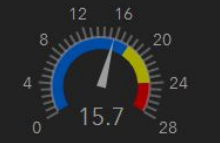
Last update: a few seconds ago

Survey Pool Metrics

Average Dissolved Oxygen (mg/L)

Average

Average Temperature °C



Average

RCT Depth below 0.2ft

33

54.1% of pools surveyed

Pool Distribution

Pool metrics do not include dry pools

Thank you to all of our partners and funders!

Special thanks to Zac Reinstein for providing graphics and Andy McClary for helping implement our data management system.

Important links:

https://caseagrant.ucsd.edu/project/russian-river-salmon-and-steelhead-monitoring-program

https://www.sonomawater.org/fisheries

Please reach out if you have any questions: abartshire@ucsd.edu