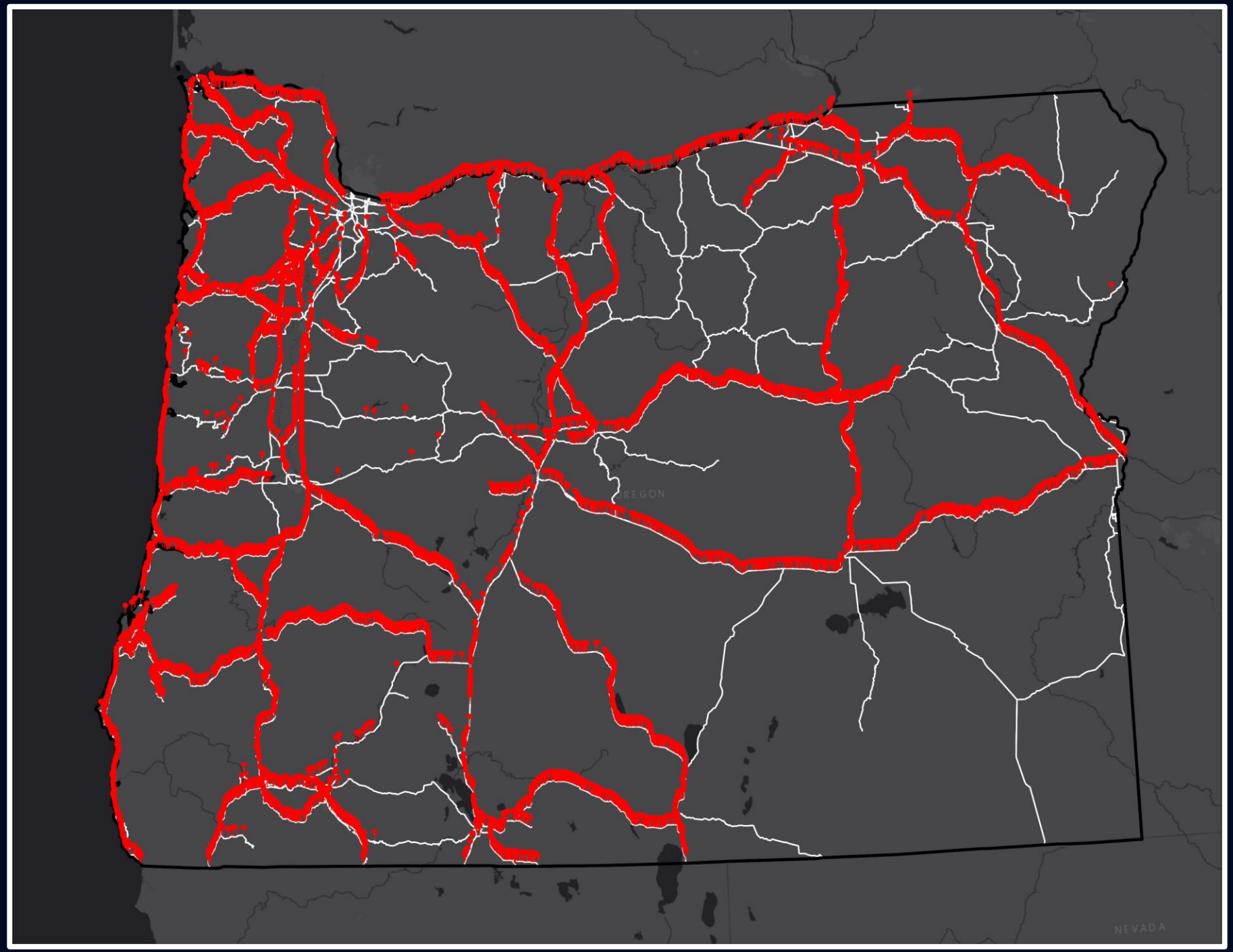
Early Predication Method for Native Migratory Fish Presence at Small Culverts

Courtney Zambory
12/14/2021

ODOT Culvert Data Delivery (15,055)



Draft Fish Call Flow Chart

Is there a defined stream channel upstream of the culvert?
(Channels downstream of culverts aren't a great indicator because the culvert can focus runoff and create an unnatural channel.)

- Yes
- No

Yes

Is there a high gradient barrier around the culvert?
(Gradient of 20% or higher for 30 feet or more)

- Yes
- No

Yes

Is the high gradient barrier downstream?

- Yes
- No

Yes

Probably no fish

May have isolated populations or lamprey above.

Check with District or e-fish to confirm no fish

No

Fish

However, may be at end of distribution.

Discuss options with District

No

Stream is known to have connection with fish bearing waterbody, or fish presence is known downstream of the culvert?

- No
- Yes

No

Stream is known to have downstream barriers to fish movement?

- No
- Yes

No

Fish
(Although further investigation is warranted if a barrier is suspected.)

Yes

Probably no fish
Check with District or e-fish to confirm no fish

Yes

Fish
This path does not take into account unnatural upstream channels in non-historic habitat or small drainages with a lack of livable space. Look for those conditions and verify fish call with the district if in doubt.

No

Is there standing water, wetland, lake, or slough habitat on both sides of the culvert?

- No
- Yes

No

No fish
- Dry channel

(roadside drainage)
- Water only on one side

(may be historic check with District)

Yes

Waterbody has known connection to habitat supporting fish populations?

- Yes
- No

Yes

Fish

No

Water body is isolated or only connected at >5% exceedance flows

- No
- Yes

No

Unknown fish
- Unique situations

Survey or check with District

Yes

Probably no fish
- May be historic fish
- May require egress passage

Check with District to determine trigger or passage requirements

DFID name of the culvert associated in the attribute table under the attribute name "DFID".

Highway ArcGIS Line network. This shapefile will be used to delineate one side of the culvert from another.

LiDAR bare earth digital elevation model. This should be in raster format and can be downloaded from the DOGMAI website (https://gis.dogami.oregon.gov/maps/lidarviewer/) as quadrangles. Ensure that the LiDAR data covers at least 1/2 mile around culverts of interest. If multiple culverts will be analyzed, mosaic multiple bare earth LiDAR rasters to a single raster and use that mosaicked product as this input.

Input the SDM network included in this package. It should comprise of a NHD High-Res network version with each segment attributed a probability (where there was data) of each of the 32 Native Migratory Fish (NMF) that would trigger a fish passage law.

Input the standing water polygon shapefile included in this package. This is simply the National Wetland Inventory dataset (https://www.fws.gov/wetlands/data/State-Downloads.html) with all riverine features excluded.

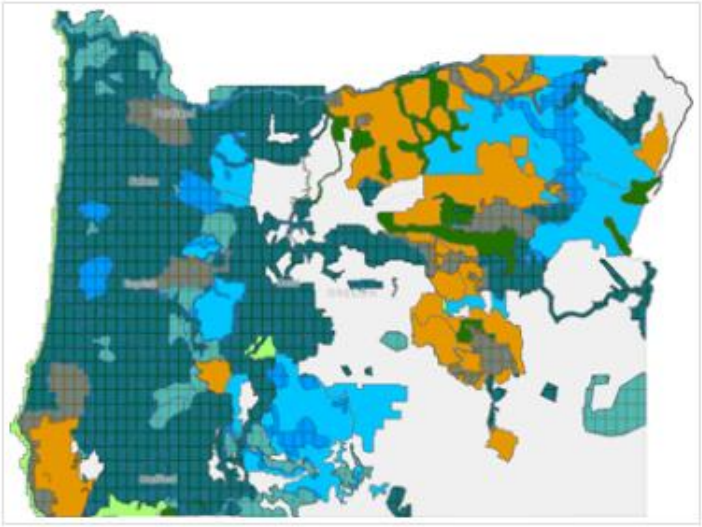
The Trace Network was derived from the NHD High-Res dataset. It has been converted from a geometric to Trace network. Reaches that have natural falls barriers that were fully blocked (found via the ODFW barrier database) have a value of 1.

The folder to which the final dataset will be written - this will also act as the folder that will hold all the temporary files.

Output dataset name

Input – LiDAR Data

- These DEMs represent “bare earth” elevation, meaning the elevation of the land surface (or water surface in the case of inundated areas) regardless of vegetation or canopy cover



Explore and Download Lidar Data

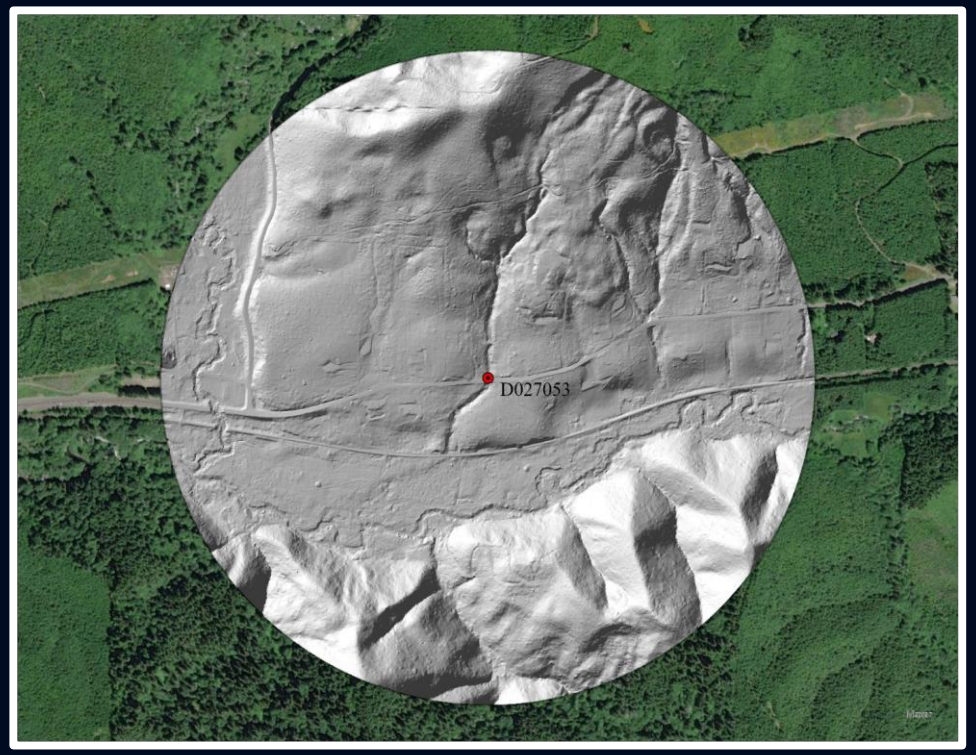
The Lidar Data Viewer interactive map shows the current extent of lidar data for the state of Oregon, including downloadable data by 7.5 minute USGS quadrangle. The data are maintained by the Oregon Department of Geology and Mineral Industries (DOGAMI).

Popups contain links to data acquisition and acceptance reports.

With the Lidar Data Viewer interactive map:

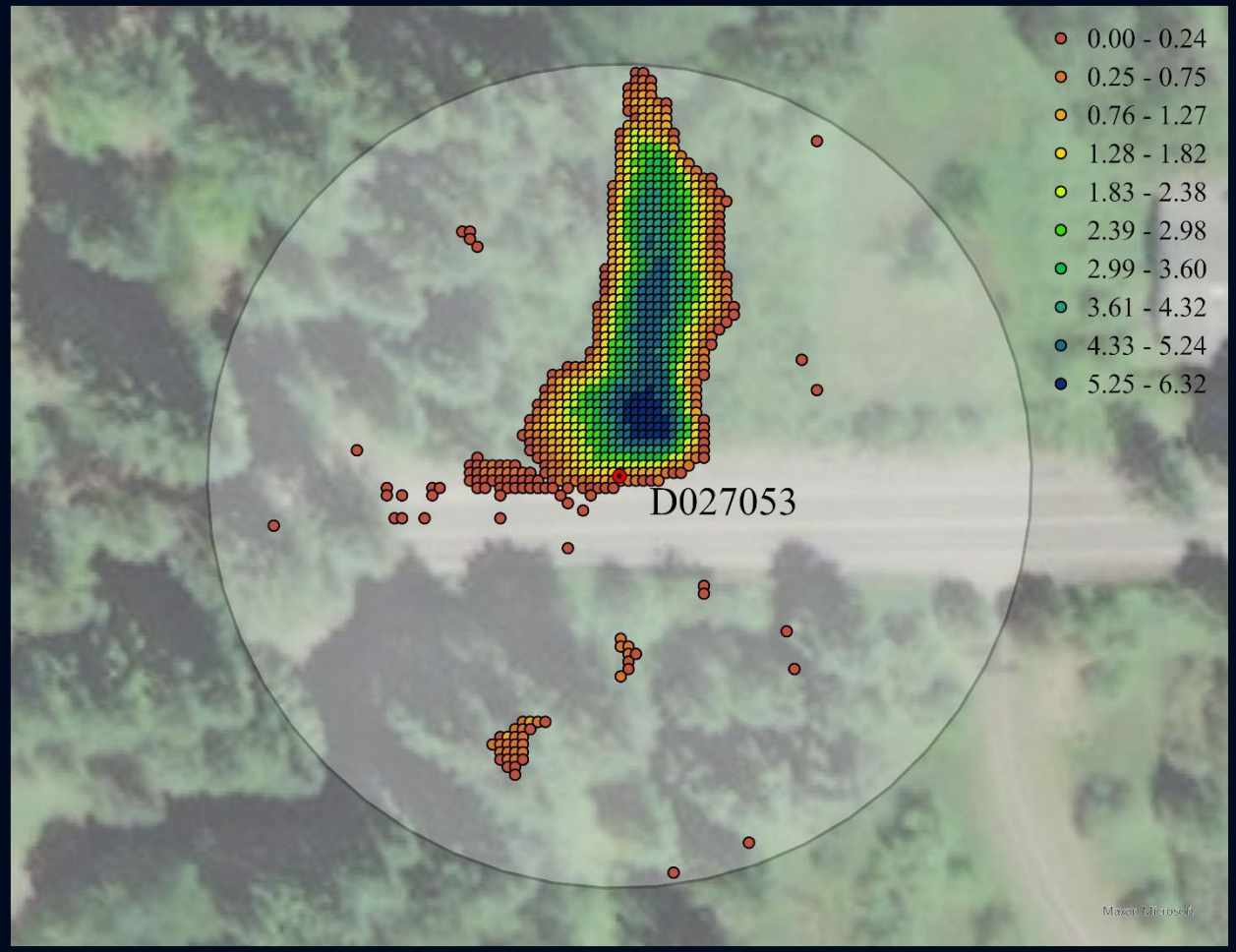
Input #1 – LiDAR Data

- Buffer the culvert location ½ mile for a total search area of 0.784 mi^2
- Extract DOGMAI LiDAR data to the search area
- Generate flow direction, flow accumulation, filled DEM, and hillshade



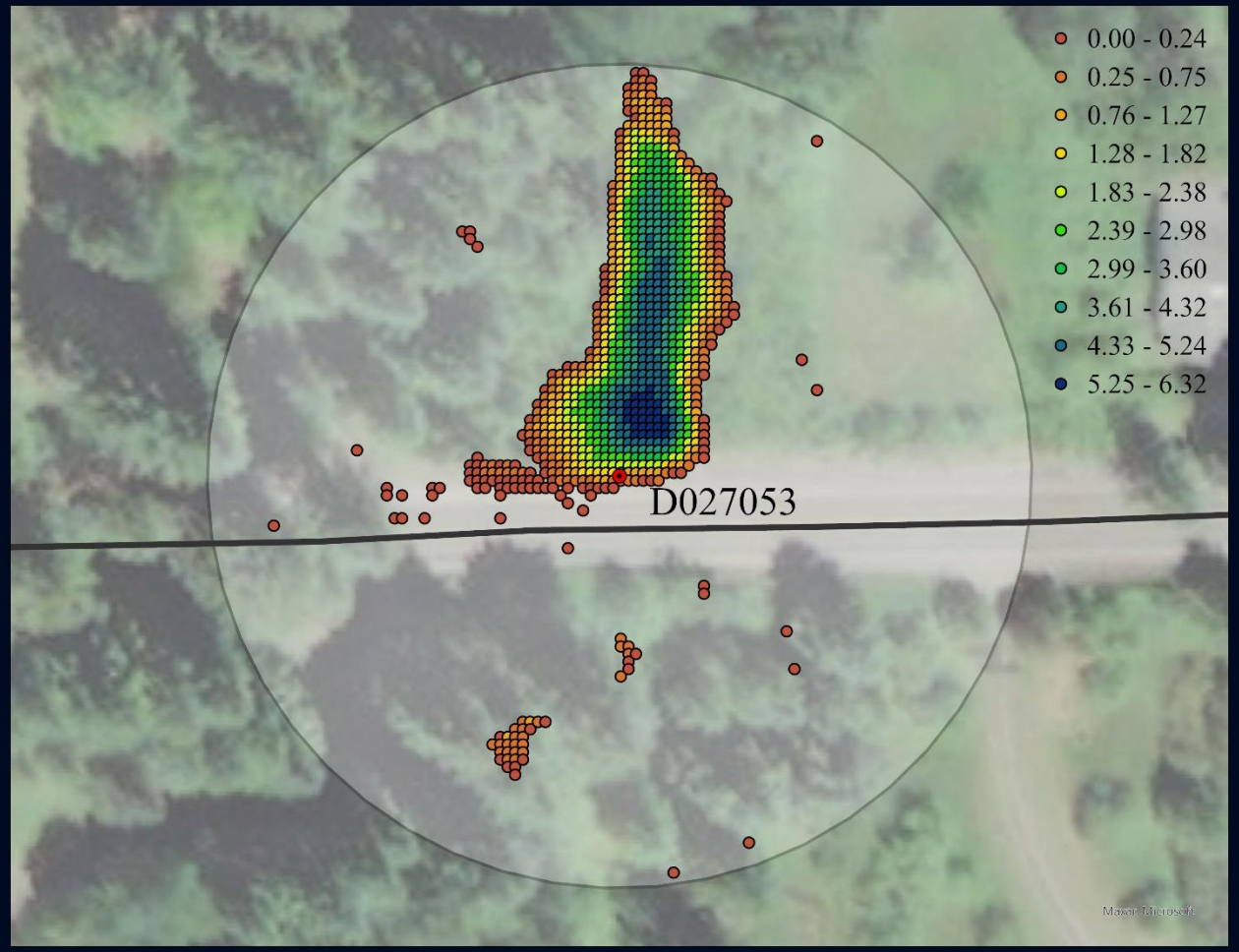
Hydro-condition the surrounding culvert

- To automate this process, search within 100ft of the culvert
- Calculate the depth of each cell (DEMFILL – DEM)



Hydro-condition the surrounding culvert

- Use the highway centerline to define each side of the highway to bisect



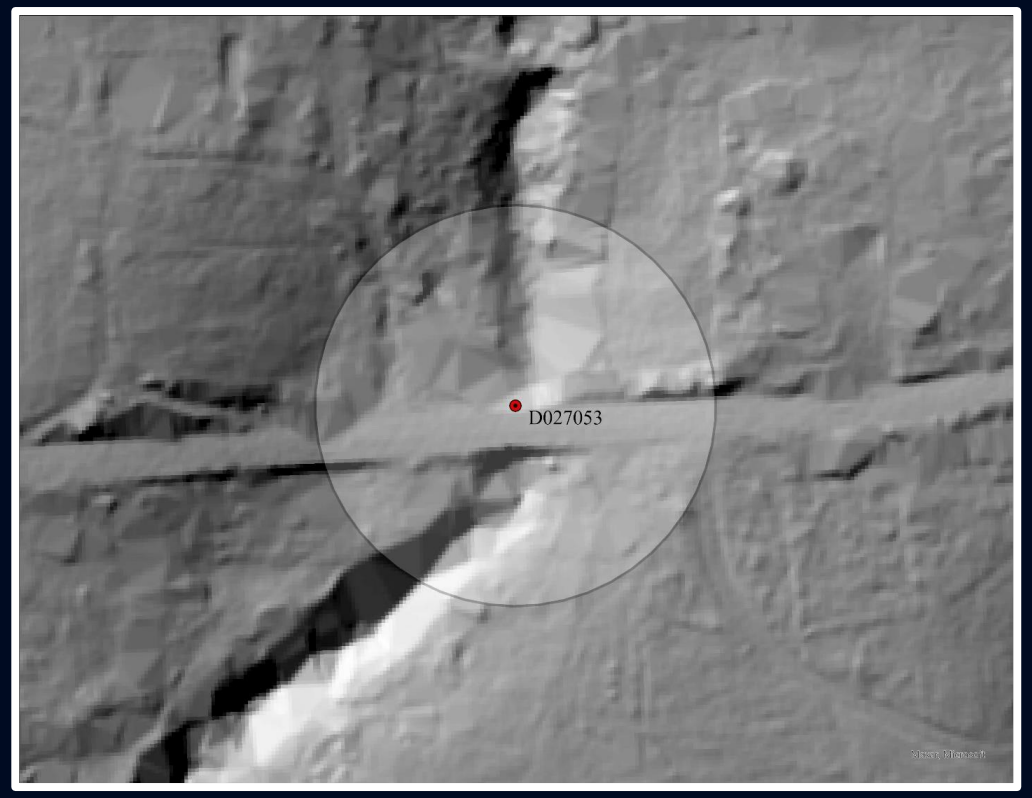
Hydro-condition the surrounding culvert

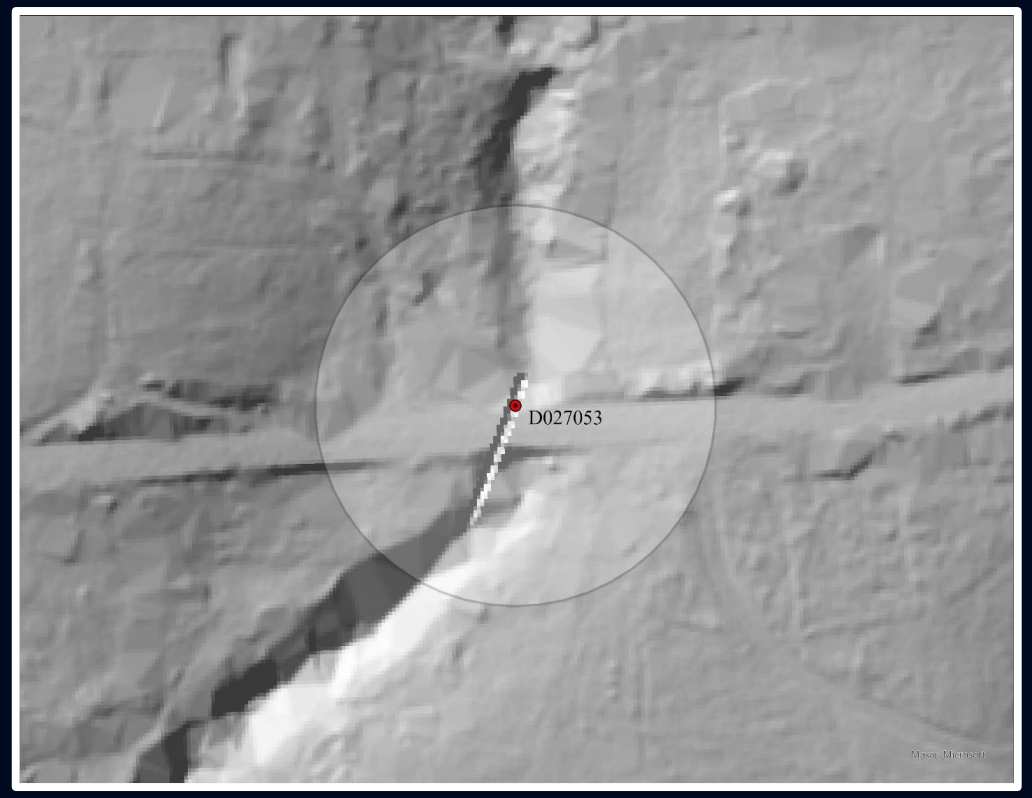
- Find the greatest depth of either side and use those as the start and end of a cut line through the highway

Hydro-condition the surrounding culvert

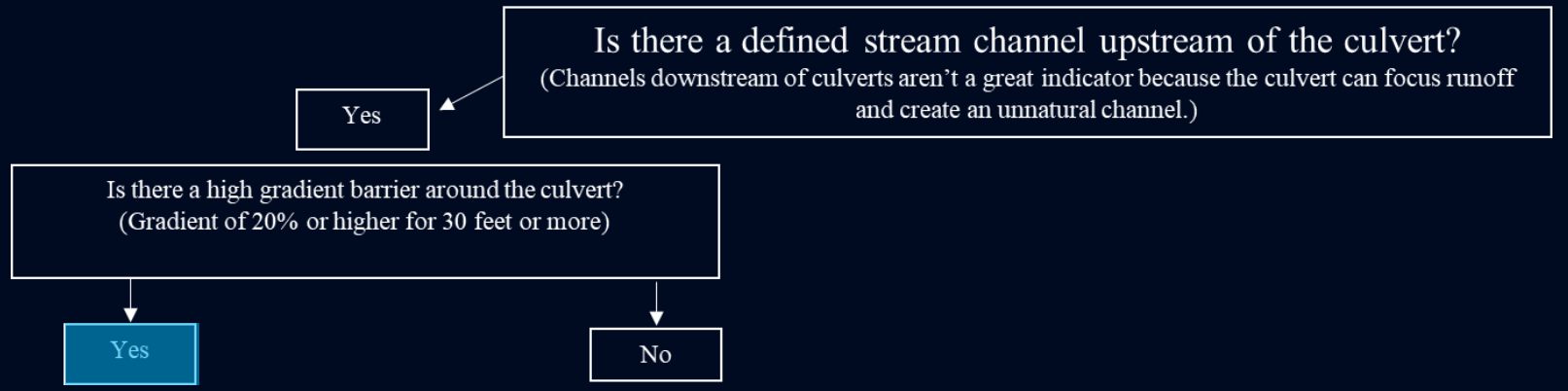
- Route a cutline through the highway and the culvert to act as a pseudo culvert line under the highway and burn it into the DEM

Hydro-condition the surrounding culvert



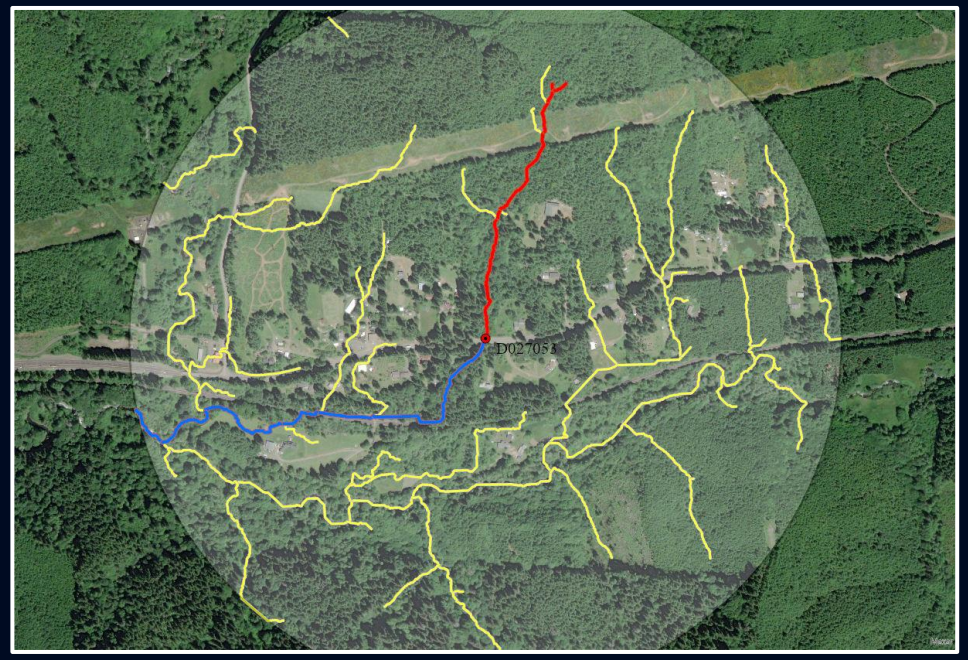


Hydro-condition the surrounding culvert



- If the upstream stream channel is a Strahler stream order >= 2, then the flow chart moves to the "yes" box

- If the upstream stream channel is a Strahler stream order < 2, then this box is a "no"



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No

Is the high gradient barrier downstream?

Yes

No

Probably no fish

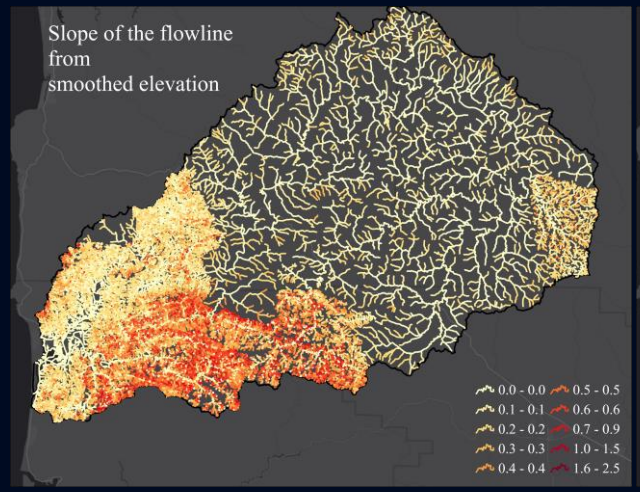
May have isolated populations or lamprey above.

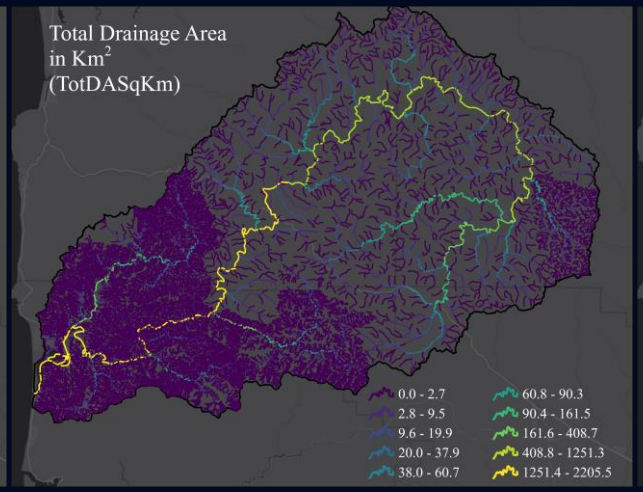
Check with District or e-fish to confirm no fish

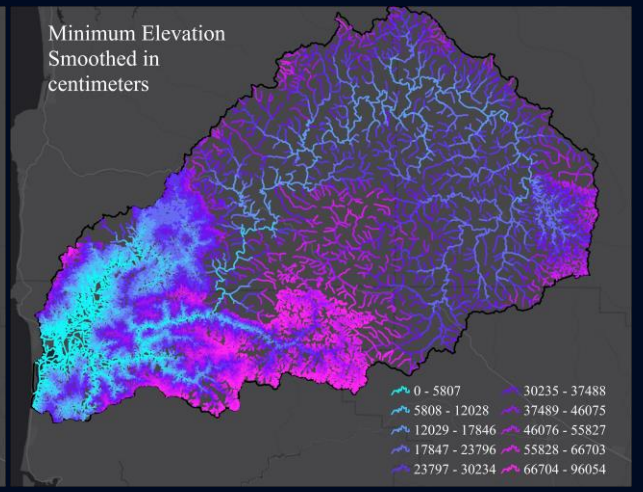
Native Migratory Fishes (NMF)

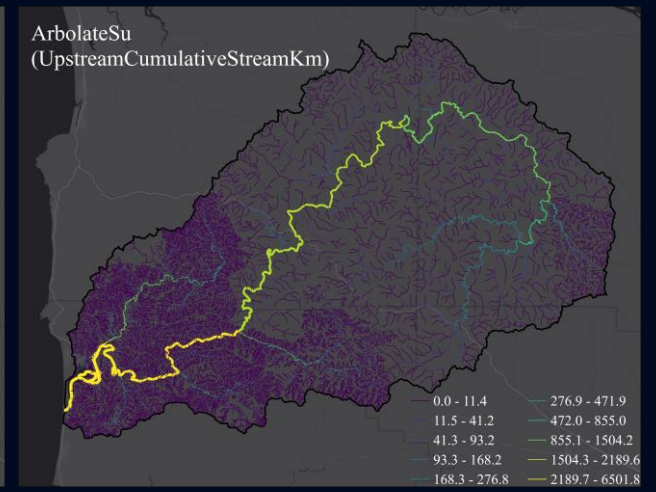
1. *Acipenser medirostris*……Green sturgeon
2. *Acipenser transmontanus*……..White sturgeon
3. *Amphistichus rhodoterus*……Redtail surfperch
4. *Catostomus columbianus*……Bridgelip sucker
5. *Catostomus luxatus/Deltistes luxa*tus…….Lost River sucker
6. *Catostomus macrocheilus*……...Largescale sucker
7. *Catostomus microps*……....Modoc sucker
8. *Catostomus occidentalis*……Goose Lake sucker
9. *Catostomus platyrhynchus*……..Mountain sucker
10. *Catostomus rimiculus*……Klamath smallscale sucker
11. *Catostomus snyderi*……Klamath largescale sucker
12. *Catostomus tahoensis*……Tahoe sucker
13. *Catostomus warnerensis*……Warner sucker
14. *Chasmistes brevirostris*…… Shortnose sucker
15. *Hypomesus pretiosus*……..Surf smelt
16. *Lampetra ayresi*…… River lamprey
17. *Lampetra lethophaga*……Pit-Klamath lamprey
18. *Lampetra minima*……Miller Lake lamprey
19. *Lampetra similes*……Klamath River lamprey
20. *Lampetra tridentate*……Pacific lamprey
21. *Oncorhynchus clarki*……..Coastal cutthroat
22. *Oncorhynchus keta*……..Chum salmon
23. *Oncorhynchus kisutch*……Coho salmon
24. *Oncorhynchus mykiss*…… Steelhead, rainbow and redband trout
25. *Oncorhynchus nerka*……Sockeye salmon/kokanee
26. *Oncorhynchus tshawytscha*……Chinook salmon
27. *Prosopium williamsoni*……Mountain whitefish
28. *Ptychocheilus oregonensis*…… Northern pikeminnow
29. *Ptychocheilus umpquae*……..Umpqua pikeminnow
30. *Salvelinus confluentus*……Bull trout
31. *Spirinchus thaleichthys*……Longfin smelt
32. *Thaleichthys pacificus*……Eulachon

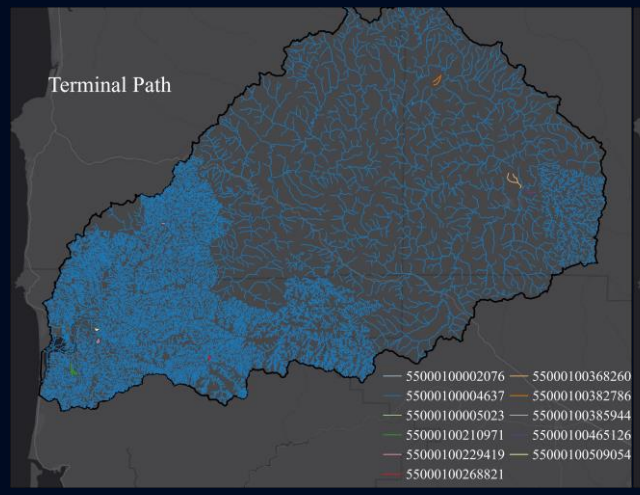
Covariates

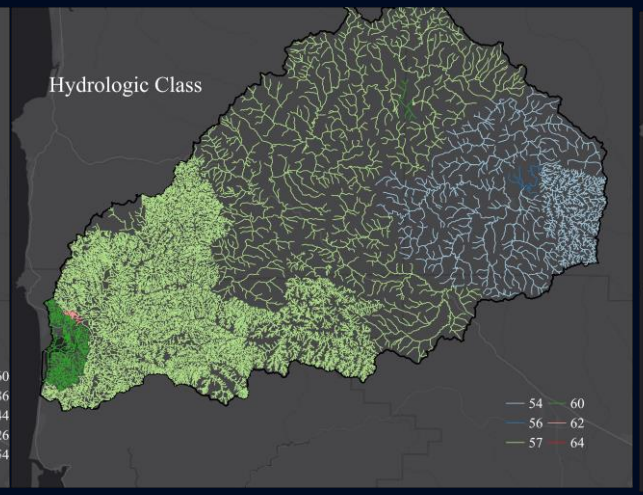

Slope of the flowline from smoothed elevation
0.0 - 0.0
0.1 - 0.1
0.2 - 0.2
0.3 - 0.3
0.4 - 0.4
0.5 - 0.5
0.6 - 0.6
0.7 - 0.9
1.0 - 1.5
1.6 - 2.5

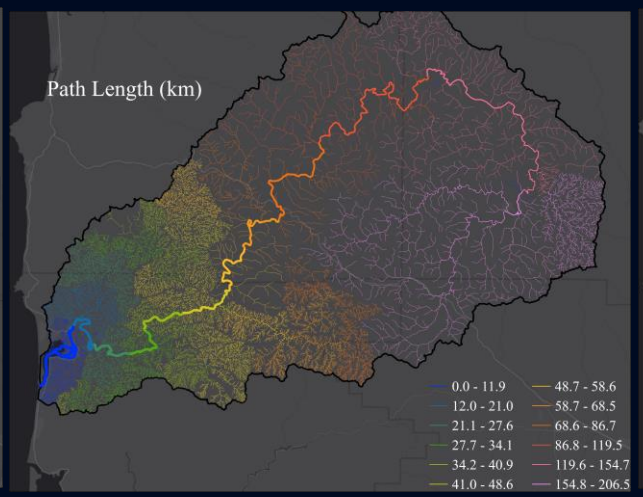

Total Drainage Area in Km^2 (TotDASqKm)
0.0 - 2.7
2.8 - 9.5
9.6 - 19.9
20.0 - 37.9
38.0 - 60.7
60.8 - 90.3
90.4 - 161.5
161.6 - 408.7
408.8 - 1251.3
1251.4 - 2205.5

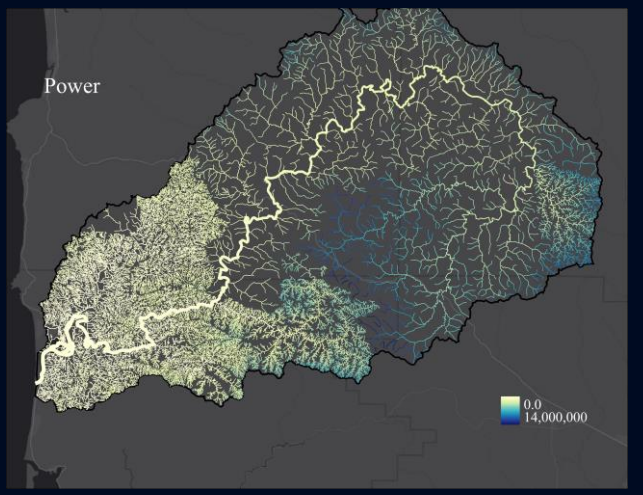

Minimum Elevation Smoothed in centimeters
0 - 5807
5808 - 12028
12029 - 17846
17847 - 23796
23797 - 30234
30235 - 37488
37489 - 46075
46076 - 55827
55828 - 66703
66704 - 96054


ArbolateSu (UpstreamCumulativeStreamKm)
0.0 - 11.4
11.5 - 41.2
41.3 - 93.2
93.3 - 168.2
168.3 - 276.8
276.9 - 471.9
472.0 - 855.0
855.1 - 1504.2
1504.3 - 2189.6
2189.7 - 6501.8

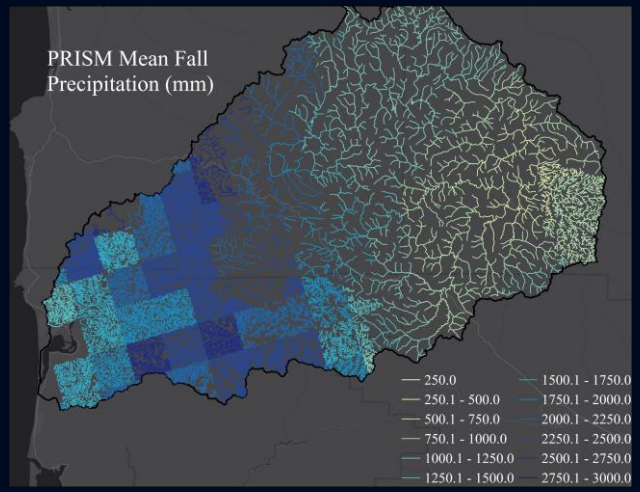

Terminal Path
55000100002076
55000100004637
55000100005023
55000100210971
55000100229419
55000100268821
55000100368260
55000100382786
55000100385944
55000100465126
55000100509054

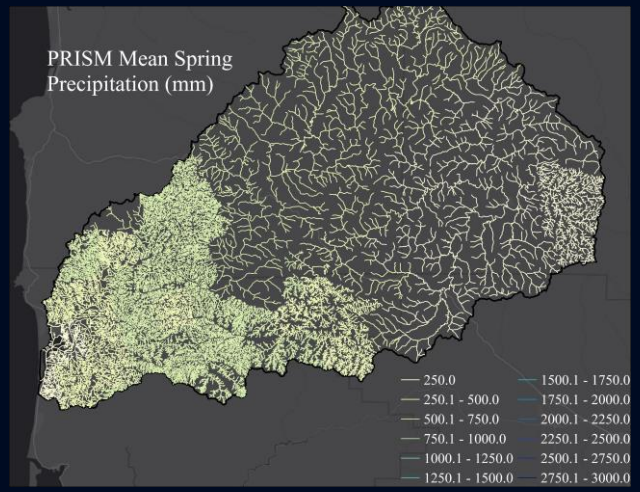

Hydrologic Class
54
56
57
60
62
64

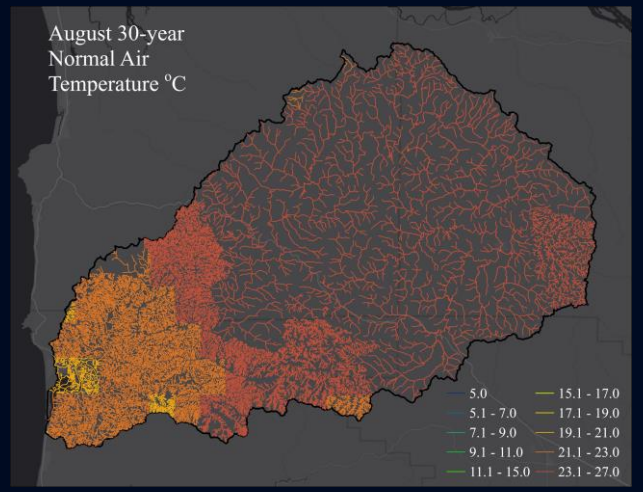

Path Length (km)
0.0 - 11.9
12.0 - 21.0
21.1 - 27.6
27.7 - 34.1
34.2 - 40.9
41.0 - 48.6
48.7 - 58.6
58.7 - 68.5
68.6 - 86.7
86.8 - 119.5
119.6 - 154.7
154.8 - 206.5

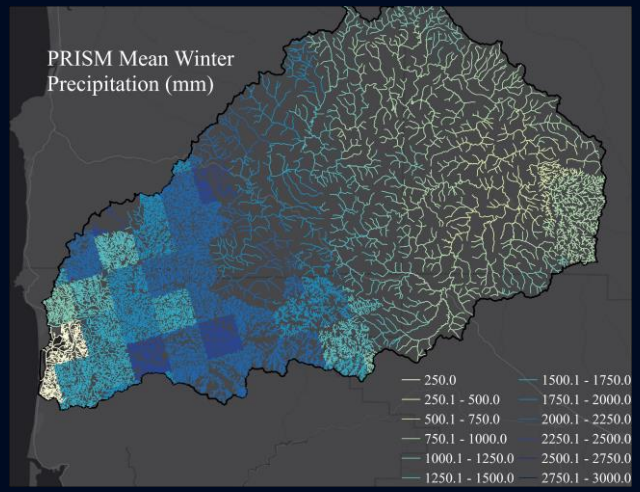

Power
0.0
14,000,000

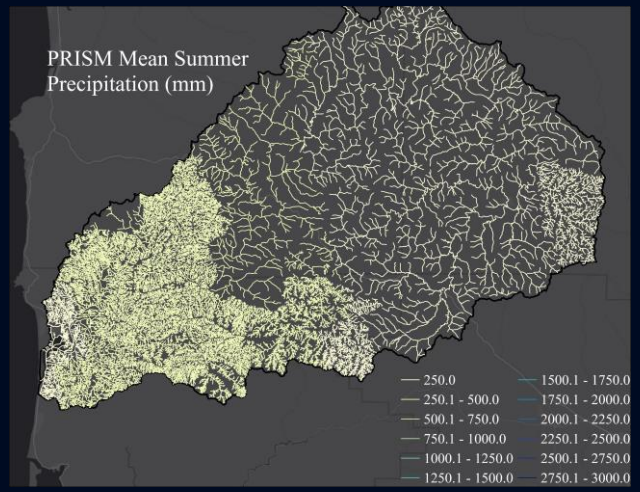
Covariates

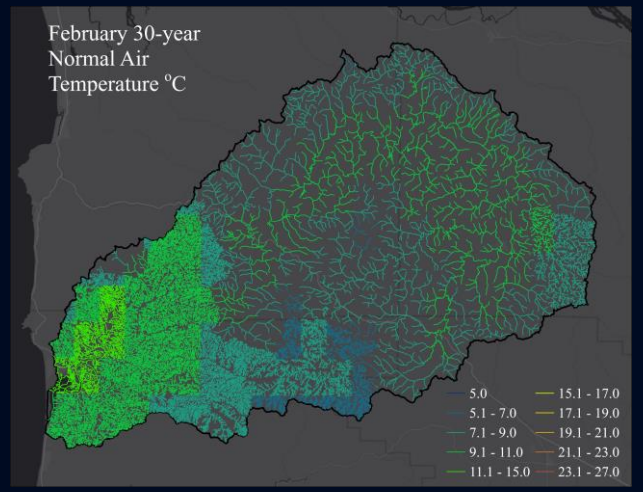

PRISM Mean Fall
Precipitation (mm)
250.0
250.1 - 500.0
500.1 - 750.0
750.1 - 1000.0
1000.1 - 1250.0
1250.1 - 1500.0
1500.1 - 1750.0
1750.1 - 2000.0
2000.1 - 2250.0
2250.1 - 2500.0
2500.1 - 2750.0
2750.1 - 3000.0

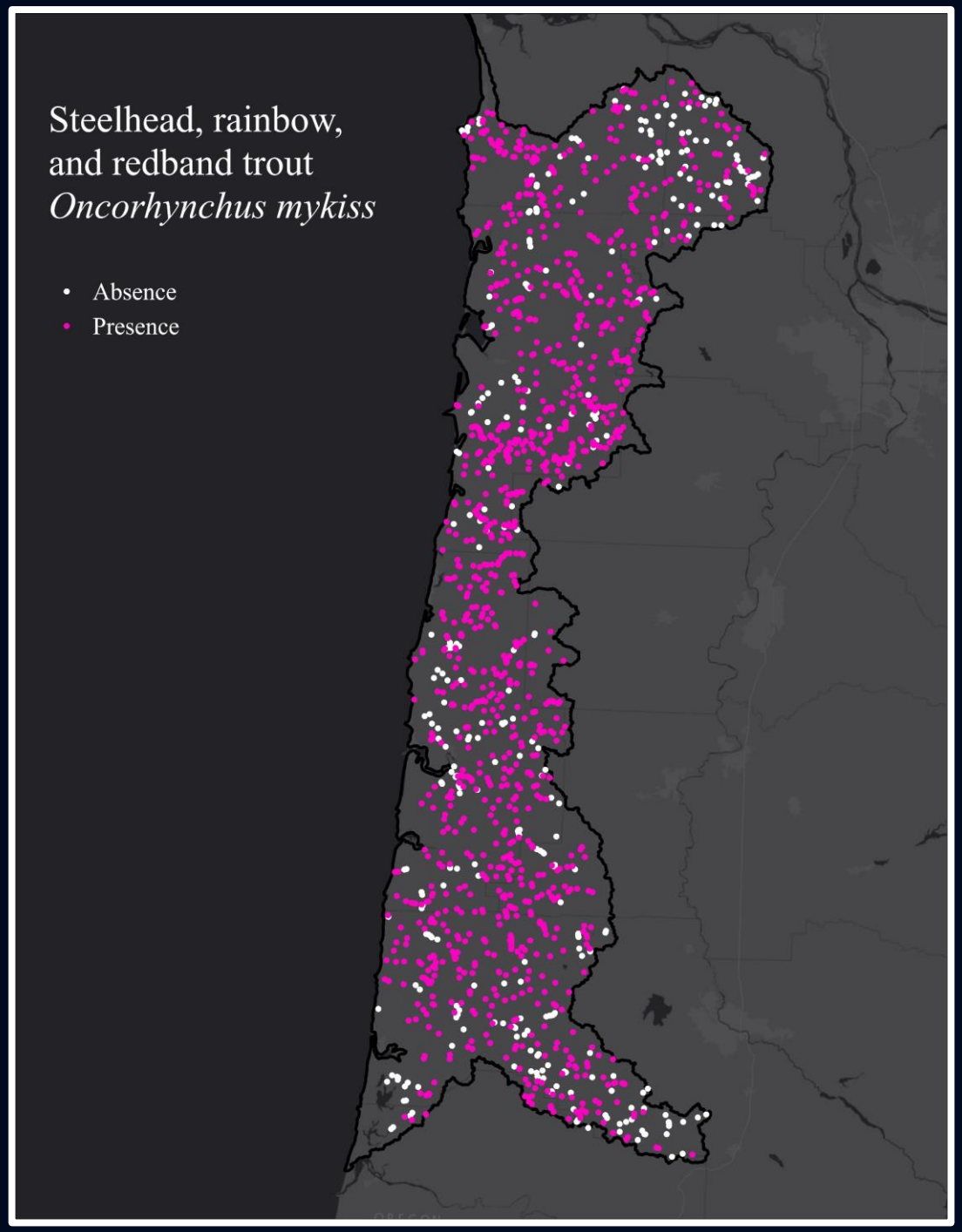

PRISM Mean Spring
Precipitation (mm)
250.0
250.1 - 500.0
500.1 - 750.0
750.1 - 1000.0
1000.1 - 1250.0
1250.1 - 1500.0
1500.1 - 1750.0
1750.1 - 2000.0
2000.1 - 2250.0
2250.1 - 2500.0
2500.1 - 2750.0
2750.1 - 3000.0

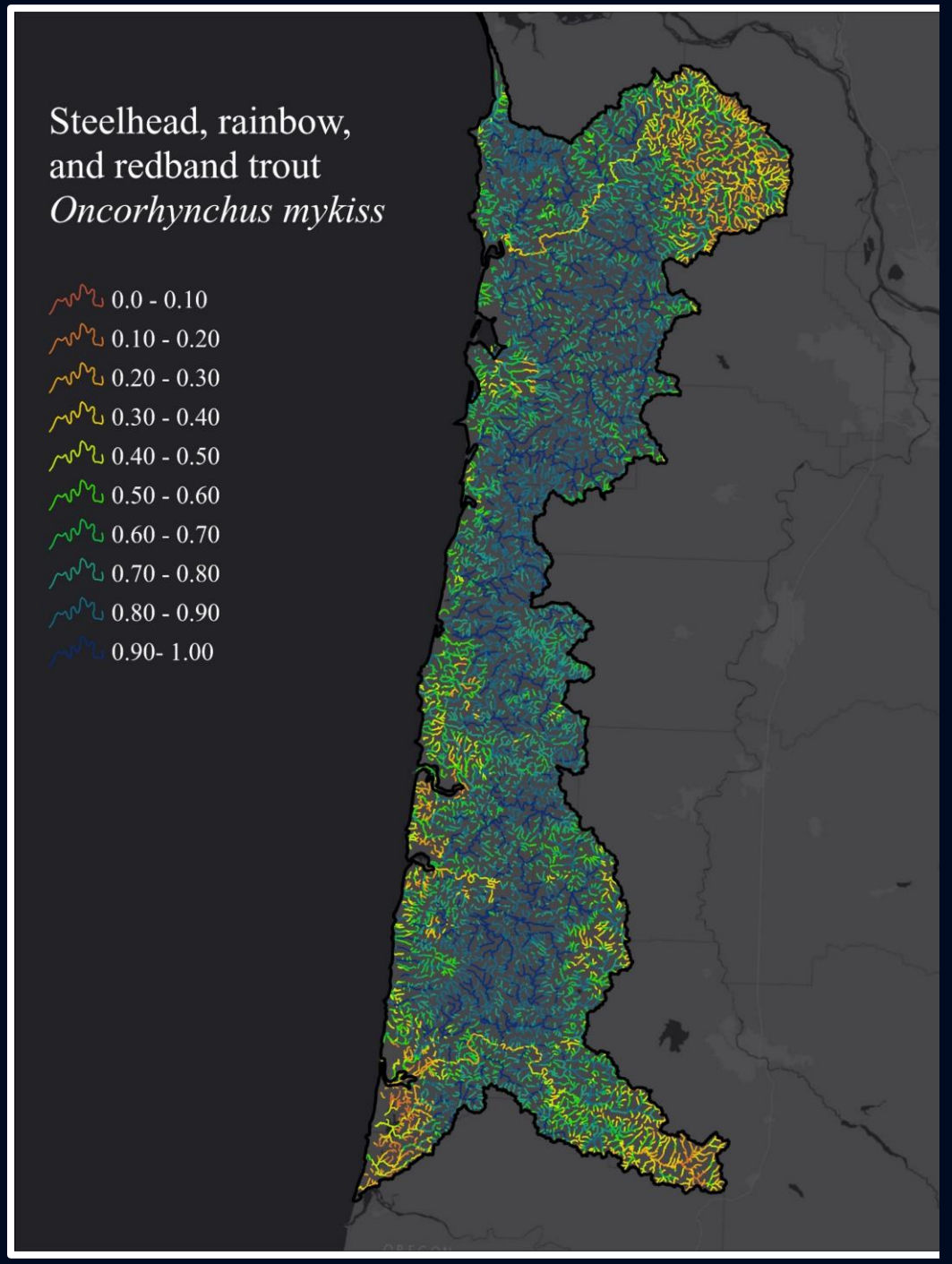

August 30-year
Normal Air
Temperature °C
5.0
5.1 - 7.0
7.1 - 9.0
9.1 - 11.0
11.1 - 15.0
15.1 - 17.0
17.1 - 19.0
19.1 - 21.0
21.1 - 23.0
23.1 - 27.0


PRISM Mean Winter
Precipitation (mm)
250.0
250.1 - 500.0
500.1 - 750.0
750.1 - 1000.0
1000.1 - 1250.0
1250.1 - 1500.0
1500.1 - 1750.0
1750.1 - 2000.0
2000.1 - 2250.0
2250.1 - 2500.0
2500.1 - 2750.0
2750.1 - 3000.0


PRISM Mean Summer
Precipitation (mm)
250.0
250.1 - 500.0
500.1 - 750.0
750.1 - 1000.0
1000.1 - 1250.0
1250.1 - 1500.0
1500.1 - 1750.0
1750.1 - 2000.0
2000.1 - 2250.0
2250.1 - 2500.0
2500.1 - 2750.0
2750.1 - 3000.0

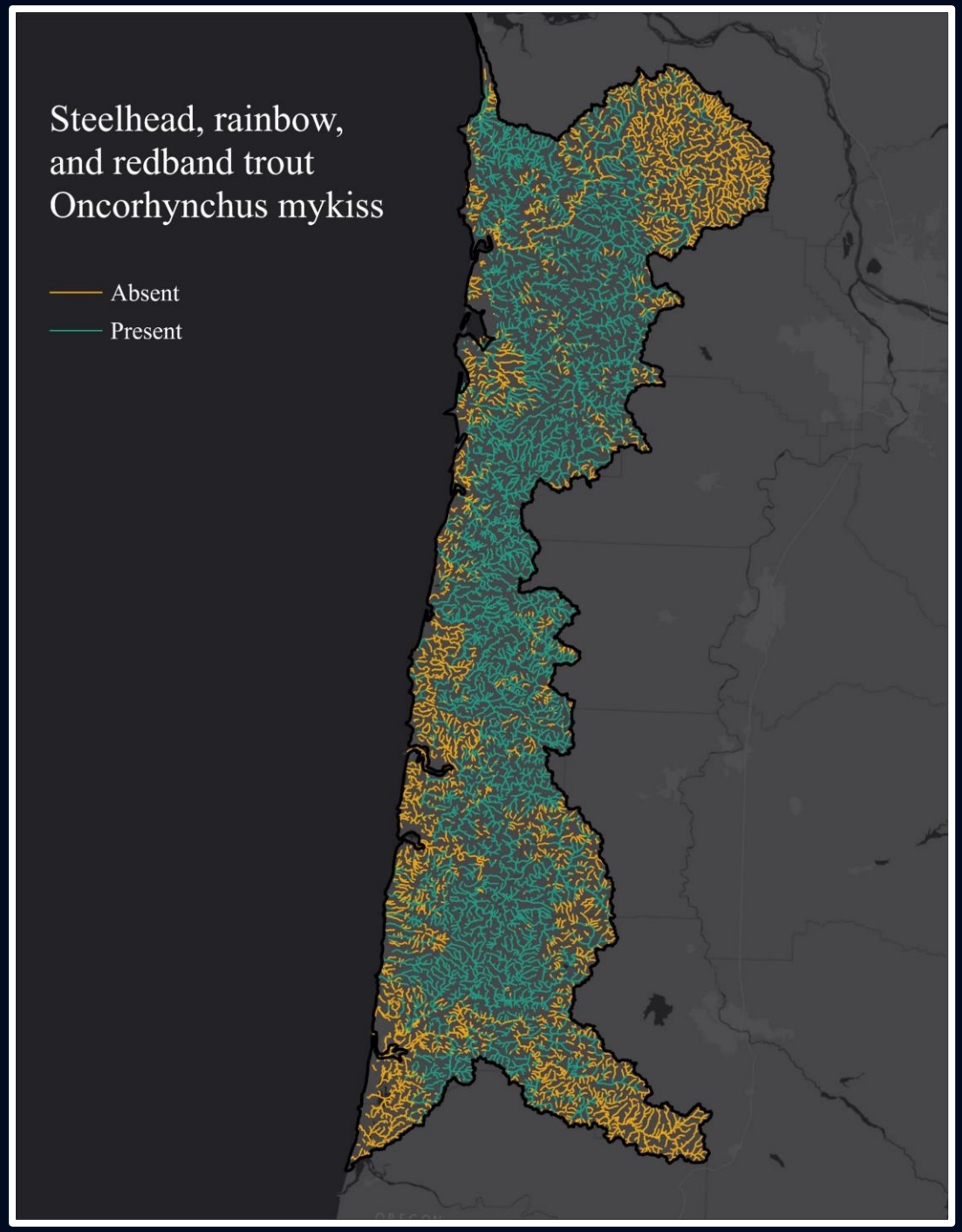

February 30-year
Normal Air
Temperature °C
5.0
5.1 - 7.0
7.1 - 9.0
9.1 - 11.0
11.1 - 15.0
15.1 - 17.0
17.1 - 19.0
19.1 - 21.0
21.1 - 23.0
23.1 - 27.0


Steelhead, rainbow,
and redband trout
Oncorhynchus mykiss
Absence
Presence


Steelhead, rainbow,
and redband trout
Oncorhynchus mykiss
0.0 - 0.10
0.10 - 0.20
0.20 - 0.30
0.30 - 0.40
0.40 - 0.50
0.50 - 0.60
0.60 - 0.70
0.70 - 0.80
0.80 - 0.90
0.90- 1.00

Cut-toff

702.5



Is there a defined stream channel upstream of the culvert?
(Channels downstream of culverts aren't a great indicator because the culvert can focus runoff and create an unnatural channel.)

Yes

Is there a high gradient barrier around the culvert?
(Gradient of 20% or higher for 30 feet or more)

No

Stream is known to have connection with fish bearing waterbody, or fish presence is known downstream of the culvert?

No

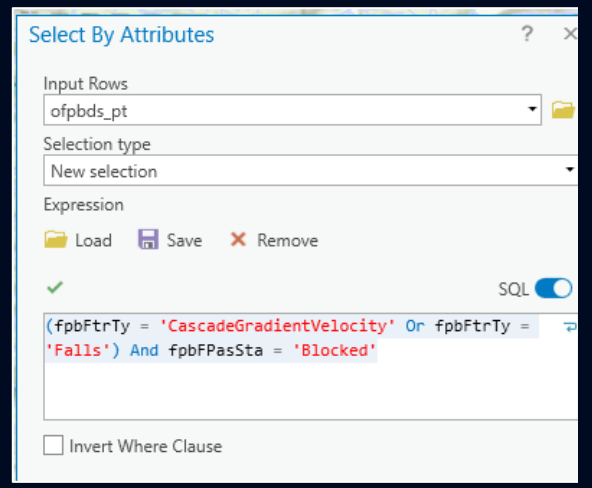
Yes

Fish
This path does not take into account unnatural upstream channels in non-historic habitat or small drainages with a lack of livable space. Look for those conditions and verify fish call with the district if in doubt.

Lamprey cutoff was .357

Natural Barriers to movement

- Barrier data was derived from the ODFW barrier dataset
- Selected only natural barriers such as Falls or Cascade, Gradient, and Velocity barriers that are deemed “blocked”



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Yes

Fish
(Although further investigation is warranted if a barrier is suspected.)

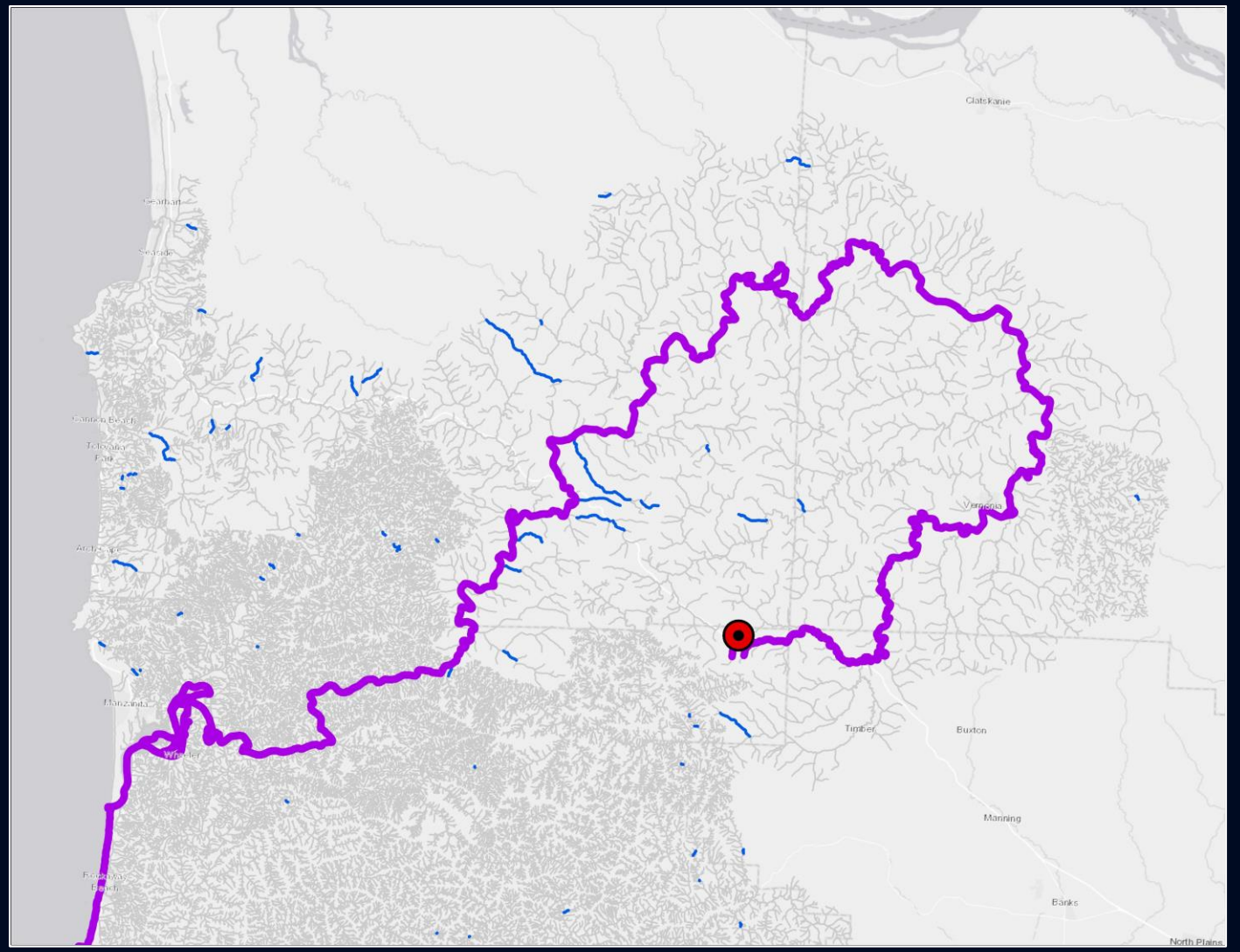
Probably no fish
Check with District or e-fish to confirm no fish

Messages

Start Time: Tuesday, December 14, 2021 2:08:47 PM

Function Result: ADD(Barriers1) = 1.000000.

Succeeded at Tuesday, December 14, 2021 2:09:03 PM (Elapsed Time: 15.84 seconds)



Standing Water

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Is there standing water, wetland, lake, or slough habitat on both sides of the culvert?

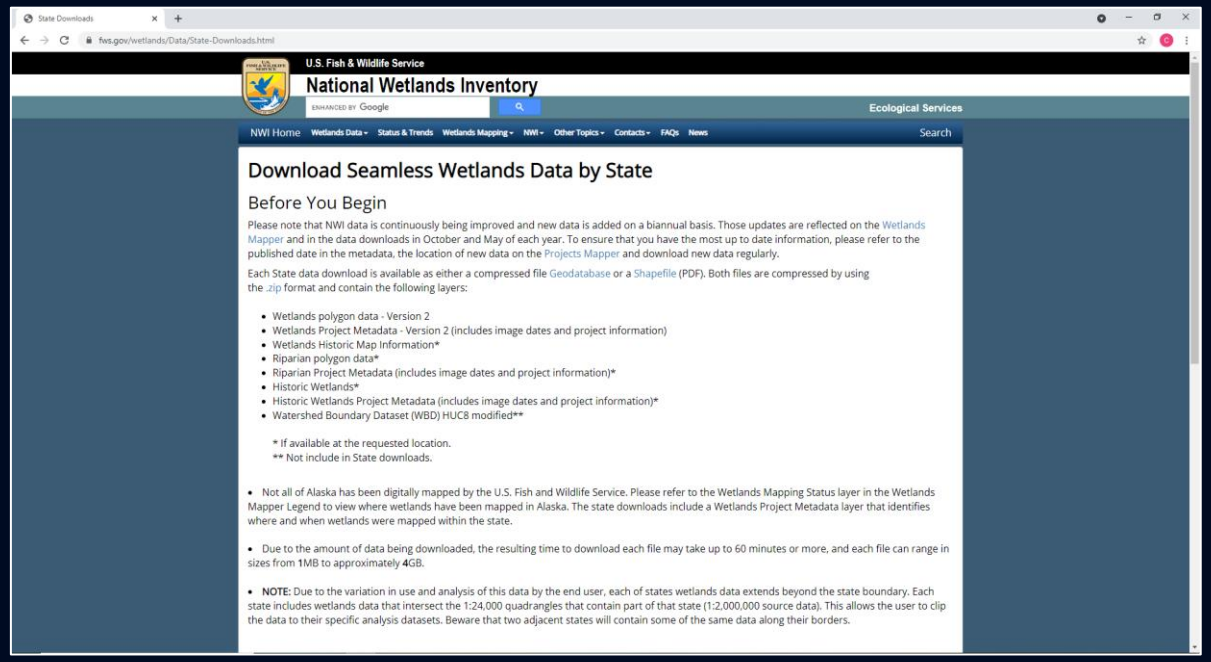
No

Yes

No fish
- Dry channel

(roadside drainage)
- Water only on one side

(may be historic check with District)



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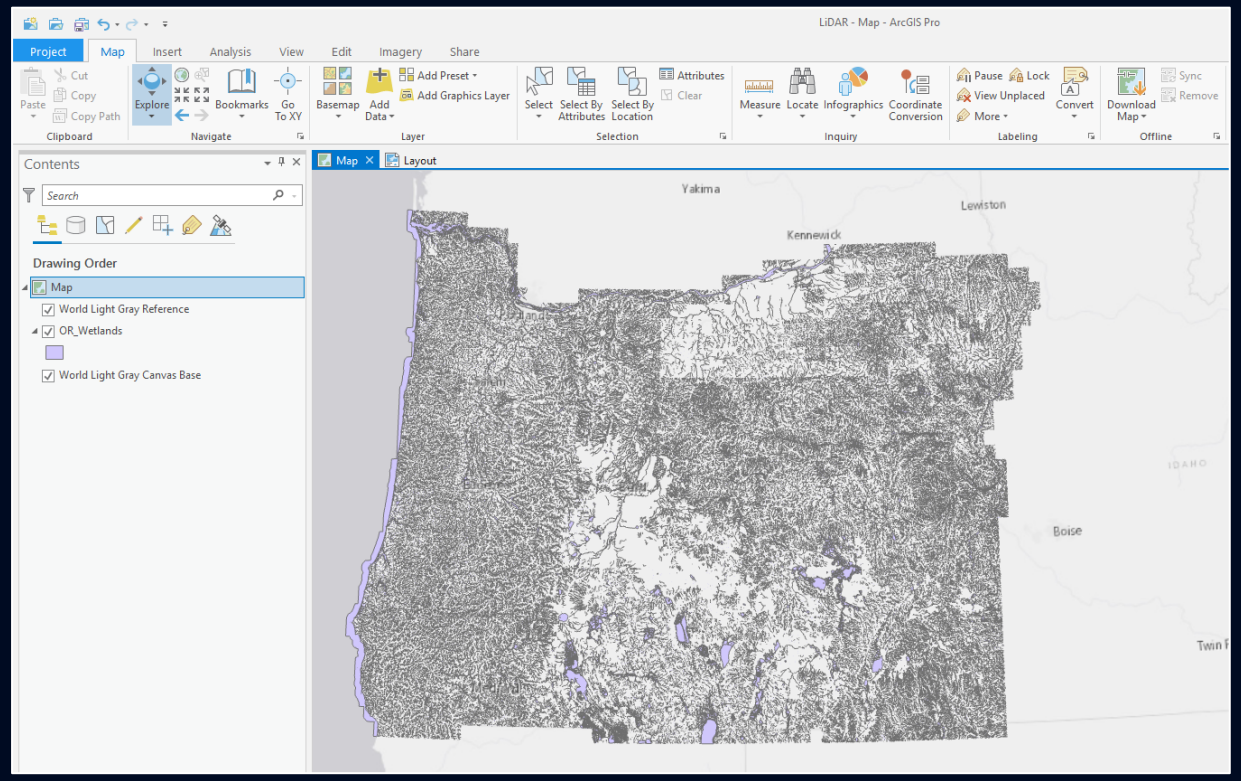

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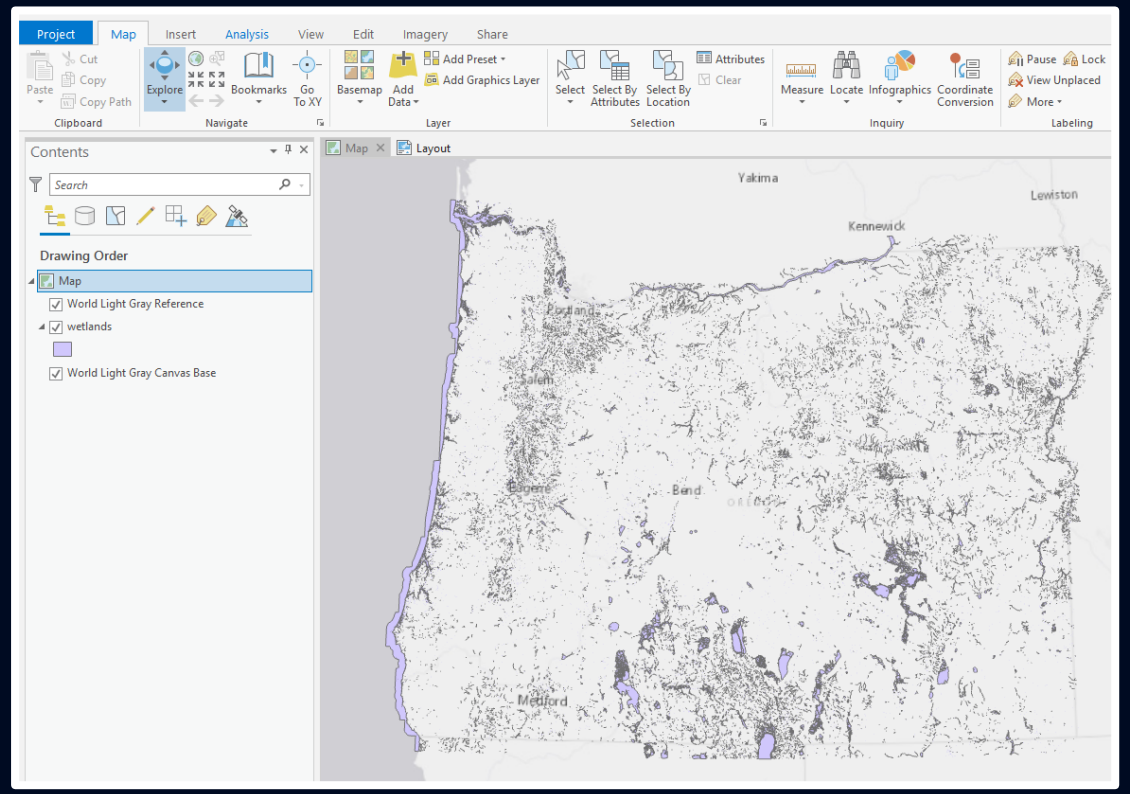
(may be historic check with District)

Standing Water



Is there a defined stream channel upstream of the culvert?
(Channels downstream of culverts aren't a great indicator because the culvert can focus runoff and create an unnatural channel.)

No

Is there standing water, wetland, lake, or slough habitat on both sides of the culvert?

No

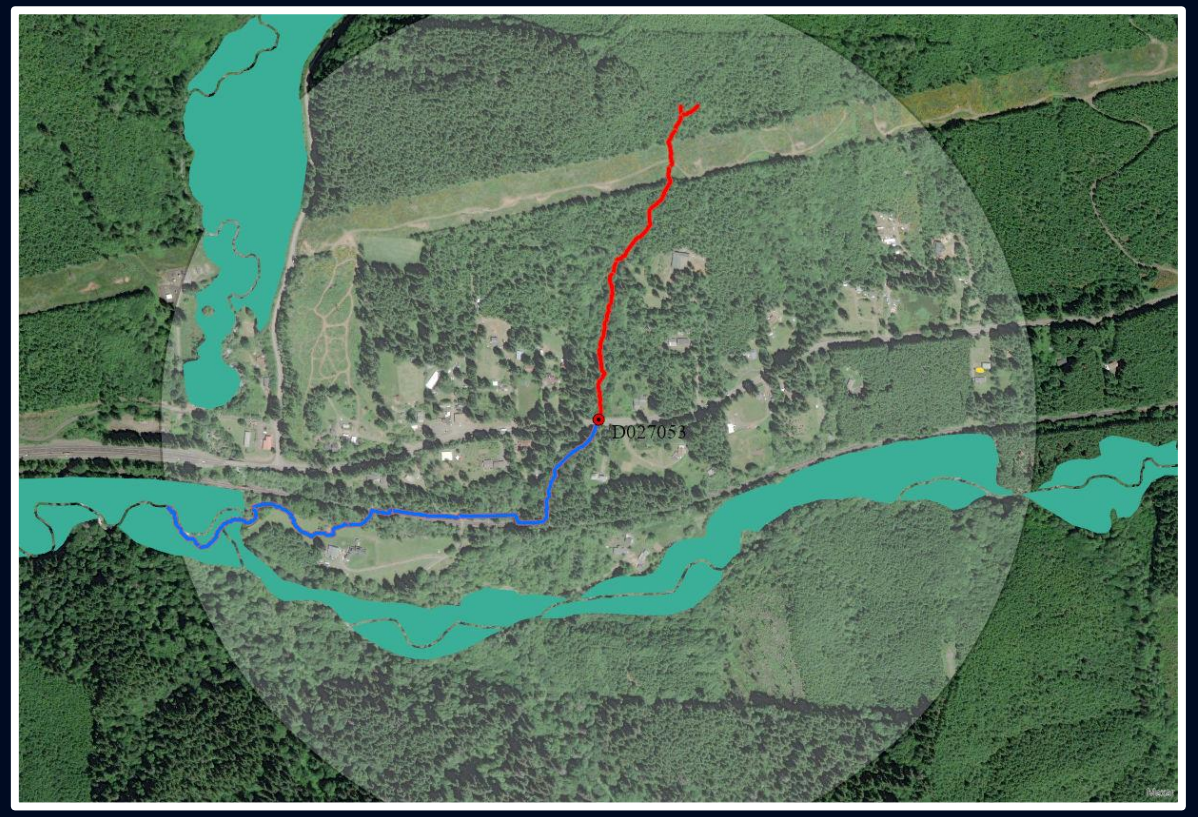
Yes

No fish
- Dry channel

(roadside drainage)
- Water only on one side

(may be historic check with District)

Standing Water



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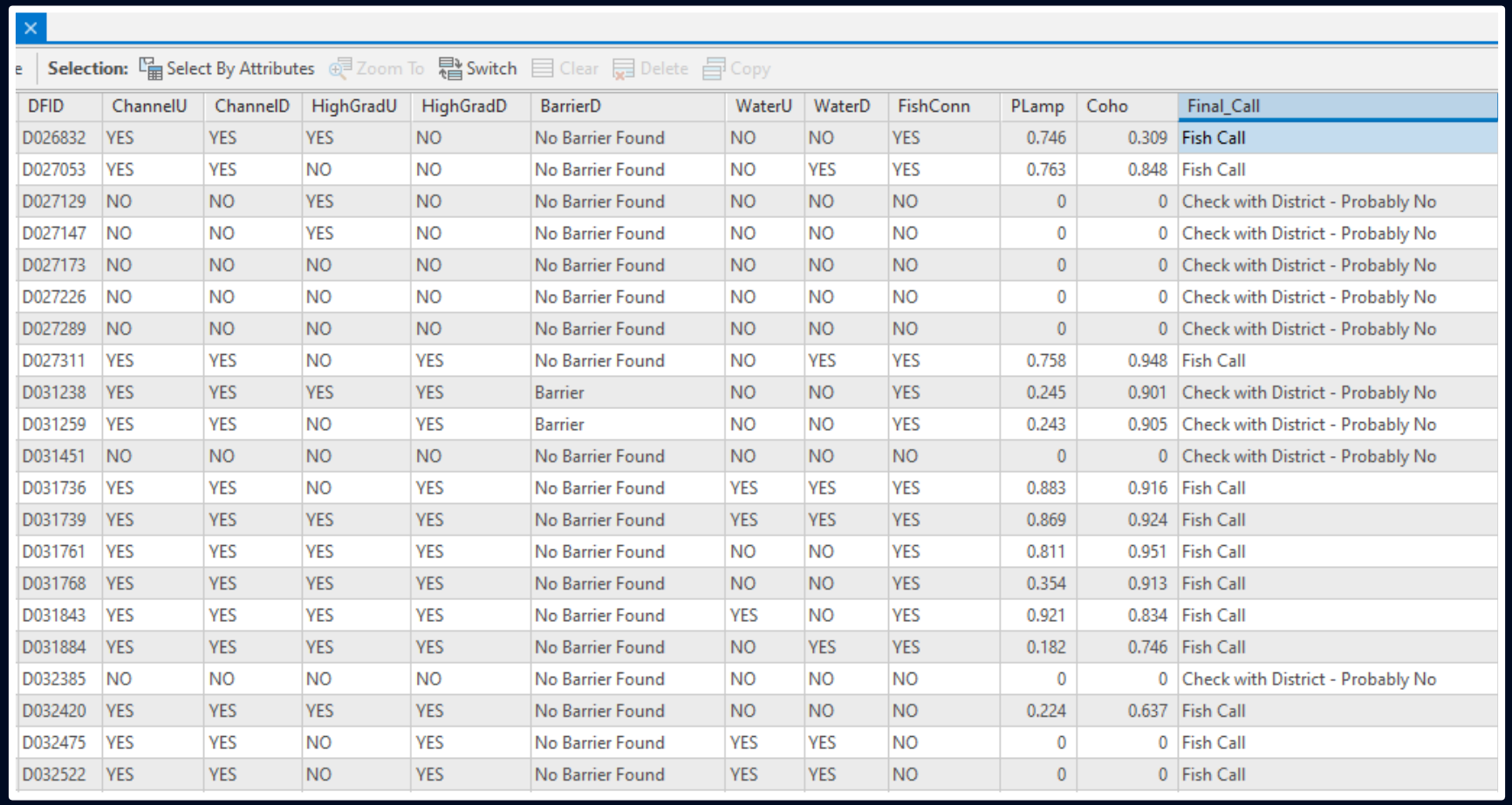
Resulting Attribute Table



Selection: Select By Attributes | Zoom To | Switch | Clear | Delete | Copy

DFID	ChannelU	ChannelD	HighGradU	HighGradD	BarrierD	WaterU	WaterD	FishConn	PLamp	Coho	Final_Call
D026832	YES	YES	YES	NO	No Barrier Found	NO	NO	YES	0.746	0.309	Fish Call
D027053	YES	YES	NO	NO	No Barrier Found	NO	YES	YES	0.763	0.848	Fish Call
D027129	NO	NO	YES	NO	No Barrier Found	NO	NO	NO	0	0	Check with District - Probably No
D027147	NO	NO	YES	NO	No Barrier Found	NO	NO	NO	0	0	Check with District - Probably No
D027173	NO	NO	NO	NO	No Barrier Found	NO	NO	NO	0	0	Check with District - Probably No
D027226	NO	NO	NO	NO	No Barrier Found	NO	NO	NO	0	0	Check with District - Probably No
D027289	NO	NO	NO	NO	No Barrier Found	NO	NO	NO	0	0	Check with District - Probably No
D027311	YES	YES	NO	YES	No Barrier Found	NO	YES	YES	0.758	0.948	Fish Call
D031238	YES	YES	YES	YES	Barrier	NO	NO	YES	0.245	0.901	Check with District - Probably No
D031259	YES	YES	NO	YES	Barrier	NO	NO	YES	0.243	0.905	Check with District - Probably No
D031451	NO	NO	NO	NO	No Barrier Found	NO	NO	NO	0	0	Check with District - Probably No
D031736	YES	YES	NO	YES	No Barrier Found	YES	YES	YES	0.883	0.916	Fish Call
D031739	YES	YES	YES	YES	No Barrier Found	YES	YES	YES	0.869	0.924	Fish Call
D031761	YES	YES	YES	YES	No Barrier Found	NO	NO	YES	0.811	0.951	Fish Call
D031768	YES	YES	YES	YES	No Barrier Found	NO	NO	YES	0.354	0.913	Fish Call
D031843	YES	YES	YES	YES	No Barrier Found	YES	NO	YES	0.921	0.834	Fish Call
D031884	YES	YES	YES	YES	No Barrier Found	NO	YES	YES	0.182	0.746	Fish Call
D032385	NO	NO	NO	NO	No Barrier Found	NO	NO	NO	0	0	Check with District - Probably No
D032420	YES	YES	YES	YES	No Barrier Found	NO	NO	NO	0.224	0.637	Fish Call
D032475	YES	YES	NO	YES	No Barrier Found	YES	YES	NO	0	0	Fish Call
D032522	YES	YES	NO	YES	No Barrier Found	YES	YES	NO	0	0	Fish Call