CALIFORNIA DEPARTMENT OF WATER RESOURCES

Monitoring Special Study

Technical Work Group #6, Sept 15, 2022

High Speed Salinity Transect Mapping

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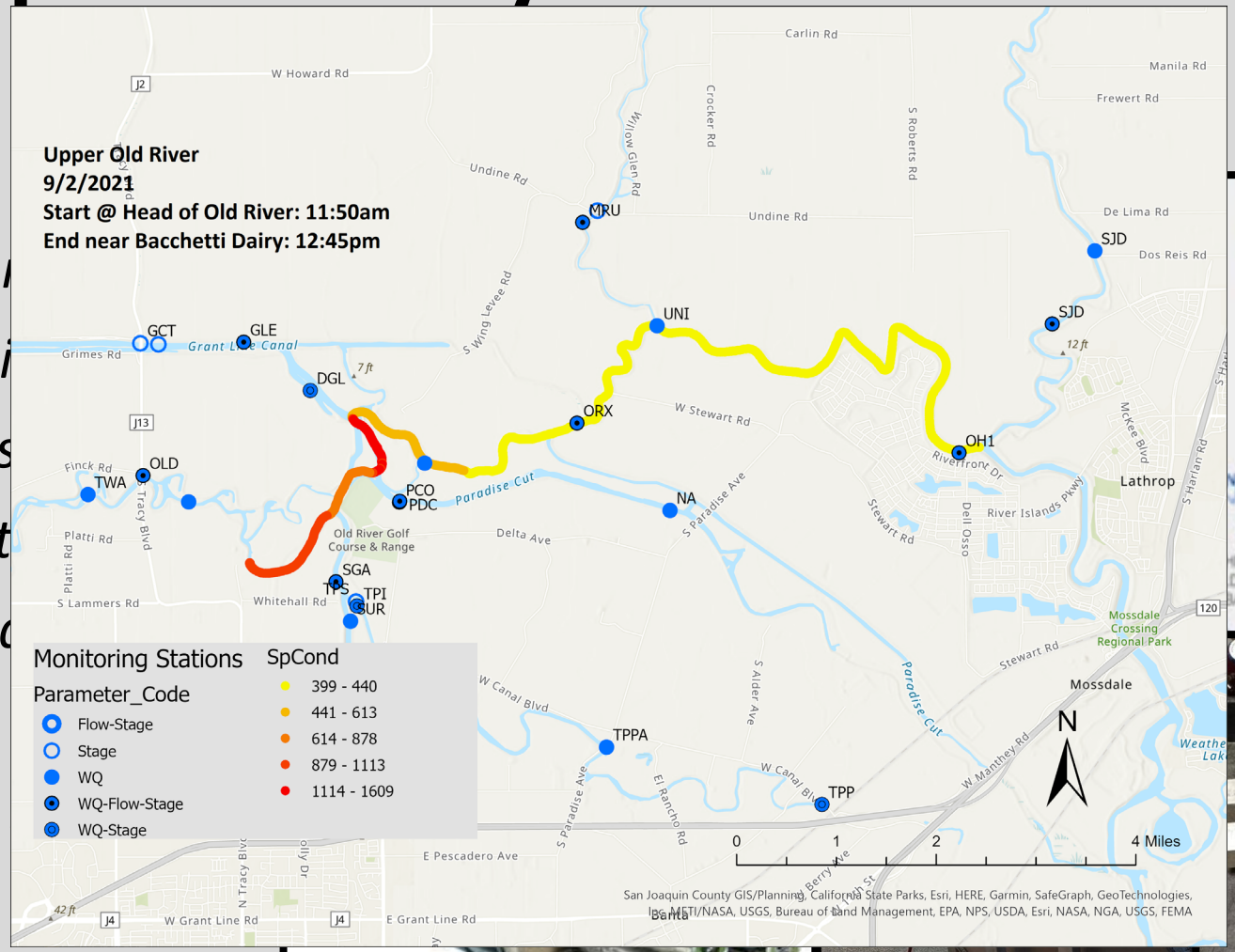
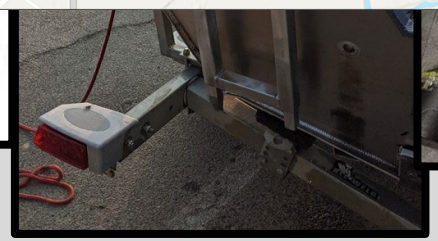
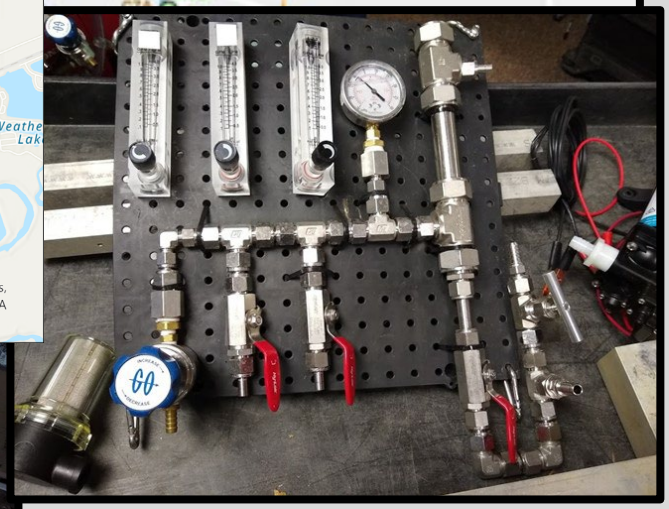
High-Speed Salinity Transects with GPS

Background:

- *High-speed boat water*
  mapping is an emergi
  method for targeted s
- *Provides a way to capt*
  channel reach water c
  conditions
- *Data collection began*
  2021







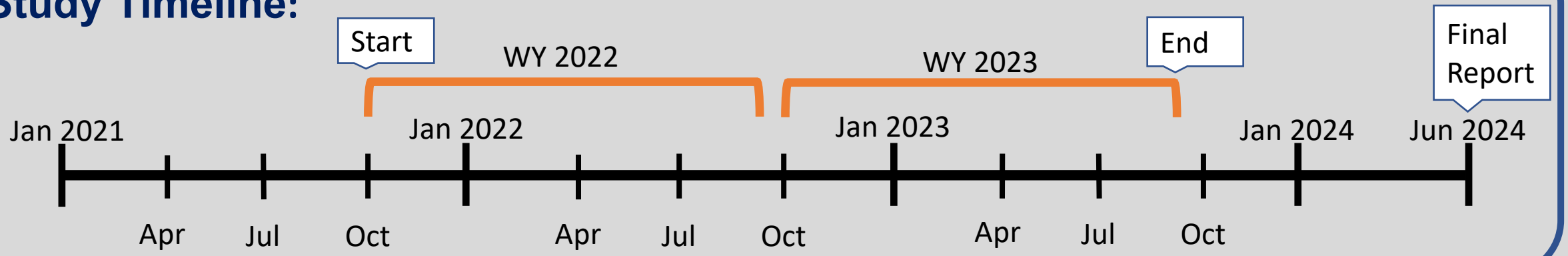
Introduction

- Salinity transects will provide insight on salinity conditions between stationary EC monitoring locations. Maps will be analyzed to assess existing compliance objectives and inform recommendations for long-term monitoring protocols.

- Data collected during the transects will be used to help validate any modeling outputs of interior southern Delta EC.

- Salinity transects may be incorporated into a long-term monitoring plan as a tool for periodic validation during development of monitoring protocols.

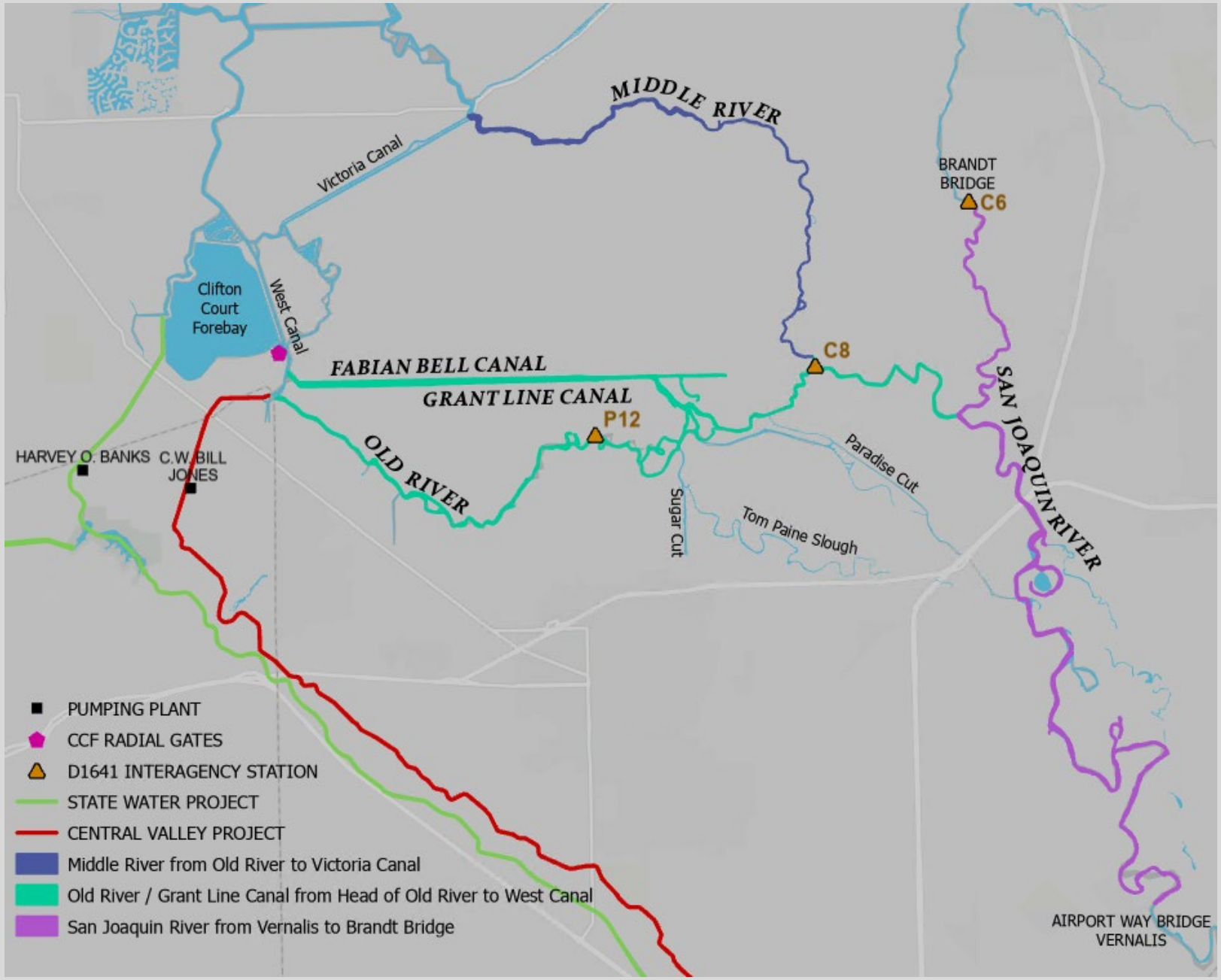
Study Timeline:



High-Speed Salinity Transect Mapping

Study Area

- Study is comprised of 5 transects
- Transects are based on reach compliance identified in the 2018 Bay-Delta Plan
- 5-Point Confluence mapped for wide range of tidal scenarios to better understand dispersion among channels and discrepancy between Upper and Lower Old River salinity



Addressing Stakeholder Comments

- **Technical Equipment Comments**

  “Sensor Depth?"
  “Can Flow rate keep up with speed of boat?"
  “Can Middle River be sampled with a shallow draft boat?”

- **Transect Route Comments**

  “Can Transects be scheduled to evaluate different operational conditions?”
  “Fabian Tract should be sampled on both ebb and flood tides.”
  “Can Fabian Tract be circumnavigated quickly enough to capture one tide?”
  “5-Point Confluence should always include all channels and Lower Old River portion should extend further downstream.”
  “Meander channel in Lower Old River mentioned in Montoya is not mapped.”

- **Data Availability**

  “Preliminary findings/results should be shared to solicit feedback”

Routes: Grant Line Canal

- 30-60 minutes
- Targeting high and low tides
- Conducted at least once per season
- Navigable year-round
- Can be appended to station maintenance field days
- Performed on 03/02/2022 and 8/24/2022

*The original proposed route consisted of fully circumnavigating Fabian tract. That route was split into Grant Line Canal and Lower Old River to minimize the tidal window captured.

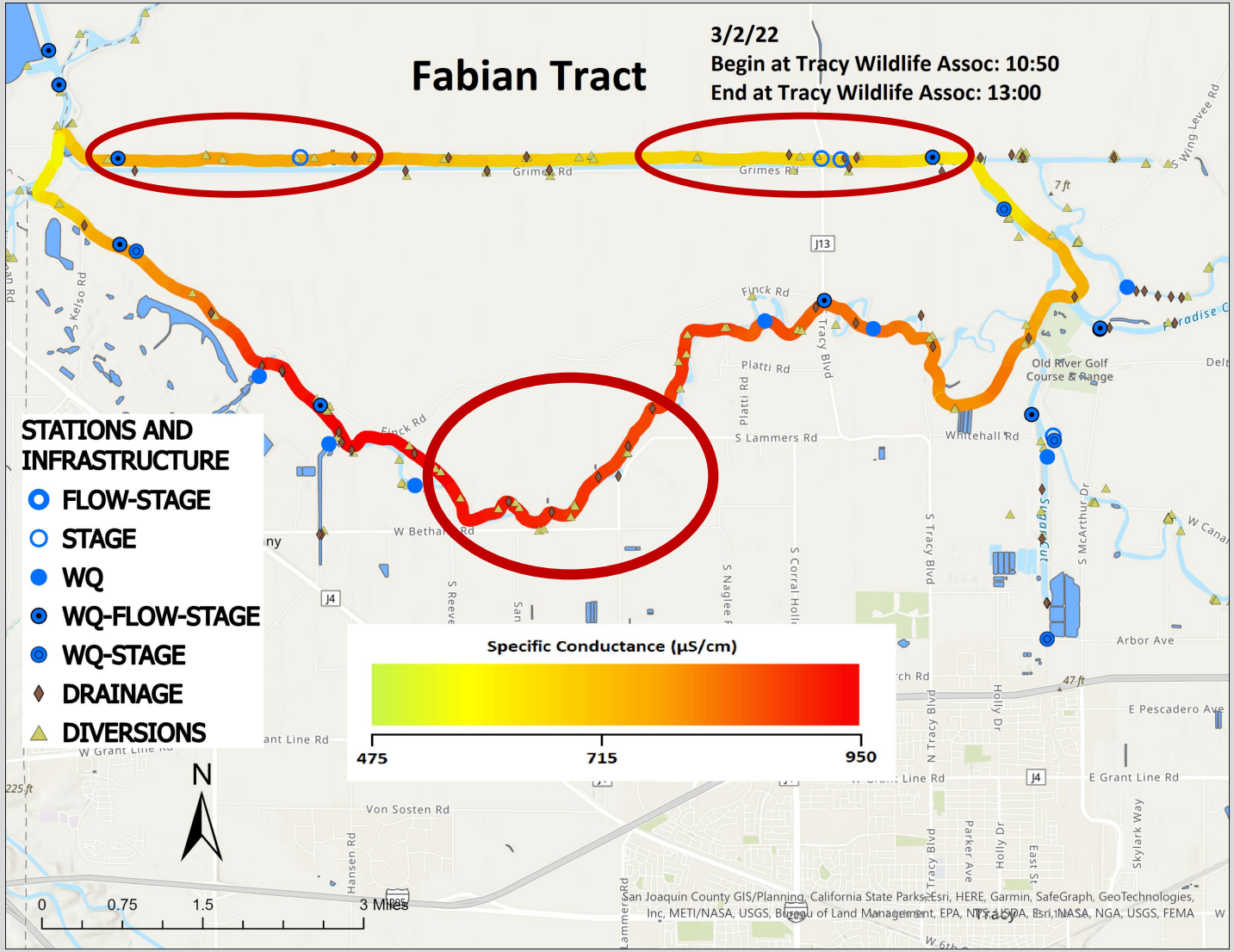
High-Speed Salinity Transect Mapping

Routes: Lower Old River

- 45 - 90 minutes
- Targeting Flood and Ebb tides
- Conducted at least once per season
- Navigable only when the channel is unimpeded from floating aquatic vegetation
- Can be appended to station maintenance field days
- Performed on 3/2/2022, 3/31/2022, 6/1/2022, and 7/6/2022

Lessons Learned:

- Route was too long to be considered a snapshot of tidal conditions (*Stakeholder Comments Addressed)
- Gap in monitoring in Lower Old River between Bethany and Lammers Rd
- Grant Line Canal stations (GLC & GLE) appear to be representative of East and West sections of GLC
- Strong corroboration between transect measurements and corresponding station measurements. All stations were within 25 µS/cm of transect reading and less than 4% RPD, except DGL which was slightly more variable, as expected



High-Speed Salinity Transect Mapping

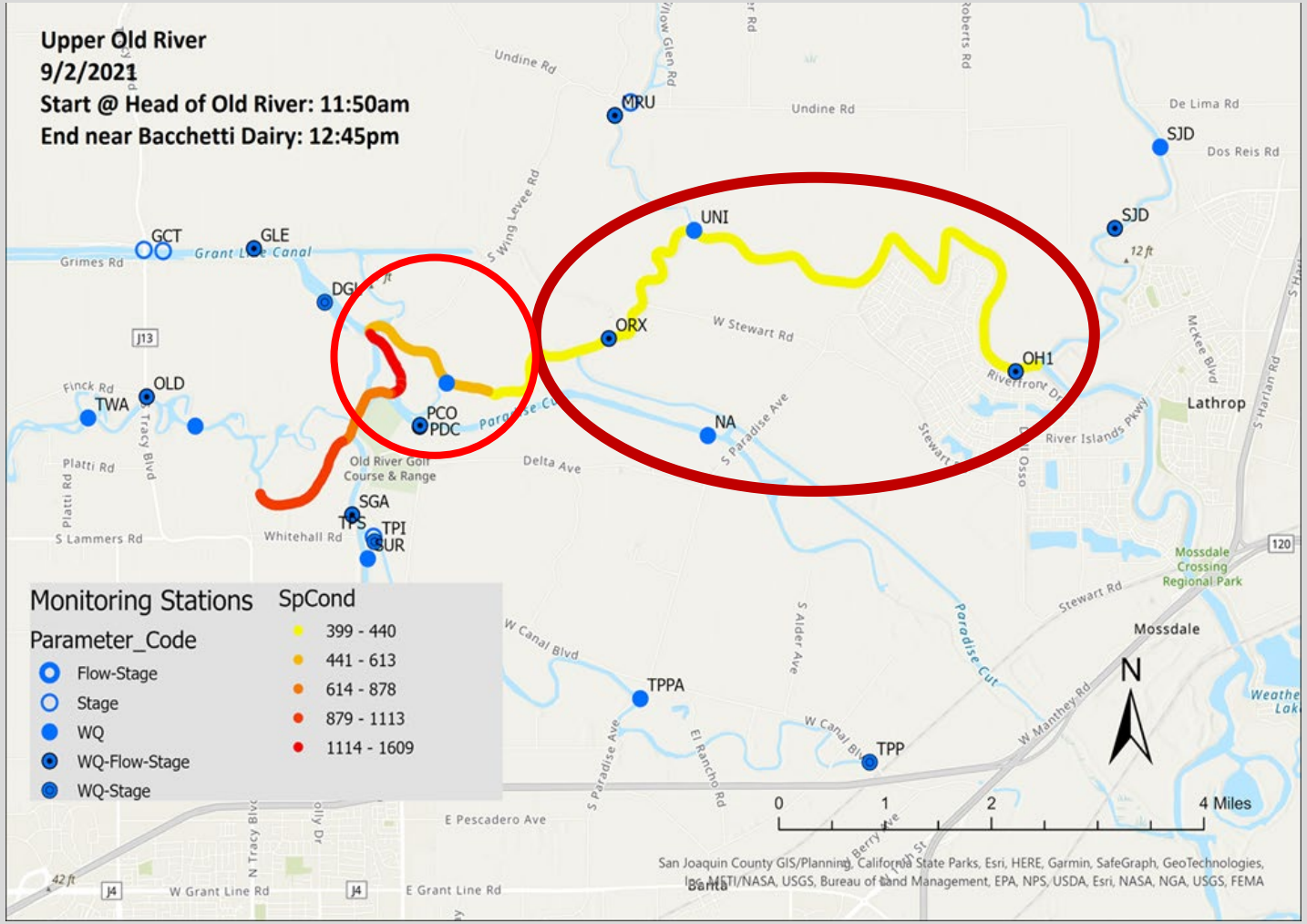
Routes: Old River Head through 5-Point Confluence

- 45 - 90 minutes
- Targeting high and low tides on the same day
- Conducted at least once per season
- Navigable only when the channel is unimpeded from floating aquatic vegetation
- Can be appended to station maintenance field days
- Performed on 9/2/2021, but Hyacinth has caused blockages in this channel since late Spring.

*The original proposed route ended at the Old River Barrier. This route was shortened to minimize the tidal window captured.

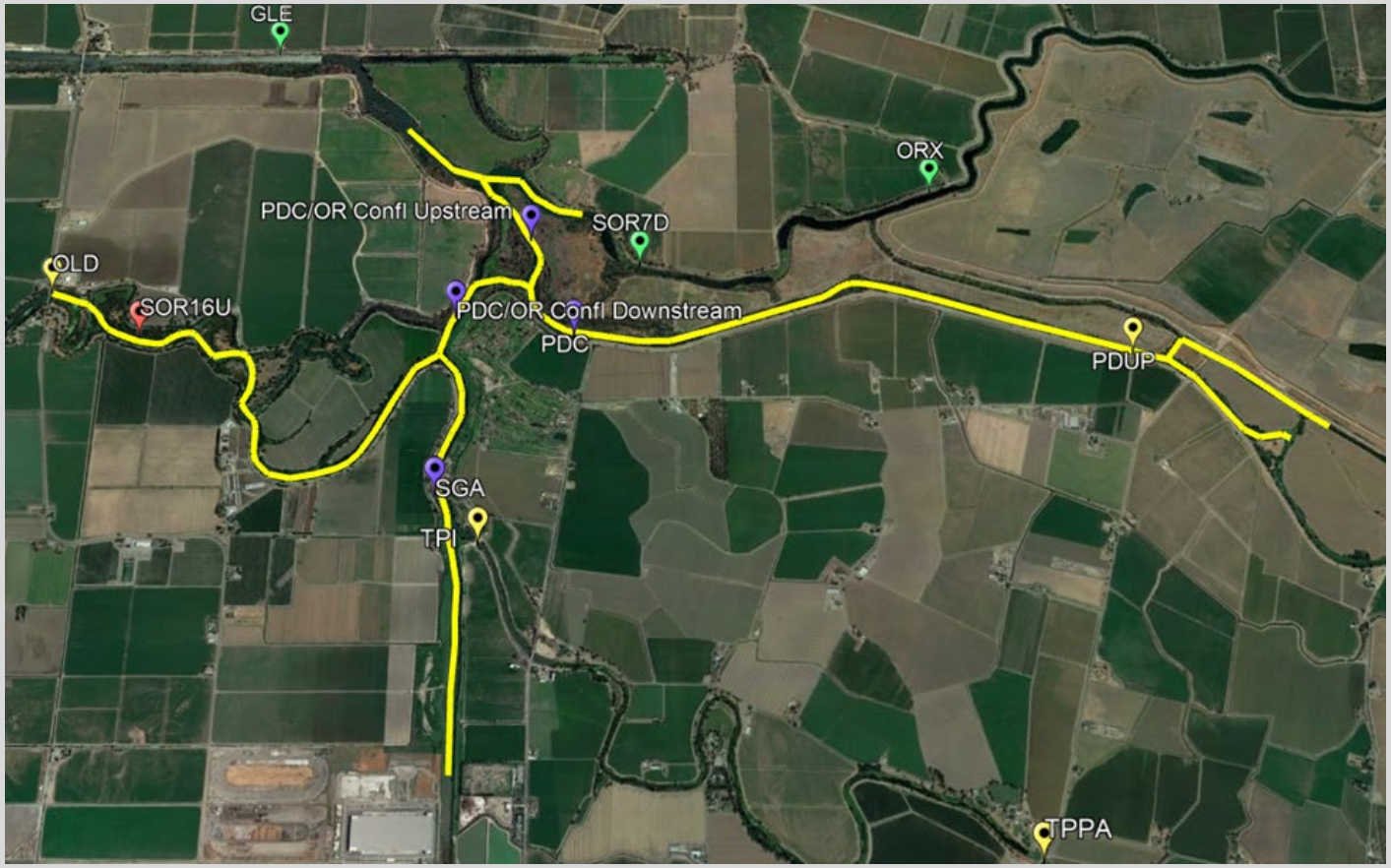
Lessons Learned:

- Maiden Voyage. Focused on function.
- OH1 and ORX are representative of the majority of Upper Old River. Not much variation between OH1 and ORX, but begin to see differences approaching the confluence.
- Careful consideration must be made to time transect to coincide with tides from beginning to end. For example, Low tide at OH1 was 12:30 and 14:30 at OLD.



High-Speed Salinity Transect Mapping

Routes: 5-Point Confluence

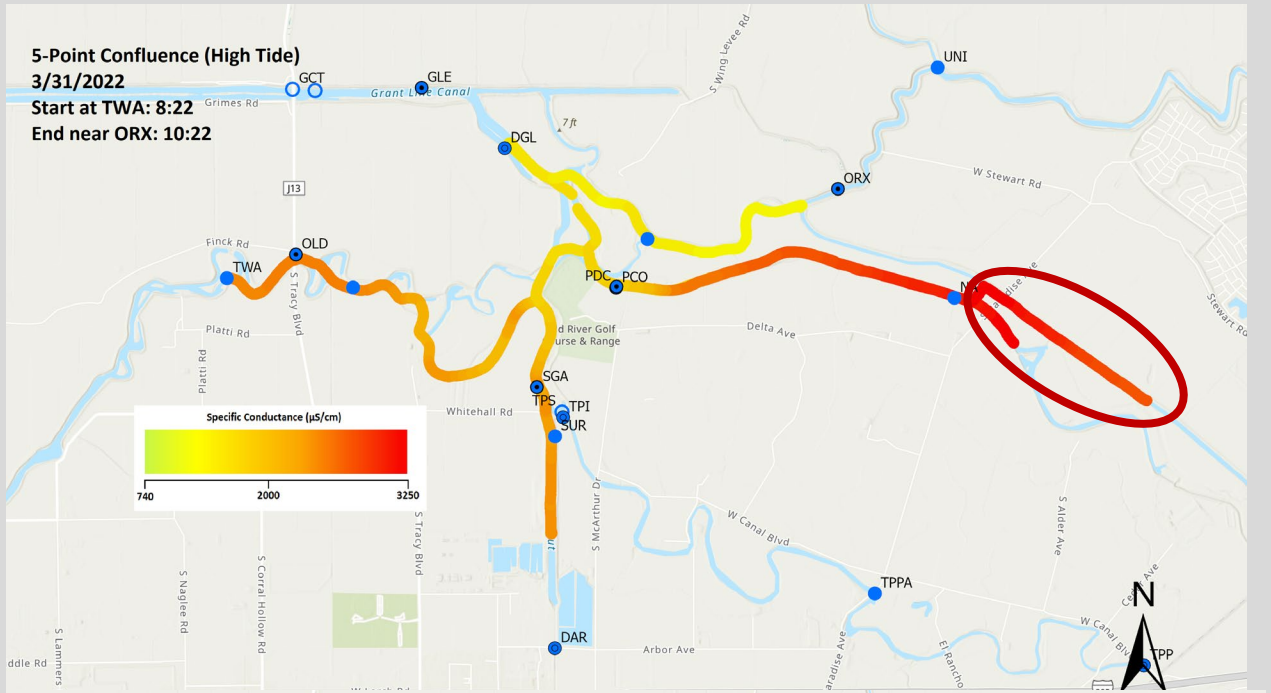


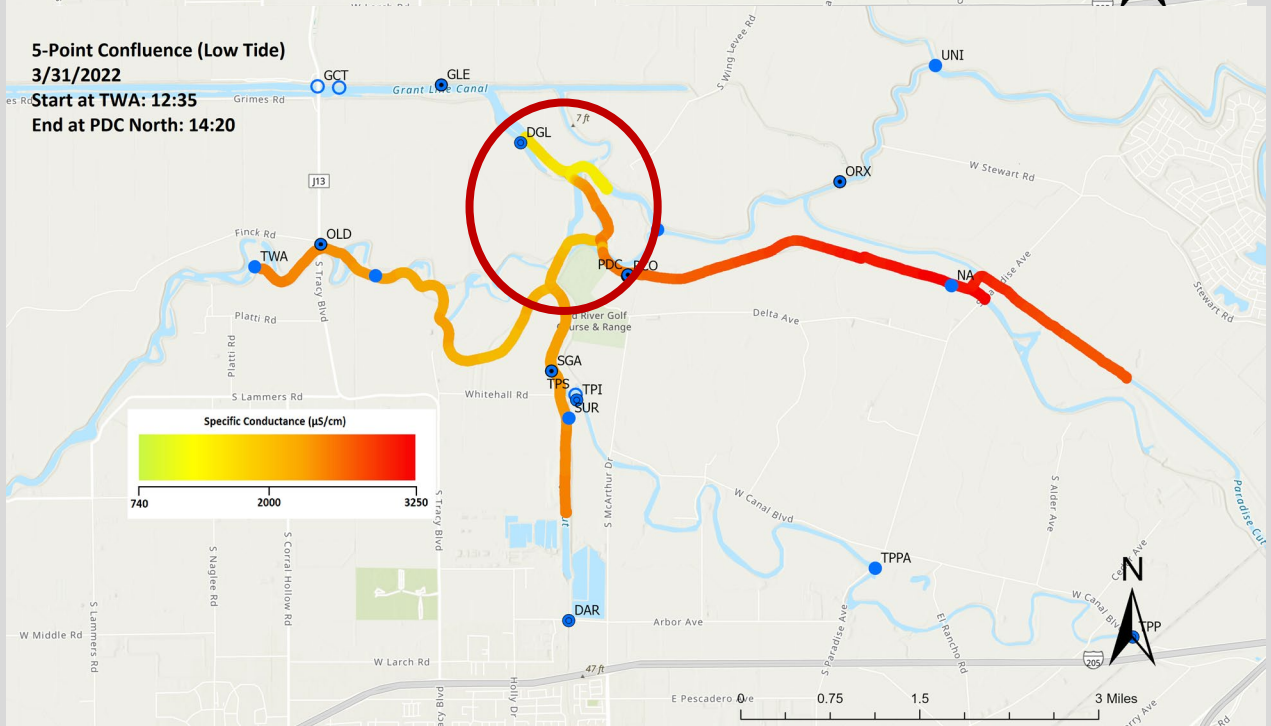
*Extended route further downstream to OLD monitoring station and farther upstream in Paradise Cut.

- 45 minutes – 2 hours
- Targeting high, transitioning, and low tides on the same day
- Focus on capturing wide range of tidal scenarios throughout Spring-Neap cycle
- Visualize salinity movement in the confluence through a range of tidal swing magnitudes. Large: >4ft, Average: 2-4ft, Small: <2ft
- Navigable only when the channels are unimpeded from floating aquatic vegetation
- Performed on 10/26/2021, 11/16/2021, and 3/31/2022

Lessons Learned:

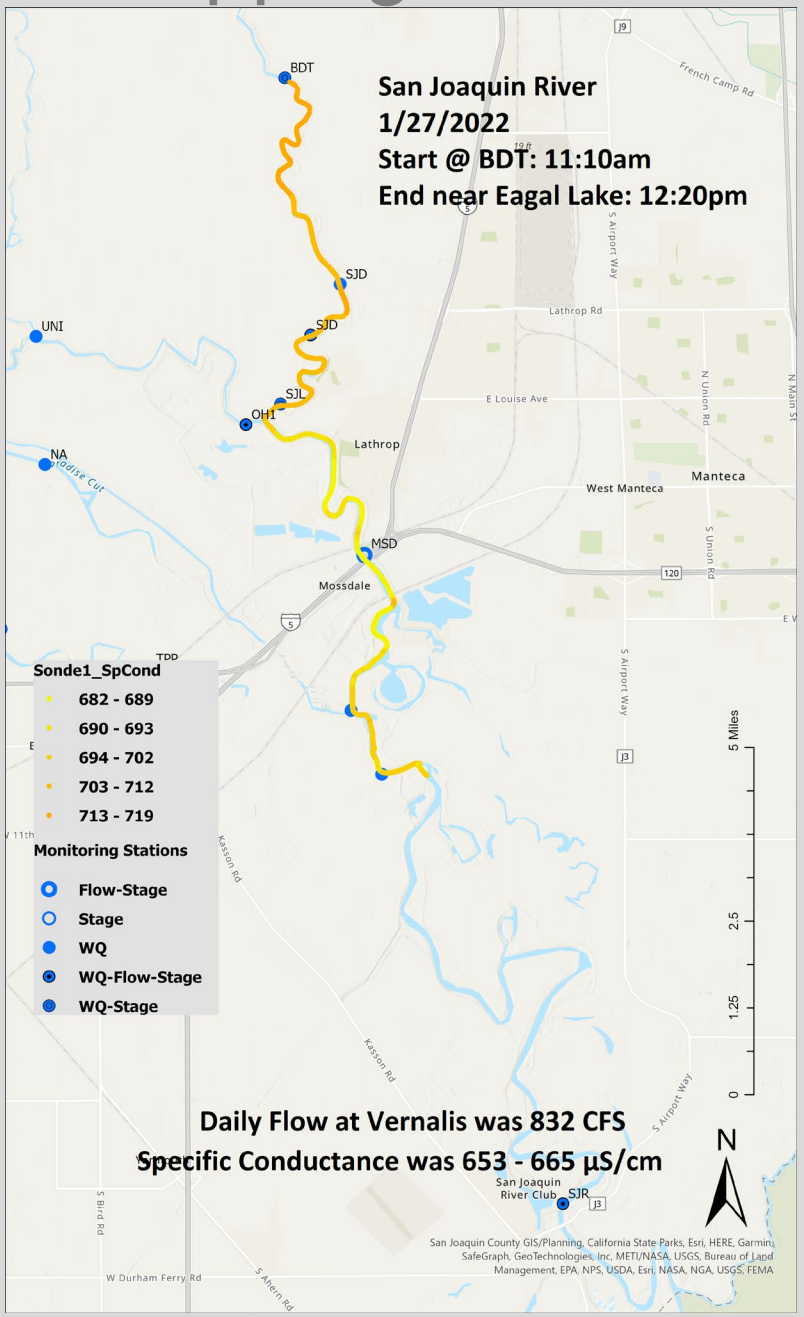
- Hyacinth Mat above PDUP cleared for first time. Able to travel much further up Paradise Cut than previously.
- North channel was deeper than expected (7-8 ft) and relatively clear of submerged vegetation. Southern channel is shallow and still dense with submerged vegetation even when clear of hyacinth.
- EC values began to decline after traveling upstream of Paradise Rd Bridge. From ~3,000 to 2,450 µS/cm
- Higher EC pushed up to the Confluence of Old River and Doughty Cut, but EC adjacent to DGL station was the same during both runs.





Routes: San Joaquin River

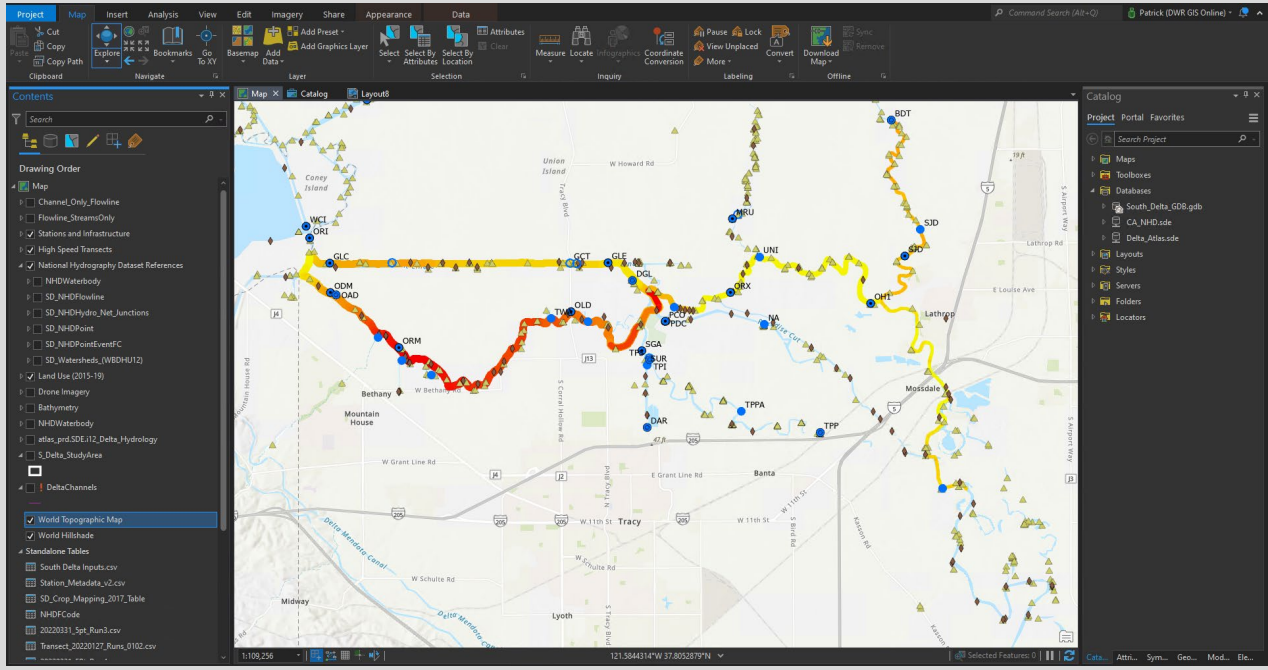
- 1-3 Hours
- Targeting high (>2000 CFS) and low (<1500 CFS) flow scenarios
- Conducted at least twice during study period
- Navigation is difficult because of shallowness upstream of Paradise Cut Weir. Most likely can only reach Vernalis during high flow periods.
- Transect results were as expected with small deviation in EC in this reach.



Geodatabase and Mapping Products

- Developing Geodatabase to house transect data

- GDB will include relevant layers from DWR Delta Atlas and National Hydrography Database for easy and consistent referencing across MSS Technical Studies, includes:
  - Drone Imagery
  - Bathymetry
  - Continuous Monitoring Stations
  - Points of Diversions and Returns
  - Crop Mapping
  - NHD Flowlines, surrounding features, and local watersheds



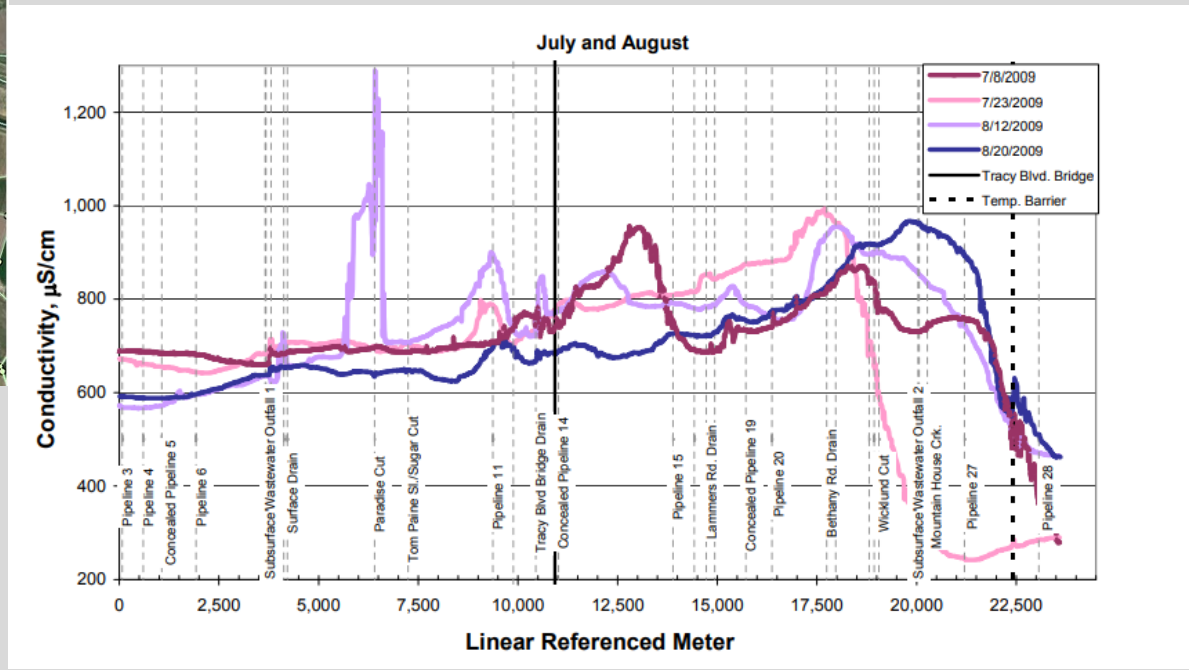
- Finalized Data packages will include Transect Maps, CSV files of QA/QC'd Data, and all relevant quality assurance documentation.

- Corresponding data (Flow, Stage, Velocity, EC) from surrounding stations and operational components (DAYFLOW) will be included in data packages.

- WY 2022 data packages are expected to be finalized by January 2023

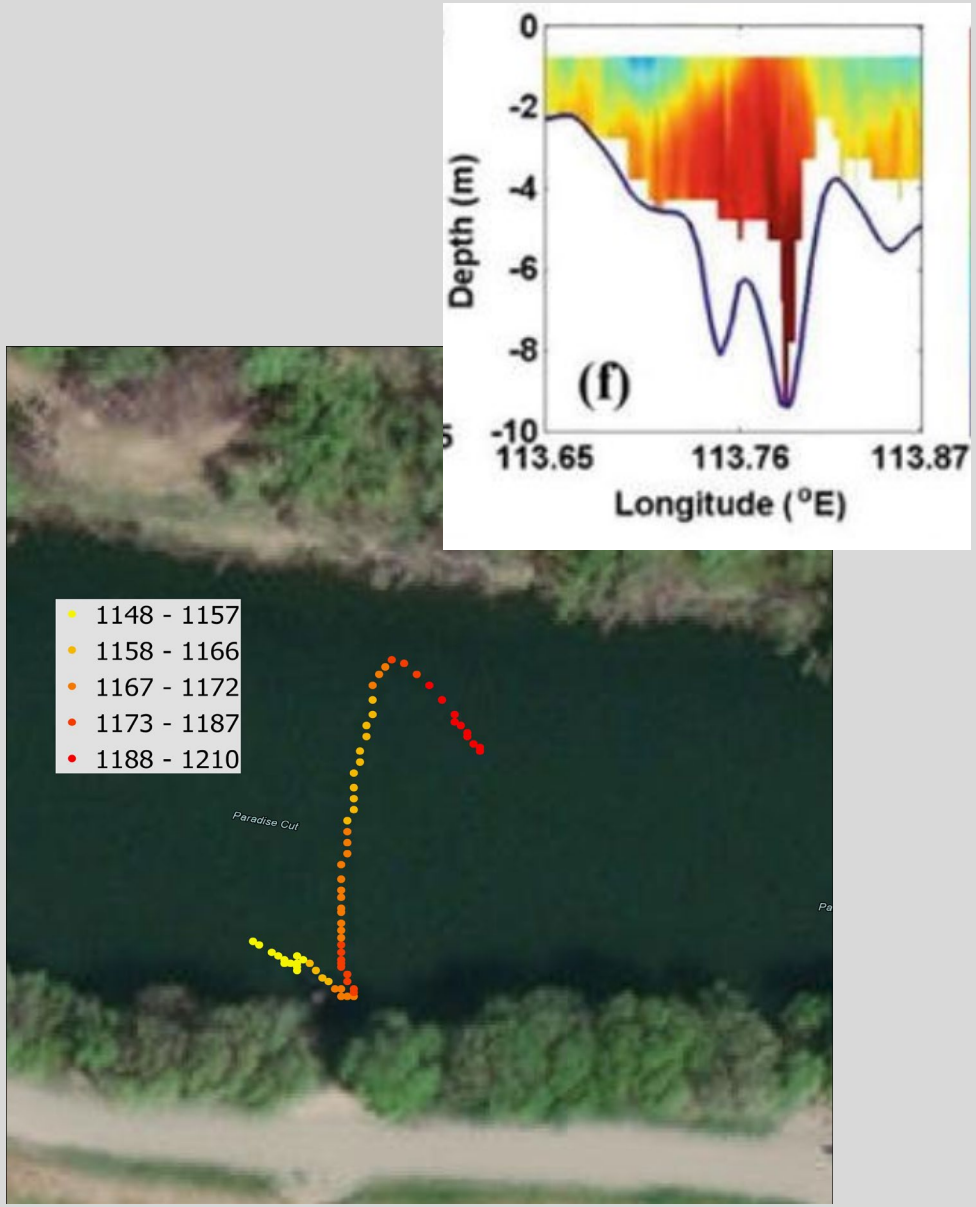
Linear Referencing and Profiling

- National Hydrography Dataset's Flowline layer used to develop linear references for all channels mapped.
- Profile templates for each route are in development.



Station Validation

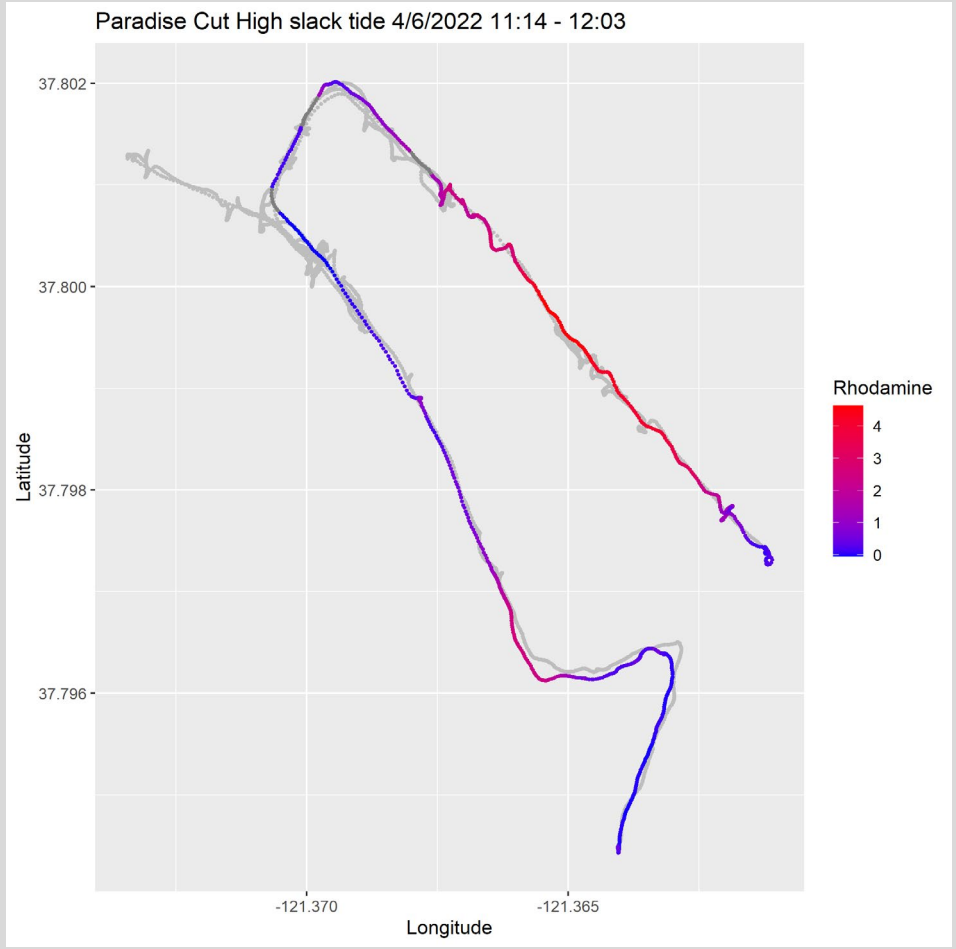
- Cross-section analysis to evaluate how representative existing stations are of South Delta channels.
- Validate stations used in Reach Compliance protocols.
- Uniform lateral mixing in South Delta channels was assumed. During pilot tests, crews noticed a 5% difference at PDC between mid-channel and side-channel during certain tidal scenarios.



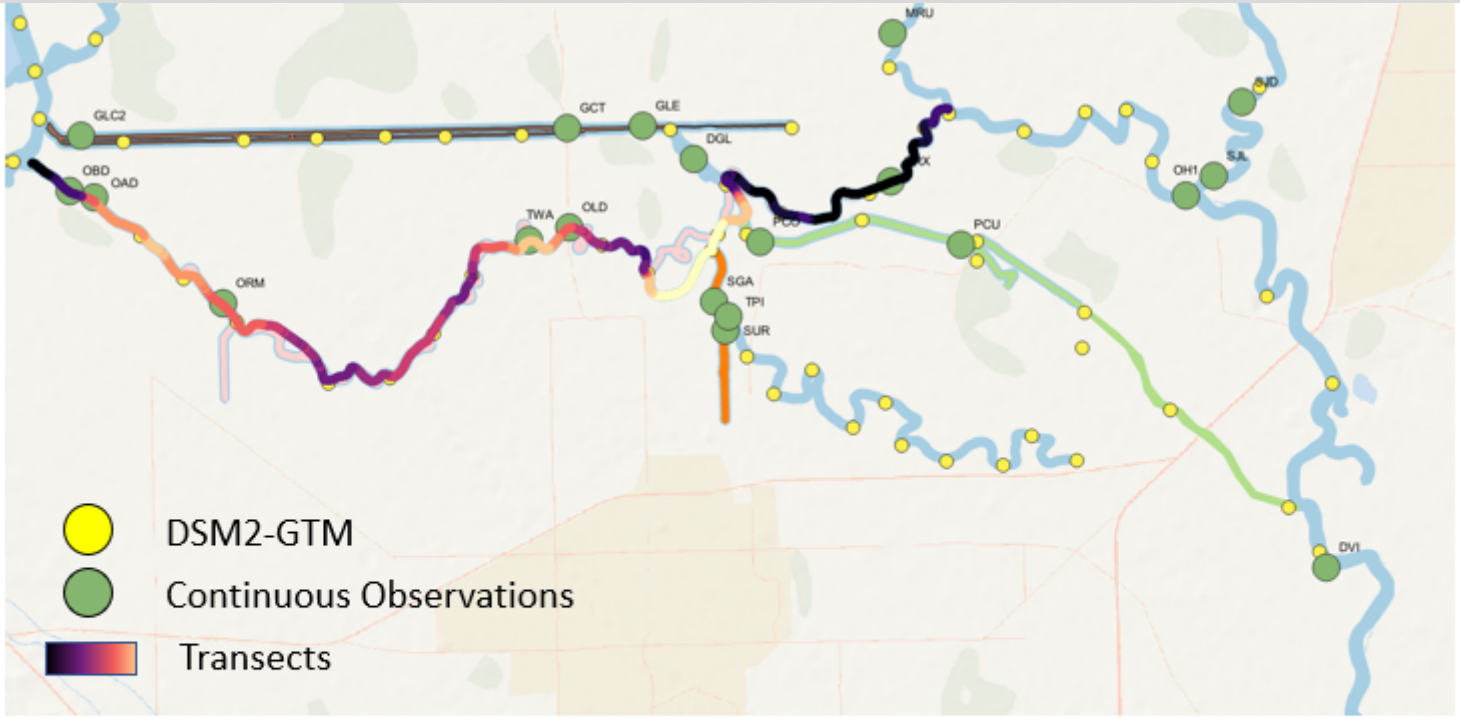
High-Speed Salinity Transect Mapping

Rhodamine Dye Studies

- Transects were included to help track the leading edge of the dye cloud's centroid in April Paradise Cut dye study.
- Transects were incorporated more heavily in 2nd and 3rd dye studies during July and August.
- Transects after each 25-hour tidal cycle gave greater resolution to centroid movement than buoy stations alone.
- These were not high-speed transects. Sondes were hung from the side of the boat at two different depths.



Model Corroboration



- **Fold together model and observations to improve EC modeling**
  - **more reliable hypothesis testing**
  - **better future predictions**
- **Infer salinity sources on Old River or upstream sloughs**

- Slide taken from Technical Workgroup Meeting #3: Data Assimilation

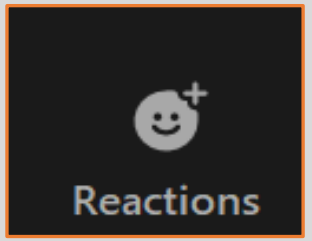
Questions, Comments & Input

Reminders:

- Add questions, comments, or input to the **Zoom chat** for discussion
  following each presentation
- Raise your hand if you would like to speak (click the "**Raise Hand**" icon in the "**Reactions**" menu)
- **Unmute** when you are called on to speak

If you are on the phone, use ***9** to raise your hand

If you are on the phone, unmute and mute your phone using ***6**



Raise Hand via "Reactions Menu"

Contact Information

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QA/QC Procedures

1. **Lab calibration and validation prior to transect**
2. **Verification readings over the side of the boat at the beginning and end of each transect**
3. **Cut power when pressure or flow rate drop. Measurements with cut battery readings are removed from the data set**

    -Accounts for vegetation clogging the intake and time spent clearing

4. **Visual QC in ArcGIS Pro**
5. **Cross Validation with continuous station readings**