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June 10, 2022

To: Mr. Patrick Chavez, PE
Albuquerque Metropolitan Arroyo Flood Control Authority
2600 Prospect Ave NE
Albuquerque, NM 87107

From: Mr. David "Sonny" Cooper, PE
Weston Solutions, Inc.
3840 Commons Ave NE
Albuquerque, NM 87109

Re: Revised Fourth Quarter (October – December) 2021 In-Stream Water Quality Monitoring Memo

1 Background

The Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) maintains a broad collection of field instrumentation within their jurisdictional watershed to monitor surface water quality. Surface water quality monitoring is performed to comply with the Middle Rio Grande Watershed Based Municipal Separate Storm Sewer System (MS4) permit (NMR 04A000) issued in December 2014. This data is collected, evaluated, and analyzed related to MS4 requirements, and presented as applicable in AMAFCA's MS4 Annual Report to the U.S. Environmental Protection Agency (EPA), Region 6. The following describes the duties and responsibilities fulfilled by Weston Solutions, Inc. (Weston) in support of instrument operation, maintenance, and data reporting tabulations for the fourth quarter of 2021.

AMAFCA maintains several water quality sondes within the Rio Grande. The locations of the four sondes were chosen to monitor the Rio Grande from US-550 to Isleta Pueblo. Surface water quality data is collected from four sites using Aqua Troll 600 sondes (manufactured by In-Situ) with remote transmission. Current locations along the Rio Grande include, from north (upstream) to south (downstream):

- US Highway 550 bridge in Bernalillo, NM
- Sandia Pueblo boundary just upstream of the North Diversion Channel outfall
- Central Avenue bridge spanning the Rio Grande
- Isleta Dam site at the northern Isleta Pueblo boundary.

These four sondes monitor and transmit several water quality parameter measurements near real-time. Data is transmitted to In-Situ's online dashboard at approximately 30-minute intervals. The data can be viewed and downloaded from the Hydro-Vu website operated by In-Situ. Access to data is shared with downstream stakeholders via the Hydro-Vu website (https://www.hydrovu.com).

The data is collected and reported by AMAFCA's current Stormwater Management Program (SWMP), dated December 1, 2018. Per SWMP Table ID #8, and to comply with the MS4 Permit Part I.C.1.c, AMAFCA monitors dissolved oxygen (DO) and temperature at these locations. The document providing

guidance for surface water quality exceedances is New Mexico Administrative Code Title 20, Chapter 6, Part 4 (20.6.4 NMAC) *Environmental Protection Water Quality Standards for Interstate and Intrastate Surface Waters*. Under 20.6.4 NMAC and the Pueblo of Isleta *Surface Water Quality Standards* for the reach of the Rio Grande under the jurisdiction of the MS4 permit, the Rio Grande has a designed use of "Marginal Warm water Aquatic Life". 20.6.4.900 H (6) NMAC provides the following guidance for marginal warm water for aquatic life, for both non-stormwater and stormwater flow conditions:

> *Dissolved oxygen 5mg/L or more. pH within the range of 6.6 to 9.0 and maximum temperature 32.2°C (90°F). Where a segment-specific temperature criterion is indicated in 20.6.4.101-899 NMAC, it is the maximum temperature.*

Per 20.6.4 NMAC, DO and temperature have established surface water quality standards while turbidity does not. In addition to 20.6.4 NMAC, the Pueblo of Isleta *Surface Water Quality Standards* also governs surface water quality standards under the MS4 Permit. The standards described in the *Surface Water Quality Standards* are the same as those described in 20.6.4 NMAC in regards to DO and temperature. Regarding turbidity, the Pueblo of Isleta *Surface Water Quality Standards* provides the following guidance under Section III, Paragraph G:

> *Turbidity attributable to other than natural causes shall not reduce light transmission to a point where aquatic biota are inhibited or to a point that causes an unaesthetic and substantial visible contrast with the natural appearance of the water. Specifically, turbidity shall not exceed 5 NTU over background when background turbidity is 50 NTU or less, with no more than 10 percent increase when background turbidity is more than 50 NTU.*

This memorandum provides the collected data for all three surface water quality parameters at all four sonde locations.

2 Sonde Data Discussion

Data from Community Collaborative Rain, Hail, and Snow Network (CoCoRaHS) was used to determine if a storm event occurred within the Middle Rio Grande MS4 Permit watershed. During the Fourth Quarter (October – December) of 2021, 16 storm events occurred, however, 5 of these events only produced trace amounts of precipitation in the watershed. The storm event dates were used to determine if variations in data from the sondes were potentially related to runoff entering the Rio Grande or if data collected were erroneous due to equipment issues (such as a fouled sensor, data transmission failure, or random anomaly).

The tables below list the average, minimum, and maximum DO, temperature, and turbidity measurements for each sonde during 2021 Quarter 4. Data that appeared to be inaccurate were purged from the dataset. Graphs of each parameter recorded by the sondes are shown in Attachment 1.

2.1 Dissolved Oxygen

Parameter		US 550 Bridge	Sandia Boundary	Central Ave Bridge	Isleta Dam
DO (mg/L)	Average	10.44	10.00	9.03	-
	Minimum	8.57	8.60	5.48	-
	Maximum	11.60	12.23	11.48	-

2.2 Temperature

Parameter		US 550 Bridge	Sandia Boundary	Central Ave Bridge	Isleta Dam
Temperature (°C)	Average	4.95	8.17	9.67	15.92
	Minimum	1.21	1.13	0.28	3.07
	Maximum	8.94	13.75	25.25	24.76

2.3 Turbidity

Parameter		US 550 Bridge	Sandia Boundary	Central Ave Bridge	Isleta Dam
Turbidity (NTU)	Average	215.99	299.25	504.24	491.27
	Minimum	3.56	44.03	45.02	73.67
	Maximum	6,913.99	1,297.38	5,108.82	1,974.39

The surface water quality standards discussed in Section 1, along with storm event dates and daily sonde record keeping, allowed Weston to determine if apparent exceedances were attributed to a natural phenomenon or were erroneous data points. If data appeared to be unrelated to a natural phenomenon, it was removed from the data set collected by the sonde. The following summaries are based upon review of the data, storm events, trends in the data collected, and sonde maintenance efforts:

Sonde	Parameter	Start Date	Start Time	End Date	End Time	Notes
US Highway 550 Bridge	DO, Temperature, and Turbidity.	10/1/2021	06:00	12/1/2021	16:00	Sonde was not deployed in the river. Data removed from data set.
	DO and Turbidity	12/1/2021	16:00	12/8/2021	19:30	Data appeared erroneous. Removed from data set.

Sonde	Parameter	Start Date	Start Time	End Date	End Time	Notes
US Highway 550 Bridge	Temperature	12/1/2021	16:00	12/2/2021	22:00	Data appeared erroneous. Removed from data set.
	Turbidity	12/11/2021	22:00	12/16/2021	16:00	Data appeared erroneous due to a fouling sensor. Removed from data set.
	Turbidity	12/17/2021	4:00	12/17/2021	5:30	Data appeared erroneous. Removed from data set.
Sandia Pueblo Boundary	DO, Temperature, and Turbidity.	10/01/2021	06:00	11/10/2021	19:44	Sonde was not deployed in the river. Data removed from data set.
	Turbidity	11/14/2021	16:30	11/15/2021	20:00	Data appeared erroneous. Removed from the data set.
	DO	11/24/2021	18:30	12/2/2021	23:00	Data appeared erroneous. Removed from the data set.
	Turbidity	11/28/2021	21:30	11/29/2021	11:30	Data appeared erroneous. Removed from the data set.

Sonde	Parameter	Start Date	Start Time	End Date	End Time	Notes
Sandia Pueblo Boundary	Turbidity	12/2/2021	5:00	12/2/2021	14:00	Data appeared erroneous due to a fouling sensor Removed from the data set.
	Turbidity	12/2/2021	20:00	12/2/2021	22:00	Data appeared erroneous. Removed from the data set.
	Turbidity	12/15/2021	10:30	12/15/2021	16:30	Data appeared erroneous. Removed from the data set.
	DO, Temperature, and Turbidity.	12/22/2021	22:30	12/28/2021	16:30	Sonde removed from the river. Data removed from the data set.
Central Avenue Bridge	DO, Temperature, and Turbidity.	10/01/2021	06:00	10/5/2021	19:33	Sonde was not deployed in the river. Data removed from data set.
	Turbidity	10/7/2021	3:30	10/14/2021	17:00	Data appeared erroneous. Removed from the data set.
	DO	10/8/2021	2:00	10/9/2021	3:00	Data appeared erroneous. Removed from the data set.

Sonde	Parameter	Start Date	Start Time	End Date	End Time	Notes
Central Avenue Bridge	DO	10/9/2021	16:30	10/9/2021	19:00	Data appeared erroneous. Removed from the data set.
	DO	10/13/2021	6:30	10/14/2021	17:00	Data appeared erroneous. Removed from the data set.
	Temperature	10/14/2021	11:30	10/14/2021	15:30	Data appeared erroneous due to a fouling sensor. Removed from the data set.
	Turbidity	10/7/2021	13:00	10/7/2021	14:30	Data appeared erroneous. Removed from the data set.
	Turbidity	10/24/2021	20:00	10/25/2021	19:50	Data appeared erroneous. Removed from the data set.
	Turbidity	10/31/2021	19:00	10/31/2021	23:00	Data appeared erroneous. Removed from the data set.
	Turbidity	11/2/2021	13:00	11/3/2021	18:00	Data appeared erroneous. Removed from the data set.
	Turbidity	11/15/2021	17:30	11/18/2021	20:00	Data appeared erroneous. Removed from the data set.
	DO	11/17/2021	0:00	11/18/2021	22:00	Data appeared erroneous. Removed from the data set.

Sonde	Parameter	Start Date	Start Time	End Date	End Time	Notes
Central Avenue Bridge	DO	12/15/2021	16:00	12/08/2019	9:30	Data appeared erroneous. Removed from the data set.
	Turbidity	12/7/2021	13:00	12/8/2021	13:00	Data appeared erroneous. Removed from the data set.
Isleta Dam	DO	10/1/2021	6:00	12:31/2021	23:30	Data appeared erroneous. Removed from the data set.
	Turbidity	10/18/2021	19:00	10/20/2021	16:00	Data appeared erroneous. Removed from the data set.
	Turbidity	10/25/2021	17:00	10/27/2021	18:00	Data appeared erroneous. Removed from the data set.
	Turbidity	11/1/2021	14:00	11/5/2021	17:00	Data appeared erroneous. Removed from the data set.
	Turbidity	11/6/2021	15:00	11/18/2021	3:00	Data appeared erroneous. Removed from the data set.
	DO, Temperature, and Turbidity.	11/18/2021	3:00	12/31/2021	23:00	Sonde removed from the river. Data removed from the data set.

3 Sonde Maintenance

Maintenance of the sonde generally consists of cleaning the sonde to ensure reliable data was being collected.

Sonde	Maintenance Dates	Maintenance Performed	Performed By	Equipment / Inventory Used
US 550 Bridge	12/02/2021	Sonde was deployed in river and the RDO cap was replaced.	AMAFCA	None
	12/08/2021	Sonde was cleaned and recalibrated.	AMAFCA	None
	12/16/2021	Sonde was cleaned.	AMAFCA	None
	12/20/2021	Sonde was cleaned.	AMAFCA	None
	12/22/2021	Sonde was cleaned.	AMAFCA	None
	12/28/2021	Sonde was cleaned.	AMAFCA	None
Sandia Boundary	11/10/2021	Sonde was deployed in river.	AMAFCA	None
	11/15/2021	Sonde was cleaned.	AMAFCA	None
	11/18/2021	Sonde was cleaned.	AMAFCA	None
	11/24/2021	Sonde was cleaned.	AMAFCA	None
	12/02/2021	Sonde was cleaned and the RDO cap was replaced.	AMAFCA	None
	12/08/2021	Sonde was cleaned.	AMAFCA	None
	12/13/2021	Sonde was cleaned.	AMAFCA	None
	12/15/2021	Sonde was cleaned.	AMAFCA	None
	12/20/2021	Sonde was cleaned.	AMAFCA	None
	12/22/2021	Sonde was removed from the river.	AMAFCA	None
	12/28/2021	Sonde was deployed in river.	AMAFCA	None
Central Ave Bridge	10/05/2021	Sonde was deployed in river.	AMAFCA	None
	10/14/2021	Sonde was cleaned.	AMAFCA	None
	10/25/2021	Sonde was cleaned.	AMAFCA	None
	11/05/2021	Sonde was cleaned.	AMAFCA	None
	11/10/2021	Sonde was cleaned.	AMAFCA	None
	11/18/2021	Sonde was cleaned.	AMAFCA	None
	11/24/2021	Sonde was cleaned.	AMAFCA	None
	12/02/2021	Sonde was cleaned and the RDO cap was replaced.	AMAFCA	None
	12/09/2021	Sonde was cleaned.	AMAFCA	None
	12/16/2021	Sonde was cleaned.	AMAFCA	None
	12/28/2021	Sonde was cleaned.	AMAFCA	None
Isleta Dam	10/20/2021	Sonde was cleaned.	AMAFCA	None
	10/27/2021	Sonde was cleaned.	AMAFCA	None
	11/05/2021	Sonde was cleaned.	AMAFCA	None
	11/10/2021	Sonde was cleaned.	AMAFCA	None

Sonde	Maintenance Dates	Maintenance Performed	Performed By	Equipment / Inventory Used
Isleta Dam	11/18/2021	Sonde was removed from the river.	AMAFCA	None

*Sonde transmission issue was not known at the time maintenance was performed.

4 Exceedances

4.1 Dissolved Oxygen

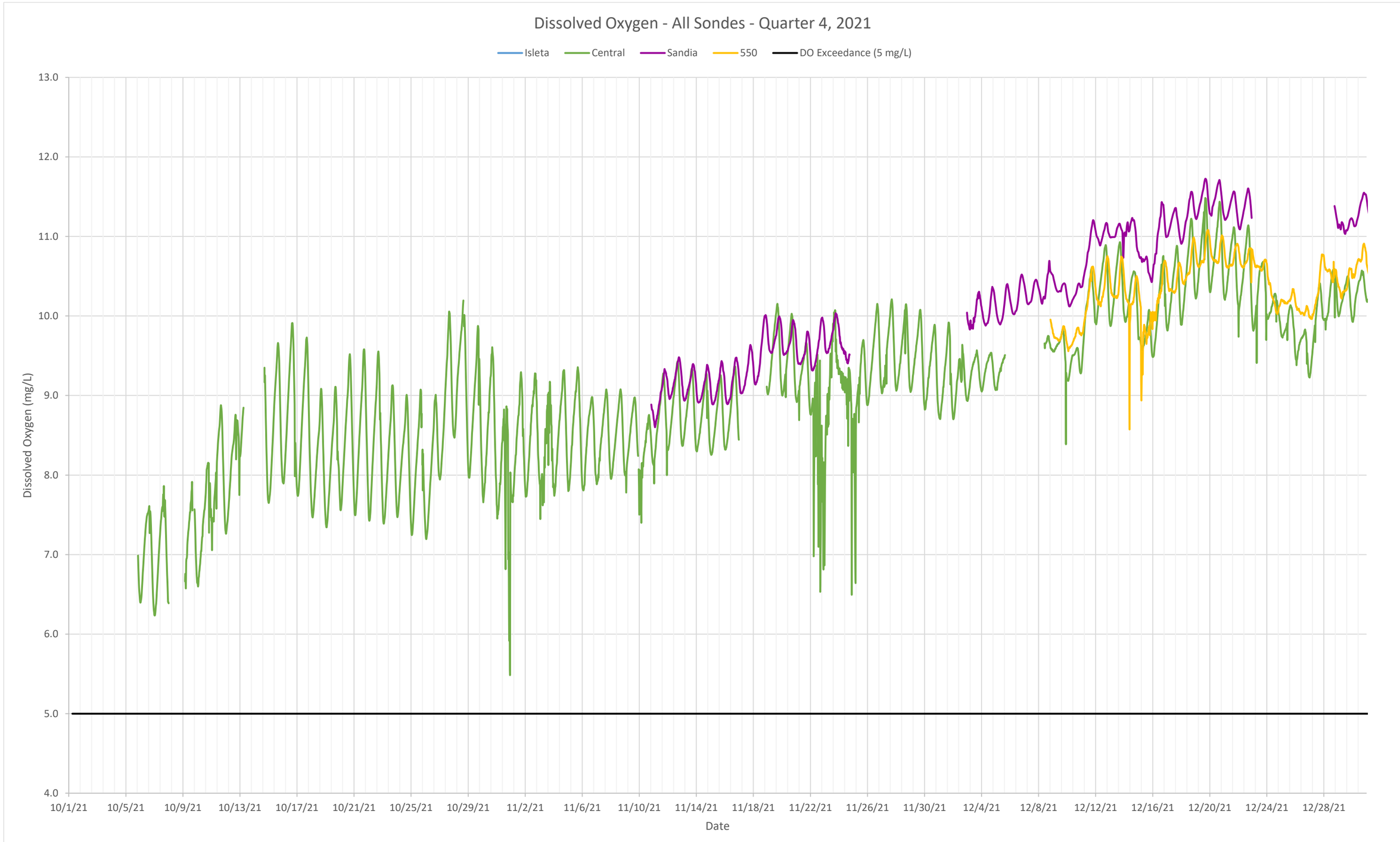
There were no dissolved oxygen exceedances for the fourth quarter of 2021.

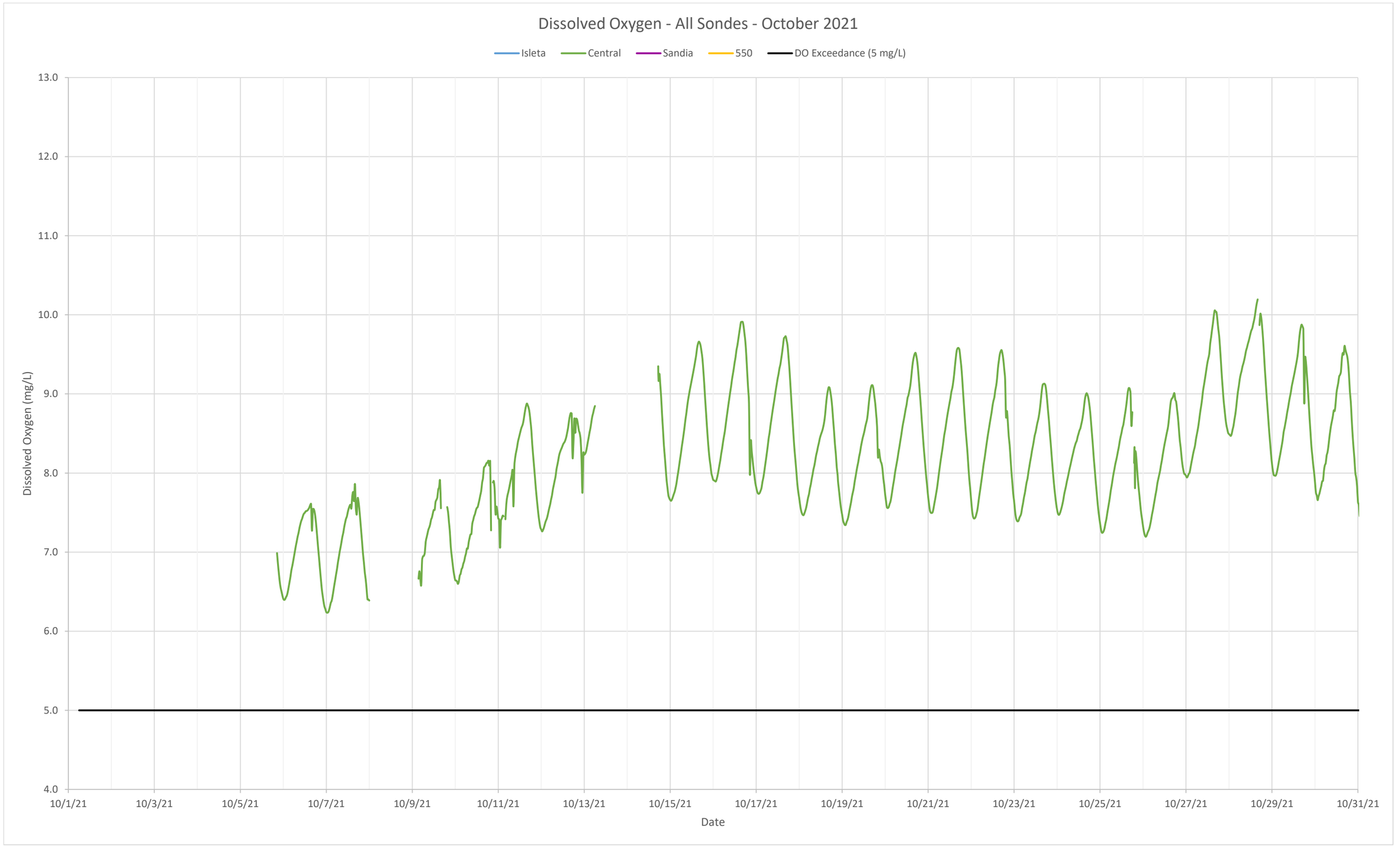
4.2 Temperature

There were no temperature exceedances for the fourth quarter of 2021.

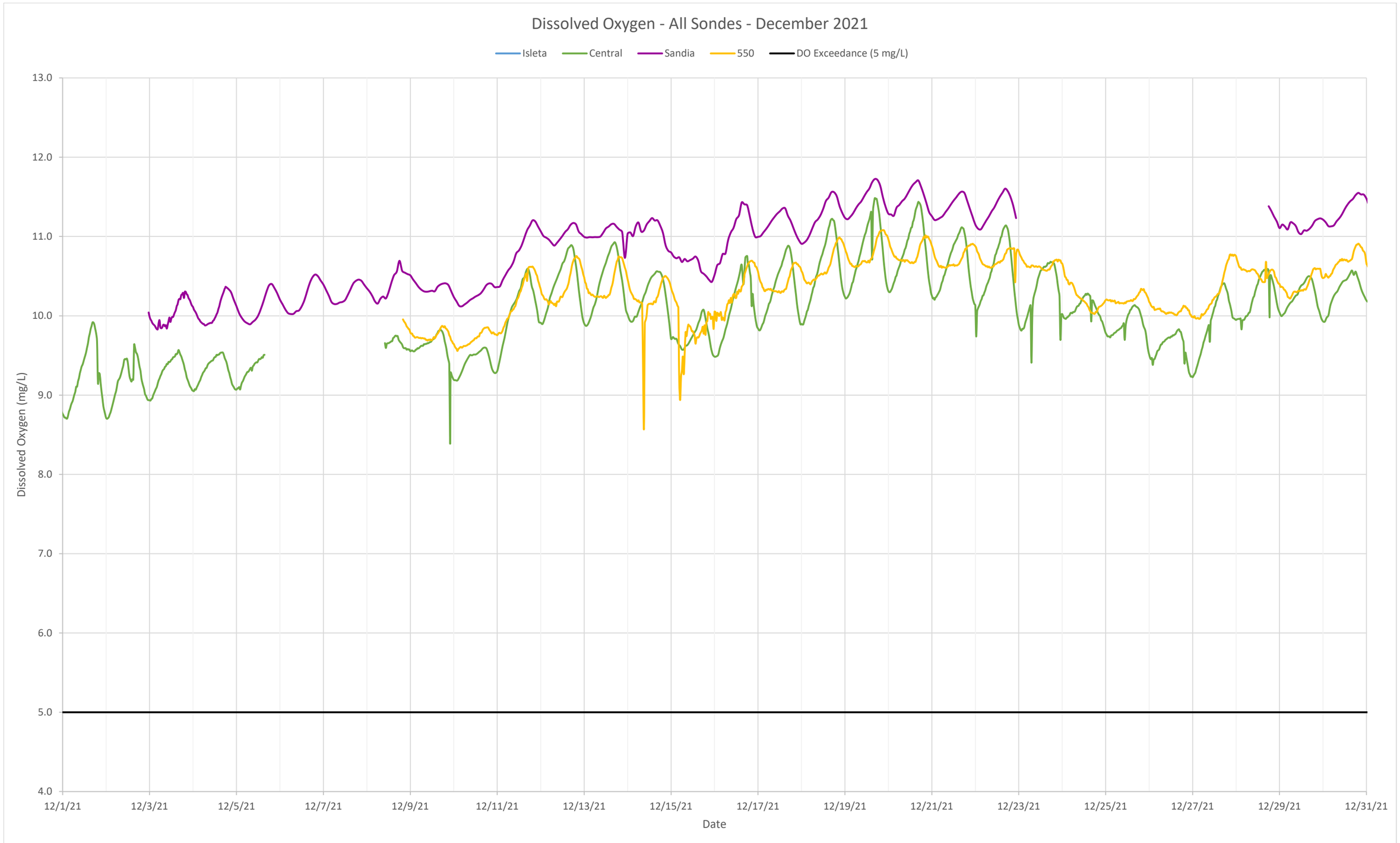
5 Attachments

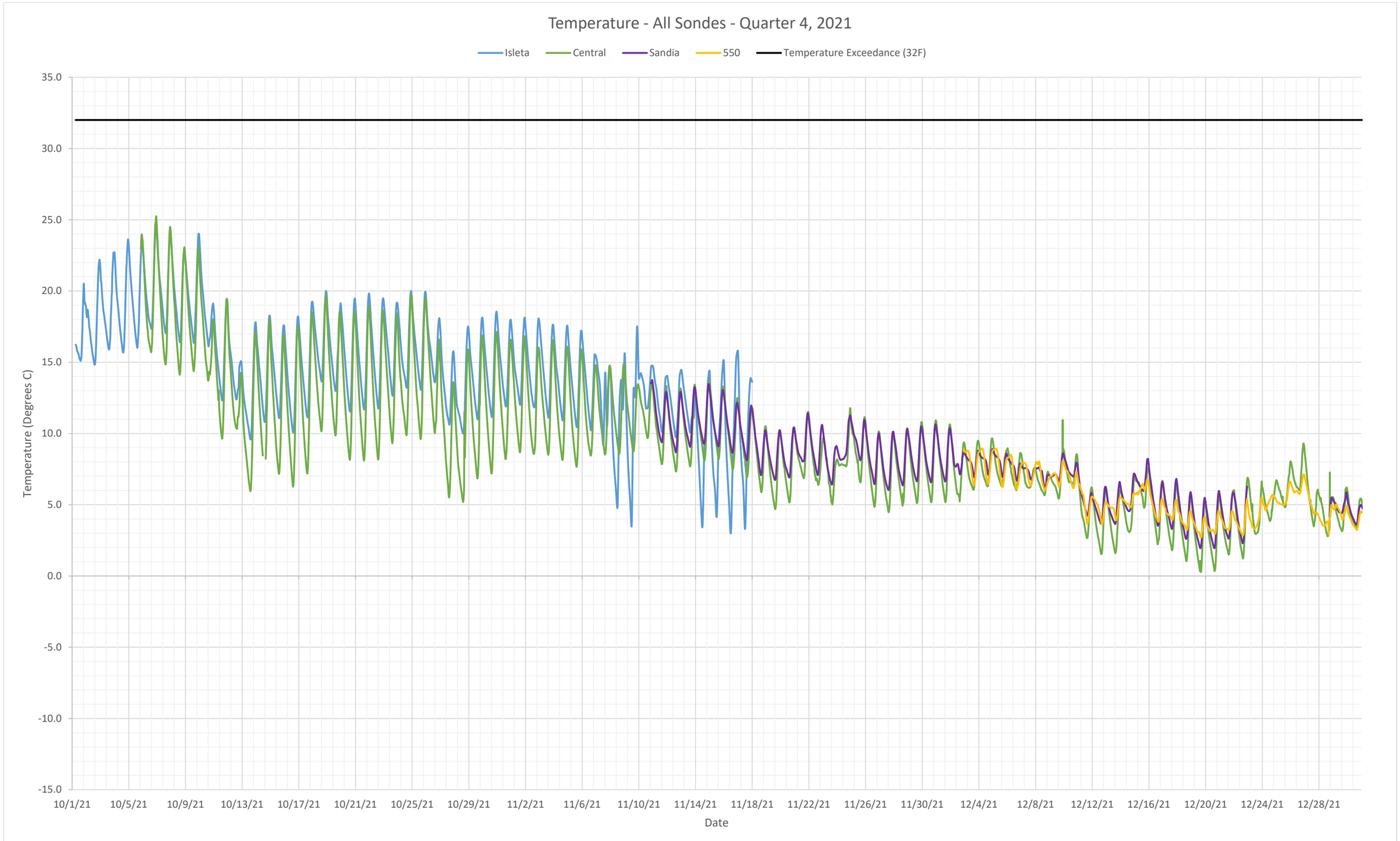
Attachment 1: Fourth Quarter Data Graphs for Dissolved Oxygen, Temperature, and Turbidity.


Dissolved Oxygen - All Sondes - Quarter 4, 2021
Isleta
Central
Sandia
550
DO Exceedance (5 mg/L)
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
Dissolved Oxygen (mg/L)
10/1/21
10/5/21
10/9/21
10/13/21
10/17/21
10/21/21
10/25/21
10/29/21
11/2/21
11/6/21
11/10/21
11/14/21
11/18/21
11/22/21
11/26/21
11/30/21
12/4/21
12/8/21
12/12/21
12/16/21
12/20/21
12/24/21
12/28/21
Date


Dissolved Oxygen - All Sondes - October 2021
Isleta
Central
Sandia
550
DO Exceedance (5 mg/L)
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
Dissolved Oxygen (mg/L)
10/1/21
10/3/21
10/5/21
10/7/21
10/9/21
10/11/21
10/13/21
10/15/21
10/17/21
10/19/21
10/21/21
10/23/21
10/25/21
10/27/21
10/29/21
10/31/21
Date


Dissolved Oxygen - All Sondes - November 2021
Isleta
Central
Sandia
550
DO Exceedance (5 mg/L)
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
Dissolved Oxygen (mg/L)
11/1/21
11/3/21
11/5/21
11/7/21
11/9/21
11/11/21
11/13/21
11/15/21
11/17/21
11/19/21
11/21/21
11/23/21
11/25/21
11/27/21
11/29/21
Date


Dissolved Oxygen - All Sondes - December 2021
Isleta
Central
Sandia
550
DO Exceedance (5 mg/L)
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
Dissolved Oxygen (mg/L)
12/1/21
12/3/21
12/5/21
12/7/21
12/9/21
12/11/21
12/13/21
12/15/21
12/17/21
12/19/21
12/21/21
12/23/21
12/25/21
12/27/21
12/29/21
12/31/21
Date


Temperature - All Sondes - Quarter 4, 2021
Isleta
Central
Sandia
550
Temperature Exceedance (32F)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
Temperature (Degrees C)
10/1/21
10/5/21
10/9/21
10/13/21
10/17/21
10/21/21
10/25/21
10/29/21
11/2/21
11/6/21
11/10/21
11/14/21
11/18/21
11/22/21
11/26/21
11/30/21
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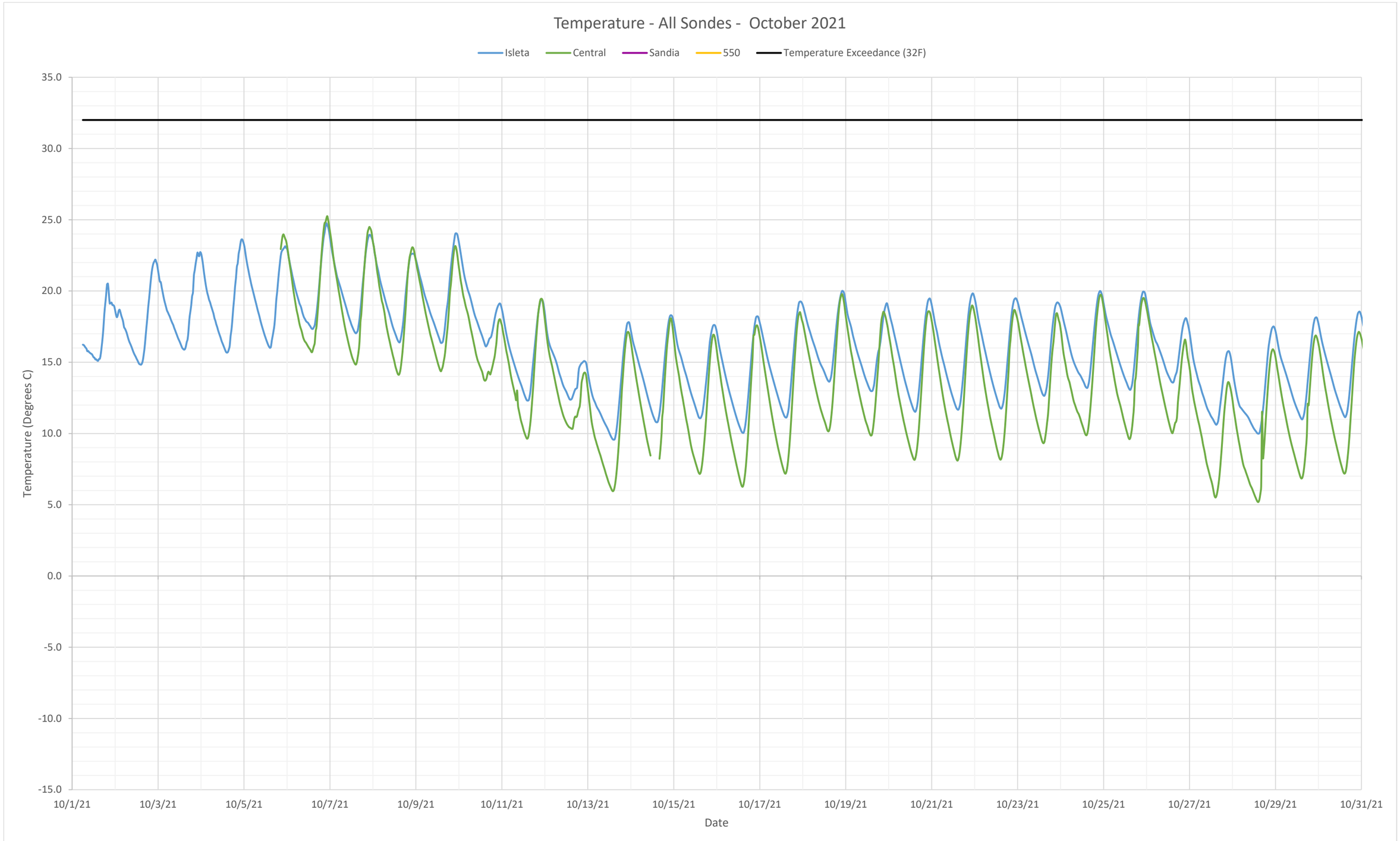
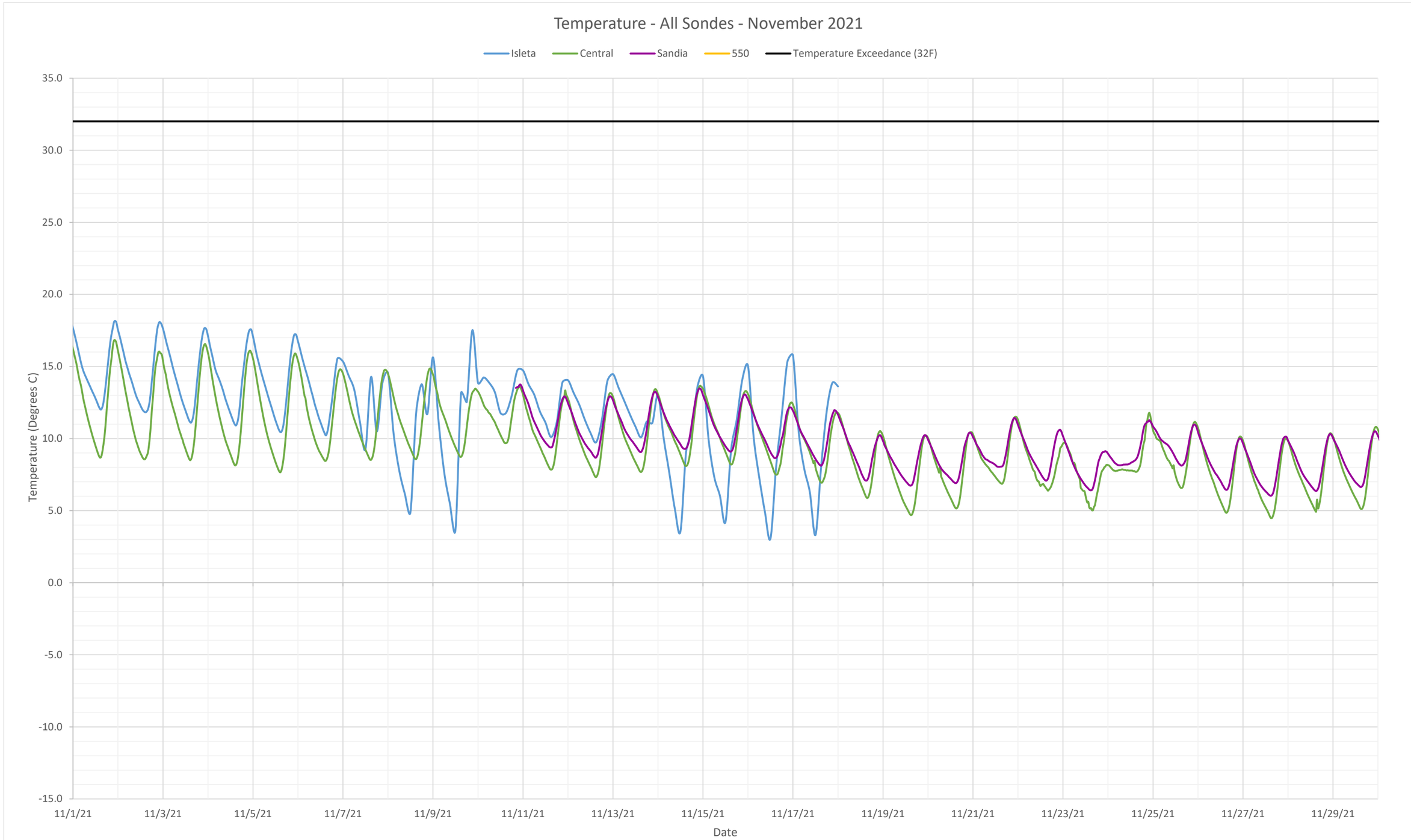
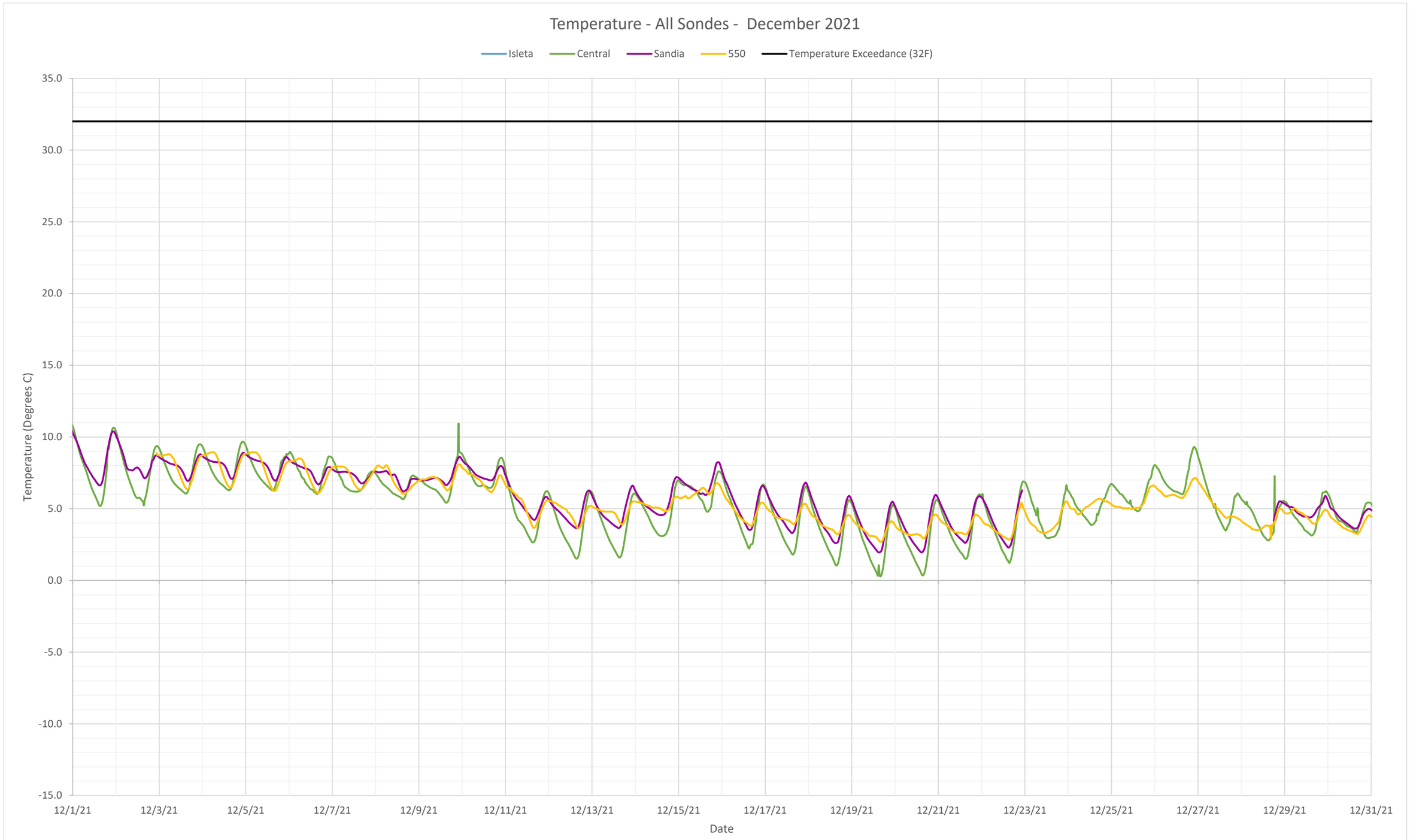
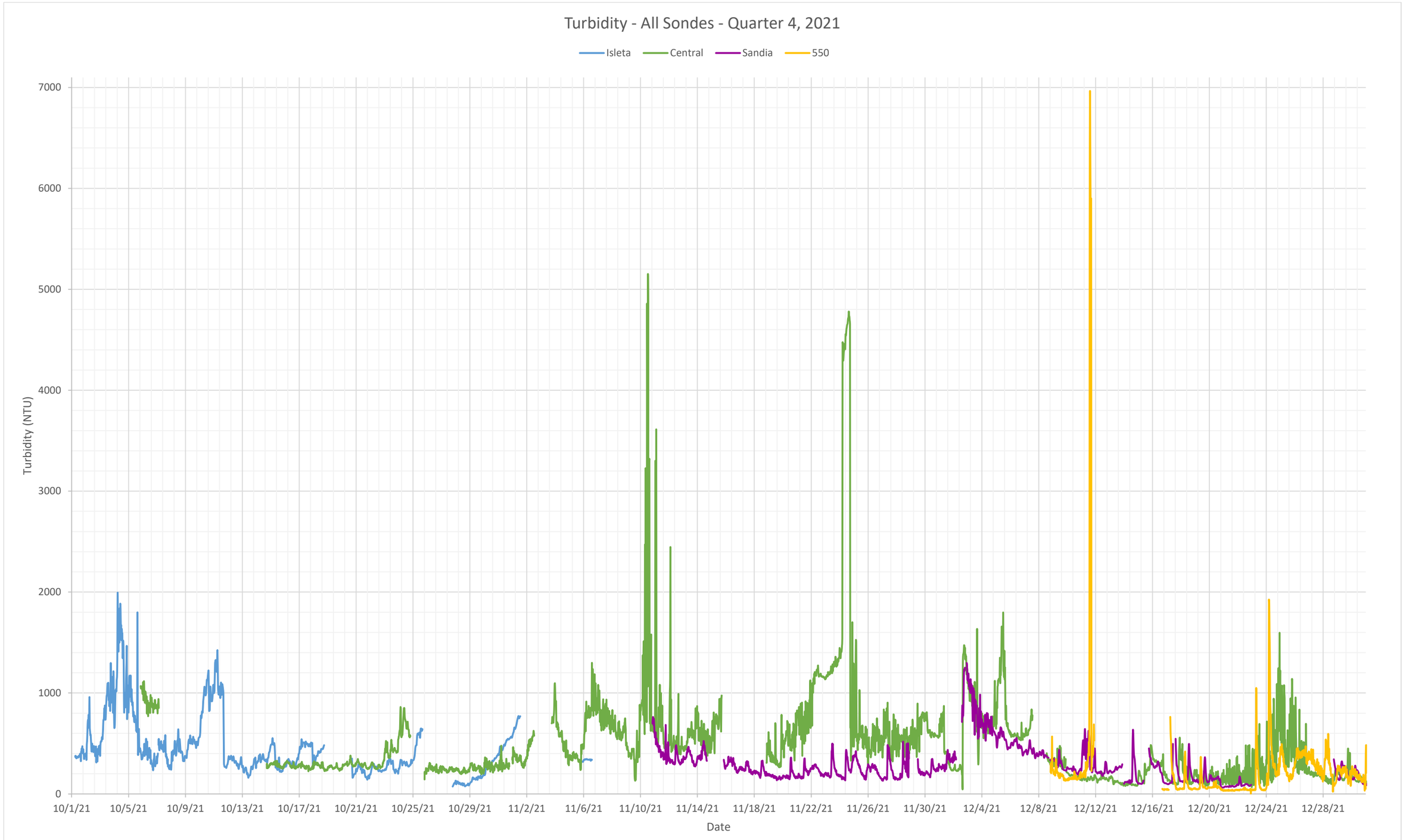
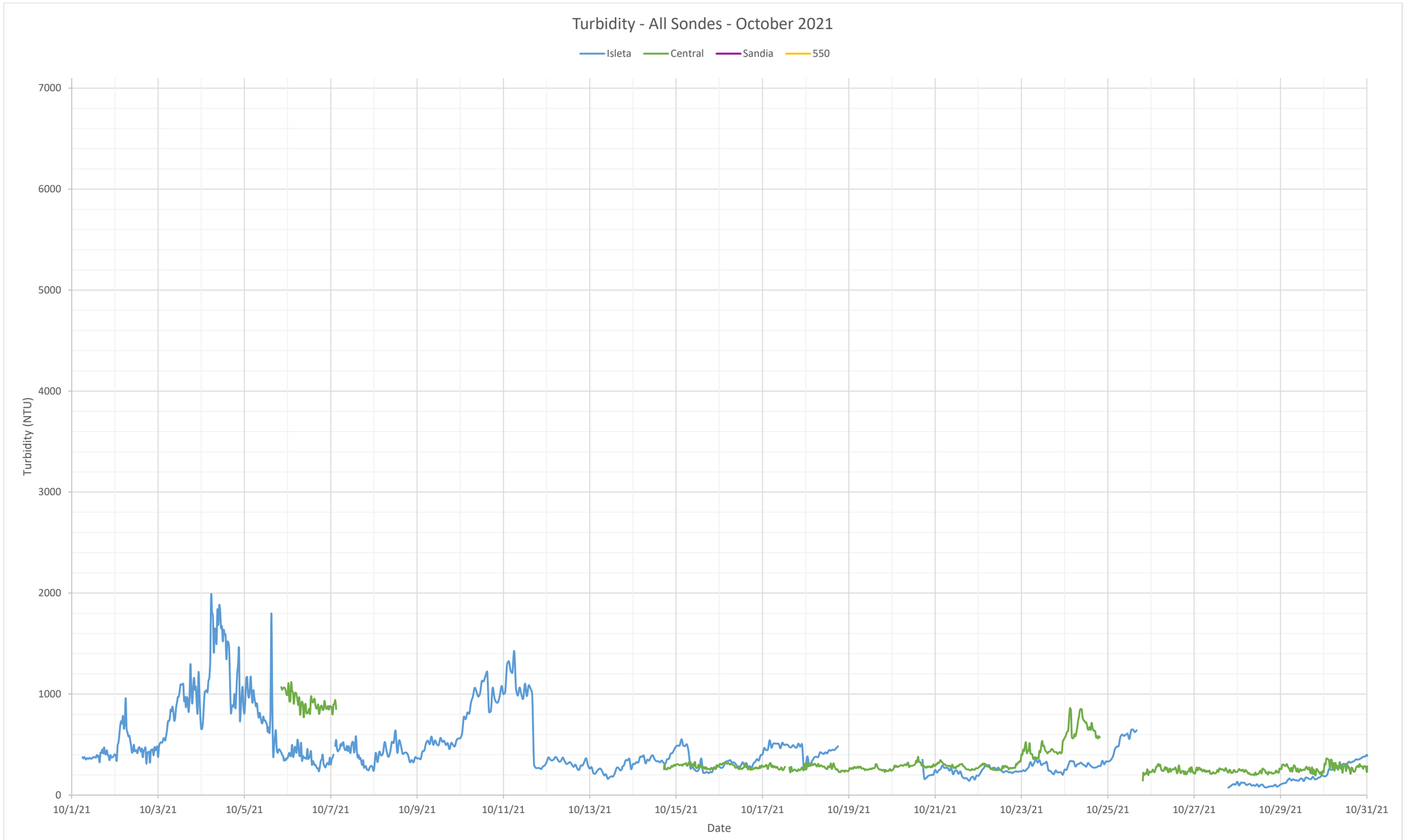
12/8/21
12/12/21
12/16/21
12/20/21
12/24/21
12/28/21
Date


Temperature - All Sondes - October 2021
Isleta
Central
Sandia
550
Temperature Exceedance (32F)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
Temperature (Degrees C)
10/1/21
10/3/21
10/5/21
10/7/21
10/9/21
10/11/21
10/13/21
10/15/21
10/17/21
10/19/21
10/21/21
10/23/21
10/25/21
10/27/21
10/29/21
10/31/21
Date


Temperature - All Sondes - November 2021
Isleta
Central
Sandia
550
Temperature Exceedance (32F)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
Temperature (Degrees C)
11/1/21
11/3/21
11/5/21
11/7/21
11/9/21
11/11/21
11/13/21
11/15/21
11/17/21
11/19/21
11/21/21
11/23/21
11/25/21
11/27/21
11/29/21
Date


Temperature - All Sondes - December 2021
Isleta
Central
Sandia
550
Temperature Exceedance (32F)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
Temperature (Degrees C)
12/1/21
12/3/21
12/5/21
12/7/21
12/9/21
12/11/21
12/13/21
12/15/21
12/17/21
12/19/21
12/21/21
12/23/21
12/25/21
12/27/21
12/29/21
12/31/21
Date


Turbidity - All Sondes - Quarter 4, 2021
Isleta
Central
Sandia
550
Turbidity (NTU)
7000
6000
5000
4000
3000
2000
1000
0
10/1/21
10/5/21
10/9/21
10/13/21
10/17/21
10/21/21
10/25/21
10/29/21
11/2/21
11/6/21
11/10/21
11/14/21
11/18/21
11/22/21
11/26/21
11/30/21
12/4/21
12/8/21
12/12/21
12/16/21
12/20/21
12/24/21
12/28/21
Date


Turbidity - All Sondes - October 2021
Isleta
Central
Sandia
550
Turbidity (NTU)
7000
6000
5000
4000
3000
2000
1000
0
10/1/21
10/3/21
10/5/21
10/7/21
10/9/21
10/11/21
10/13/21
10/15/21
10/17/21
10/19/21
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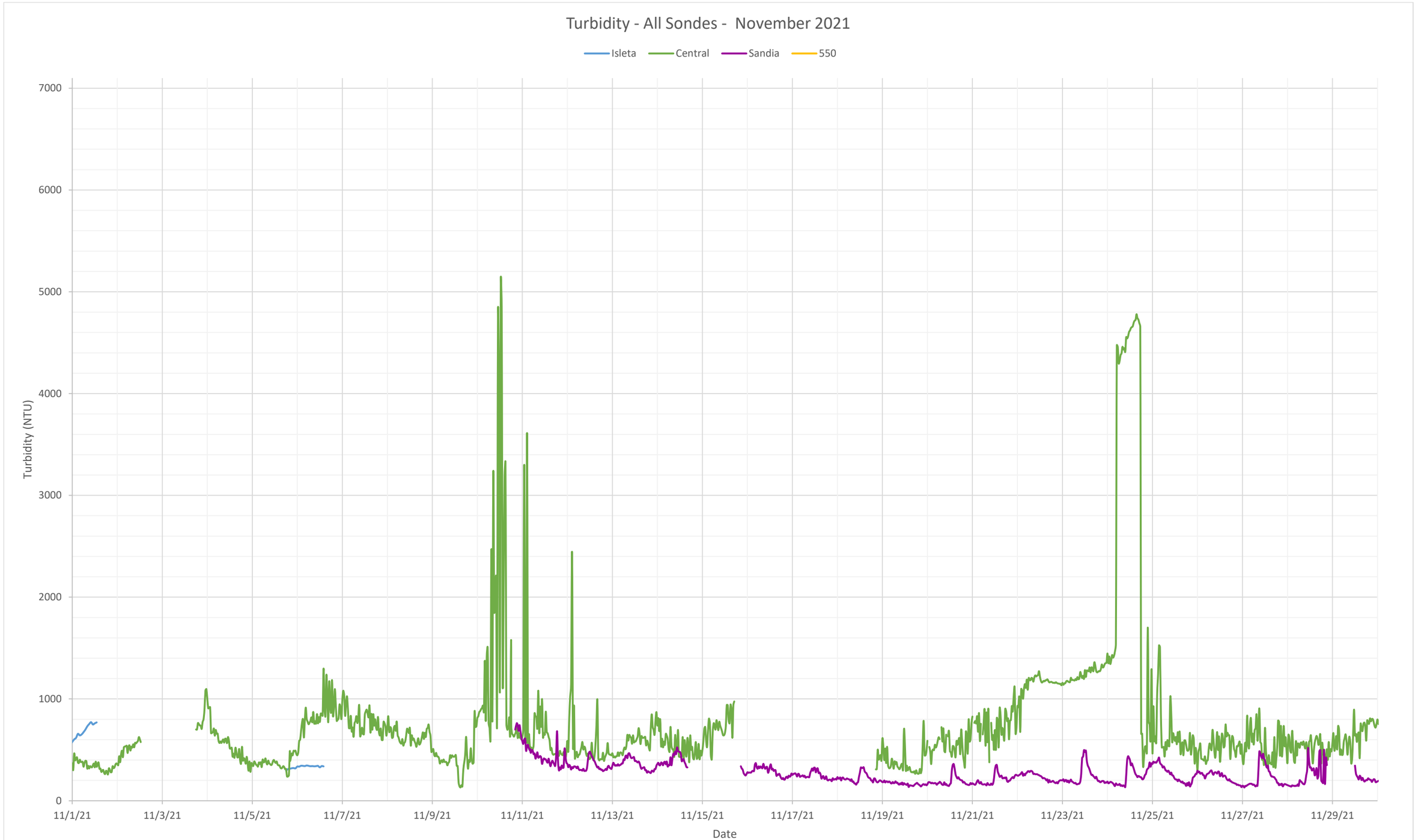
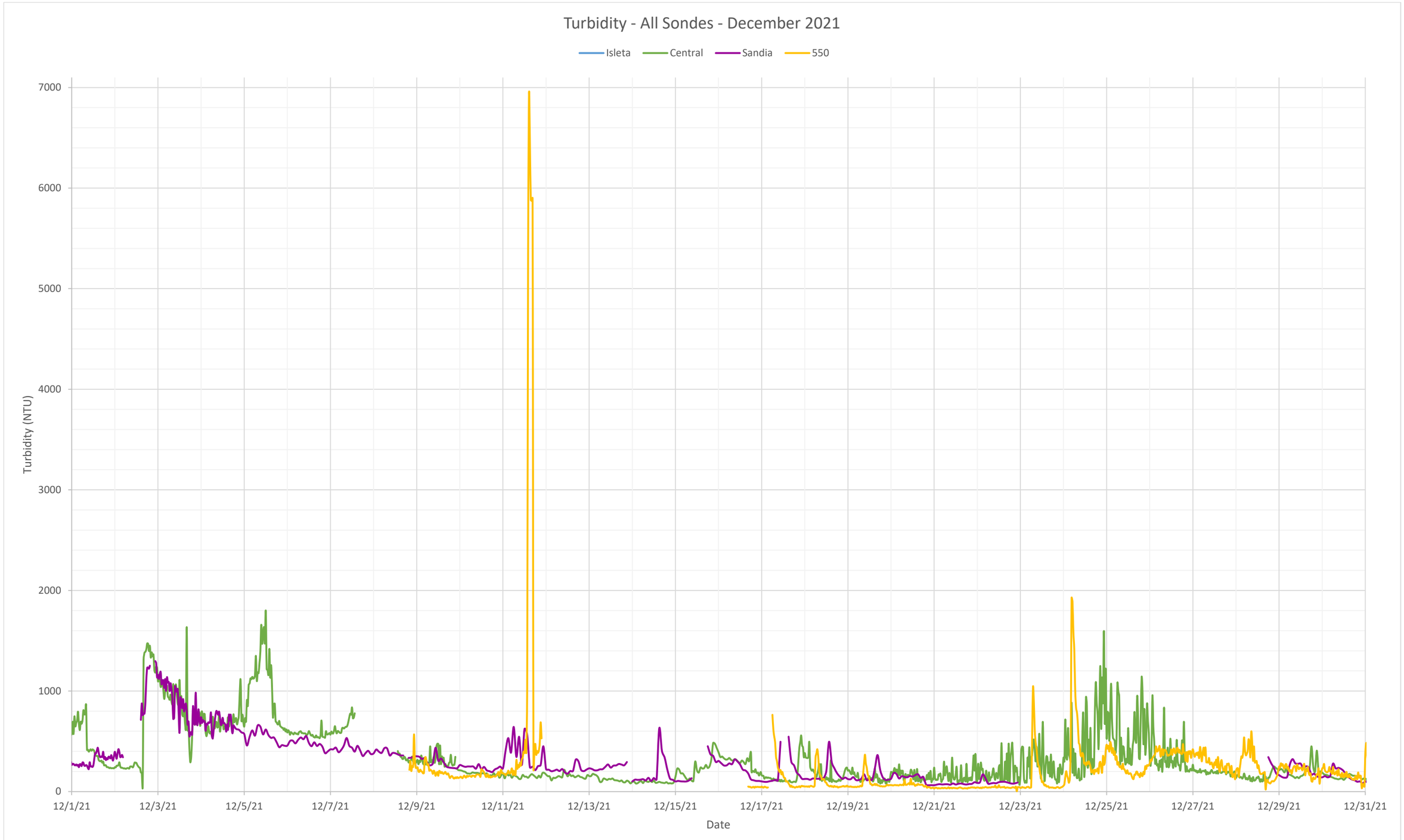
10/27/21
10/29/21
10/31/21
Date


Turbidity - All Sondes - November 2021
Isleta
Central
Sandia
550
Turbidity (NTU)
7000
6000
5000
4000
3000
2000
1000
0
11/1/21
11/3/21
11/5/21
11/7/21
11/9/21
11/11/21
11/13/21
11/15/21
11/17/21
11/19/21
11/21/21
11/23/21
11/25/21
11/27/21
11/29/21
Date


Turbidity - All Sondes - December 2021
Isleta
Central
Sandia
550
7000
6000
5000
4000
3000
2000
1000
0
Turbidity (NTU)
12/1/21
12/3/21
12/5/21
12/7/21
12/9/21
12/11/21
12/13/21
12/15/21
12/17/21
12/19/21
12/21/21
12/23/21
12/25/21
12/27/21
12/29/21
12/31/21
Date