

# Seasonal Progress Report #30

## SR431 Treatment Vault Effectiveness Monitoring

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**Agreement Number: P211-23-019**

**Submitted by: Tahoe Resource Conservation District**

**Submitted to: Nevada Department of Transportation**

**Current Contract Term: July 1, 2023 – June 30, 2028**

**Water Year: 2026**

**Period: Fall/Winter Season, October 1, 2025 – February 28, 2026**

**Submission Date: March 31, 2026**

Two stormwater filter vaults, a Contech Media Filtration System (MFS) and a Jellyfish Filter, were installed by the Nevada Department of Transportation (NDOT) on State Highway 431 (SR431) above Incline Village, Nevada in 2013. Monitoring equipment was installed at the inflows and outflows of these two vaults. The Tahoe Resource Conservation District (Tahoe RCD) continued the effectiveness monitoring efforts of the Desert Research Institute (DRI) at the four monitoring stations on May 1, 2015 and will continue to monitor through the spring of water year 2025 (May 31, 2025) and beyond if funding allows. New contracts have been executed continuously from May 1, 2015 through present. The July 1, 2023 - June 30, 2025 contract was amended to extend the term through June 30, 2028. Tahoe RCD follows sampling protocols outlined in the Regional Stormwater Monitoring Program Framework and Implementation Guidance document (RSWMP FIG Update, Tahoe RCD et al 2017). Tahoe RCD appreciates the opportunity to provide these water quality monitoring services for NDOT and looks forward to continuing the partnership.

Tasks and subtasks associated with this project and a summary of work completed to date are described below. Table 1 provides a summary of tasks, due dates and percent completion to date for the current agreement. ASWMR refers to the Annual Stormwater Monitoring Report submitted each year to the Nevada Division of Environmental Protection (NDEP) on March 31st as part of the IMP partnership.

Table 1 Summary of tasks, due dates, and percent completion to date.

Task	Description	Due Date	% Of Work Complete	Date Submitted
1	Project Administration			
1.1	Quarterly Invoices	10/31/23, 1/31/24, 4/30/24, 7/31/24, 10/31/24, 1/31/25, 4/30/25, 7/31/25, 10/31/25, 1/31/26, 4/30/26	ongoing	2/23/24, 6/3/24, 7/18/24, 11/12/24, 1/22/25, 5/1/25, 7/18/25, 10/22/25, 1/20/26
1.2	Seasonal Progress Reports	10/31/23, 3/31/24, 6/30/24, 10/31/24, 3/31/25, 6/30/25, 10/31/25, 3/31/26	ongoing	10/26/23, 3/28/24, 6/25/24, 10/9/24, 3/21/25, 6/30/25, 10/17/25, 3/20/26
2	Stormwater Monitoring			
2.1	Collect continuous flow and turbidity data at four monitoring stations	9/30/2025	ongoing	Available on Acuity
2.2	Collect stormwater runoff samples during eight events per year	9/30/2025	ongoing	NA
2.3	Collect three diurnal non-event snowmelt events if conditions allow	9/30/2025	ongoing	NA
2.4	Collect flow bypass data in both vaults	9/30/2025	ongoing	Available in Seasonal Progress Reports
2.5	Provide precipitation data to date	9/30/2025	ongoing	Available in Seasonal Progress Reports
2.6	Provide hydrograph, turbidity, and sample distribution graphs to date	9/30/2025	ongoing	Available in Seasonal Progress Reports
3	Condition Assessments			
3.1	Estimate Road RAM score prior to eight sampled events	Discontinued as of June 1, 2021	100%	NA

3.2	Measure depth of sediment in both vaults after sampled events	9/30/2025	ongoing	Available in Seasonal Progress Reports
4	Final Report			
4.1	Provide raw data	3/31/2024, 3/31/2025	ongoing	Available in Annual Stormwater Monitoring Report
4.2	Provide treatment effectiveness analysis	3/31/2024, 3/31/2025	ongoing	Available in Annual Stormwater Monitoring Report
4.3	Correlate Road RAM score to pollutant concentration and load	Discontinued WY20	100%	Available in Annual Stormwater Monitoring Report
4.4	Provide mass loading v. volume calculations for select events	6/30/2016	100%	3/31/16, 6/30/16

## Task 1: Project Administration

### 1. Invoices

Quarterly invoices will be submitted for this project covering the following periods:

- 1) July 1, 2023 - December, 2023 (due January 31, 2024)
- 2) January 1, 2024 - March 31, 2024 (due April 30, 2024)
- 3) April 1, 2024 - June 30, 2024 (due July 31, 2024)
- 4) July 1, 2024 - September 30, 2024 (due October 31, 2024)
- 5) October 1, 2024 - December 31, 2024 (due January 31, 2025)
- 6) January 1, 2025 - March 31, 2025 (due April 30, 2025)
- 7) April 1, 2025 - June 30, 2025 (due July 31, 2025)
- 8) July 1, 2025 - September 30, 2025 (due October 31, 2025)
- 9) October 1, 2025 - December 31, 2025 (due January 31, 2026)
- 10) January 1, 2026 - March 31, 2026 (due April 30, 2026)
- 11) April 1, 2026 - June 30, 2026 (due July 31, 2026)
- 12) July 1, 2026 - September 30, 2026 (due October 31, 2026)
- 13) October 1, 2026 - December 31, 2026 (due January 31, 2027)
- 14) January 1, 2027 - March 31, 2027 (due April 30, 2027)
- 15) April 1, 2027 - June 30, 2027 (due July 31, 2027)
- 16) July 1, 2027 - September 30, 2027 (due October 31, 2027)
- 17) October 1, 2027 - December 31, 2027 (due January 31, 2028)
- 18) January 1, 2028 - March 31, 2028 (due April 30, 2028)
- 19) April 1, 2028 - June 30, 2028 (due July 31, 2028)

## 2. Progress Reports

Progress reports are not concurrent with quarterly invoices. Seasonal progress reports will be submitted for this project covering the following periods (report number is consistent with prior agreement's reports beginning May 2015):

- #23: Summer: June 1, 2023 - September 30, 2023 (due October 31, 2023)
- #24: Fall/winter: October 1, 2023 - February 29, 2024 (due March 31, 2024)
- #25: Spring: March 1, 2024 - May 31, 2024 (due June 30, 2024)
- #26: Summer: June 1, 2024 - September 30, 2024 (due October 31, 2024)
- #27: Fall/winter: October 1, 2024 - February 29, 2025 (due March 31, 2025)
- #28: Spring: March 1, 2025 - May 31, 2025 (due June 30, 2025)
- #29: Summer: June 1, 2025 - September 30, 2025 (due October 31, 2025)
- #30: Fall/winter: October 1, 2025 - February 29, 2024 (due March 31, 2026)
- #31: Spring: March 1, 2026 - May 31, 2026 (due June 30, 2026)
- #32: Summer: June 1, 2026 - September 30, 2026 (due October 31, 2026)
- #33: Fall/winter: October 1, 2026 - February 29, 2027 (due March 31, 2027)
- #34: Spring: March 1, 2027 - May 31, 2027 (due June 30, 2027)
- #35: Summer: June 1, 2027 - September 30, 2027 (due October 31, 2027)
- #36: Fall/winter: October 1, 2027 - February 29, 2028 (due March 31, 2028)
- #37: Spring: March 1, 2028 - May 31, 2028 (due June 30, 2028)

Please accept this report as seasonal progress report #30 for the fall/winter season of water year 2026.

## Task 2: Stormwater Monitoring

### 1. Maintain four stormwater monitoring stations to collect continuous flow and turbidity data

The fall/winter season of WY26 began on October 1, 2025 and ended February 28, 2026. Continuous flow and turbidity were successfully monitored during this time period.

On February 25, 2026 a snowplow hit the equipment box and tilted it backwards (Figure 1). The meteorological station is affixed to the side of the equipment box and was askew after the accident. Though this event did not affect the collection of continuous flow and turbidity data, it did affect the collection of meteorological data. The box and associated meteorological station were righted to their correct positions on March 17, 2026 (Figure 1). Therefore, meteorological data between February 25 and March 17 is not valid.



Figure 1 Damage to equipment box and meteorological station pole tilted backwards on February 25, 2026 (left) and box and pole righted to correct position March 17, 2026 (right).

### 2. Collect stormwater runoff samples at four monitoring sites during eight runoff events per year

During the fall/winter of WY26, five events were successfully sampled at Contech Inflow (CI), Jellyfish Inflow (JI), Contech Outflow (CO), and Jellyfish Outflow (JO) (rain events on October 2, 2025, November 5, 2025, and November 13-14, 2025; an event snowmelt on October 14, 2025; and a rain on snow even on February 24-25, 2026; see Appendix A, Figure 8 - Figure 27 at the end of this report for hydrographs, continuous turbidity, and sample distributions for the event sampled). The successful samples were composited and sent to the lab for analysis. This brings the water year total to five sampled events at Contech Inflow, Jellyfish Inflow, Contech Outflow, and Jellyfish Outflow.

### 3. If conditions allow for non-event snowmelt sampling, analyze one composite consisting of three diurnals

This task is typically only applicable during the spring season and counts as one of the eight required events.

#### 4. Install a pressure transducer in each treatment vault to identify bypass flow

New pressure transducers were installed in June 2016 and linked to the remote access data management system currently used at the SR431 monitoring site. Data indicate that during the fall/winter of WY26 the Contech MFS cartridge filters were bypassed seven times (on October 2, 2025 (rain), October 14, 2025 (rain/snow), November 5, 2025 (rain), November 13, 2025 (rain), December 19, 2025 (rain), December 21-22, 2025 (snow), and February 24-25, 2026 (rain on snow)) (Figure 2), and the Jellyfish filters bypassed zero times (Figure 3).

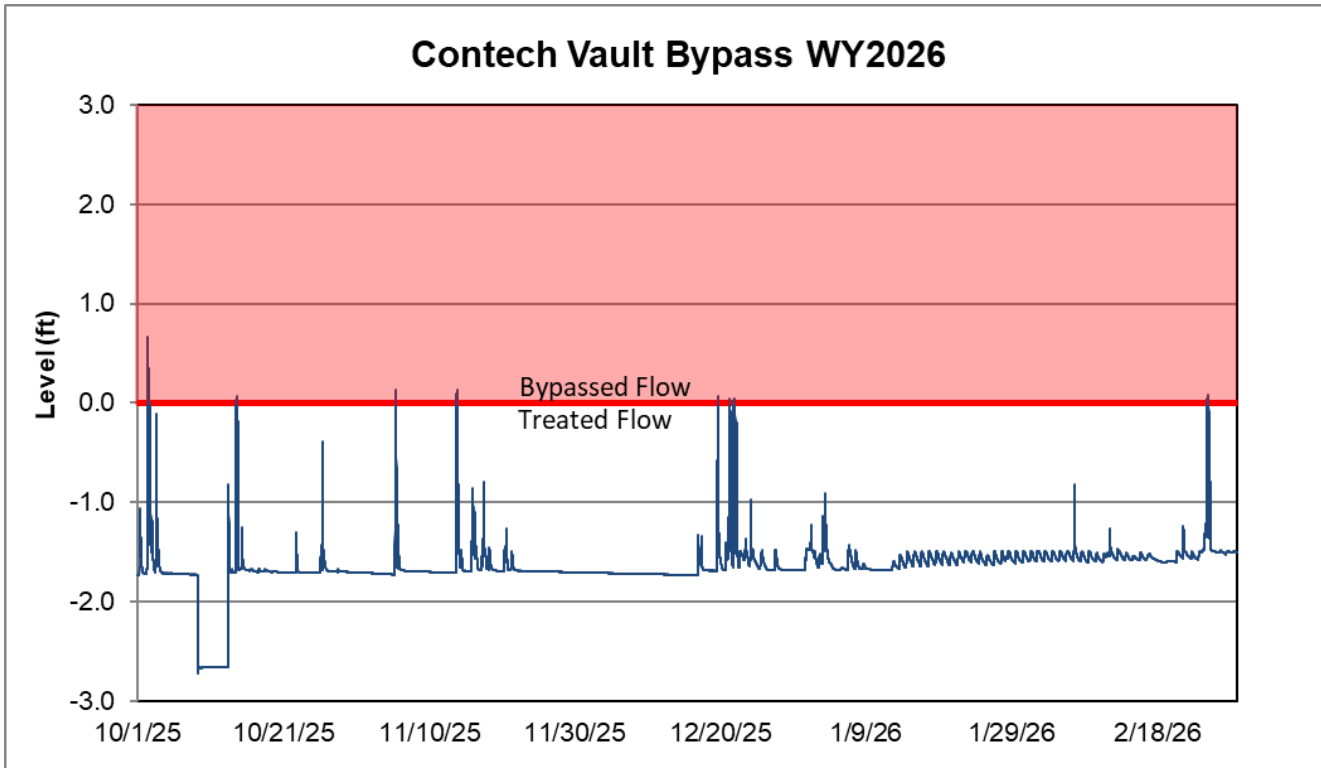


Figure 2 Bypassed flow in the Contech MFS vault for fall/winter WY26.

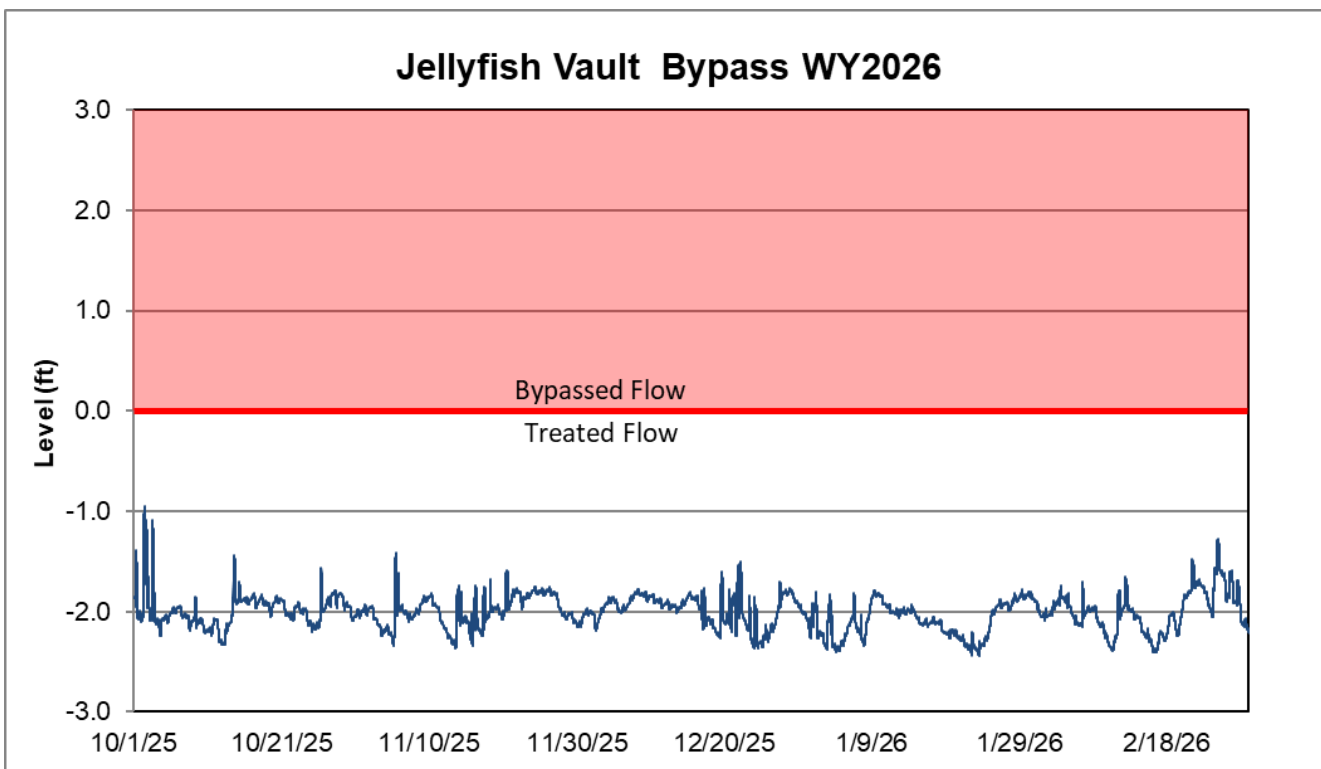


Figure 3 Bypassed flow in the Jellyfish vault for fall/winter WY26.

## 5. Provide precipitation data to date

Table 2 provides summary data for all 27 fall/winter WY26 precipitation events recorded at the NDOT meteorological station including event start and end dates, total precipitation, peak precipitation, minimum and maximum temperature, and precipitation type. Because of its high elevation, precipitation often falls in the form of snow during fall/winter and spring and thus does not always generate sufficient runoff for sampling. In general, events consisting of less than 0.5 inches of rain do not produce sufficient runoff for sampling. However, some events less than 0.5 inches can be successfully sampled.

Table 2 Summary of fall/winter precipitation events at SR431 for WY26. Highlighted rows indicate events that were sampled.

Station ID	Precip Event (#)	Precipitation event start (PST)	Event end (PST)	Event duration (days)	Interevent duration (days)	Event precipitation (inches)	Event peak precipitation (inch/5min)	Event minimum temp (°C)	Event maximum temp (°C)	Type of Precipitation
NDOT	--	--	9/28/2025 1:00	--	--	--	--	--	--	--
NDOT	NDOT-25-01	10/1/2025 6:25	10/1/2025 10:20	0.163	3.2	0.0720	0.012	6	8	Rain
NDOT	NDOT-25-02	10/2/2025 4:45	10/3/2025 0:30	0.823	0.8	0.7190	0.062	4	10	Rain
NDOT	NDOT-25-03	10/3/2025 13:30	10/3/2025 18:50	0.222	0.5	0.1190	0.019	3	5	Rain
NDOT	NDOT-25-04	10/13/2025 10:00	10/13/2025 13:45	0.156	9.6	0.0880	0.008	1	3	Rain
NDOT	NDOT-25-05	10/14/2025 9:20	10/15/2025 8:10	0.951	0.8	1.3350	0.019	-1	4	Rain/Snow
NDOT	NDOT-25-06	10/22/2025 20:40	10/22/2025 20:50	0.007	7.5	0.0240	0.012	7	8	Rain
NDOT	NDOT-25-07	10/25/2025 7:25	10/25/2025 7:25	0.000	2.4	0.0040	0.004	3	3	Rain
NDOT	NDOT-25-08	10/26/2025 3:05	10/26/2025 14:40	0.483	0.8	0.4520	0.012	0	4	Rain
NDOT	NDOT-25-09	11/5/2025 8:30	11/5/2025 22:00	0.563	9.7	0.4850	0.019	0	3	Rain
NDOT	NDOT-25-10	11/13/2025 10:30	11/14/2025 11:45	1.052	7.5	1.0870	0.027	1	8	Rain
NDOT	NDOT-25-11	11/15/2025 18:30	11/16/2025 14:45	0.844	1.3	1.0970	0.027	0	8	Rain
NDOT	NDOT-25-12	11/17/2025 5:55	11/18/2025 4:30	0.941	0.6	0.3080	0.008	-2	1	Rain
NDOT	NDOT-25-13	11/20/2025 6:35	11/20/2025 21:40	0.628	2.1	0.1840	0.008	-1	0	Snow
NDOT	NDOT-25-14	12/16/2025 8:40	12/17/2025 10:25	1.073	25.5	0.1400	0.012	4	8	Rain
NDOT	NDOT-25-15	12/19/2025 13:30	12/19/2025 19:05	0.233	2.1	0.3280	0.016	1	2	Rain
NDOT	NDOT-25-16	12/20/2025 17:45	12/27/2025 14:30	6.865	0.9	5.9840	0.023	-5	7	Snow
NDOT	NDOT-25-17	12/31/2025 8:25	1/1/2026 12:20	1.163	3.7	0.1950	0.023	2	7	Rain
NDOT	NDOT-25-18	1/2/2026 22:25	1/4/2026 18:20	1.830	1.4	1.4470	0.019	-3	2	Rain, Snow
NDOT	NDOT-25-19	1/6/2026 10:35	1/8/2026 13:10	2.108	1.7	0.4960	0.012	-10	3	Rain, Snow
NDOT	NDOT-25-20	1/9/2026 13:30	1/9/2026 13:30	0.000	1.0	0.0040	0.004	2	2	Rain
NDOT	NDOT-25-21	1/28/2026 1:45	1/28/2026 4:55	0.132	18.5	0.0200	0.004	-3	-2	Snow
NDOT	NDOT-25-22	2/6/2026 15:00	2/6/2026 15:45	0.031	9.4	0.0520	0.008	2	3	Rain
NDOT	NDOT-25-23	2/10/2026 20:05	2/12/2026 19:30	1.976	4.2	0.6520	0.012	-4	3	Rain, Snow
NDOT	NDOT-25-24	2/16/2026 7:40	2/18/2026 0:10	1.688	3.5	1.0120	0.008	-10	0	Snow
NDOT	NDOT-25-25	2/20/2026 13:30	2/20/2026 17:35	0.170	2.6	0.1040	0.004	-5	-4	Snow
NDOT	NDOT-25-26	2/21/2026 12:00	2/21/2026 14:55	0.122	0.8	0.0560	0.008	-1	0	Snow
NDOT	NDOT-25-27	2/24/2026 6:55	2/25/2026 10:10	1.135	2.7	0.5620	0.019	3	7	Rain

## 6. Provide hydrograph, continuous turbidity, and sample distribution graphs for each sampled event

See Appendix A Figure 8 - Figure 27 at the end of this report for hydrographs, continuous turbidity, and sample distributions for the events sampled in the fall/winter season of WY26.

### Task 3: Condition Assessments

#### 1. Estimate Road RAM score prior to monitored runoff events

This task was initiated in November 2015 following a meeting between Tahoe RCD and NDOT where it was decided that determining a Road RAM score prior to runoff events was valuable. However, after five and a half years of collecting this data, it was clear that there is no relationship between Road RAM score and event mean sediment concentration at the SR431 site and this task was discontinued beginning June 1, 2021 (summer season of WY21).

#### 2. Measure depth of sediment in vaults after eight monitored runoff events

This task was initiated November 2015 following the meeting between Tahoe RCD and NDOT mentioned above where it was determined that post event sediment depth was valuable information. The depths shown in Table 3 represent the average depth in each vault in feet. All clean-outs restored sediment depth in the respective vaults to near zero. Summer and fall of WY18 were dry and minimal sediment accumulation occurred by January of 2019 (~0.1 feet for both the Contech MFS and the Jellyfish). No sediment accumulation measurements were conducted during the lapse of funding that occurred July 2018-December 2018. February 2019 was the snowiest month on record for many areas in the Tahoe basin, and therefore it was not possible to conduct sediment accumulation until May 2019 due to lack of access to the vaults. By May 2019, substantial sediment had entered the system and a cleanout was performed in June 2019, restoring the sediment depth to zero. A small amount of sediment

accumulation occurred by the end of summer WY19 due to a series of thunderstorms in September. Little to no sediment accumulation occurred during the fall/winter of WY20. Some sediment accumulation was observed during the spring of WY20. Both vaults were vactored on May 12, 2020. Little to no sediment accumulation was observed at the Contech vault over the summer of WY20, possibly due to the fact that sediment accumulation in the splitter chamber was preferentially routing flow to the Jellyfish. The Jellyfish vault saw 0.13 feet of summertime sediment accumulation (from 0.11 feet in June 2020 to 0.24 feet in September 2020). Little to no sediment accumulation occurred during the fall/winter of WY21 in either vault. Both the Contech and the Jellyfish vaults were vactored on March 8, 2021. A small amount of sediment accumulation occurred during the spring of WY21. The pipes from the splitter vault to the outflows were cleaned with a pressure washer by Tahoe RCD on May 11, 2021. Minimal sediment accumulation occurred over the summer of WY21. The system was fully vactored and rinsed on October 21, 2021, and the filters to both the Contech MFS and the Jellyfish were replaced. There was minimal sediment accumulation during the fall/winter and spring of WY22. In the summer of WY22 there was minimal sediment accumulation in the Jellyfish vault and some accumulation in the Contech vault. On November 17, 2022 NDOT rinsed the Contech MFS filters and vactored the hydrodynamic separator, the splitter vault, splitter to inflow pipes, and Contech MFS vault. In the record-breaking fall/winter and spring of WY23, manhole access to the vaults was inaccessible, so sediment depth was not recorded after the sampled events in the spring season. Vaults were accessible on June 4, 2023, so a sediment depth was taken in both vaults then. During the summer of WY23, construction activities made manhole access challenging, but sediment depth was taken on June 18, 2023. Sediment depth was measured on August 21, 2023 and had decreased. There is no record of maintenance between these two dates, but it's possible that NDOT maintained the vault system and didn't inform us. Sediment depth increased minimally in the Contech MFS vault and remained stable in the Jellyfish vault as of November 1, 2023. Sediment increased in the Jellyfish vault and remained the same in the Contech MFS vault as of May 6, 2024. Both vaults were vactored by NDOT on June 11, 2024 and sediment level measured zero on August 1, 2024. Sediment increased slightly as of September 25, 2024. No sediment depth measurements were taken during the fall/winter of WY25. Sediment didn't accumulate in the Contech MFS and increased slightly in the Jellyfish as of March 25, 2025. Sediment accumulated in the vault by June 10, 2025. NDOT maintenance crews cleaned out the splitter vault, Jellyfish and Contech vaults on August 14, 2025 – they did not contact Tahoe RCD before performing this maintenance. Sediment was measured on September 18, 2025 and minimal sediment accumulation was observed. NDOT replaced the Jellyfish and Contech MFS filters on October 9, 2025. No sediment accumulation was observed on October 28, 2025.

Table 3 Average depth of sediment in vaults.

Table 3 Continued.

Date Time	Contech MFS (ft)	Jellyfish (ft)
12/30/2015	0.33	0.92
3/16/2016	0.58	1.14
4/15/2016	0.61	na
4/22/2016	0.56	na
6/3/2016	0.75	2.17
8/3/2016	1.10	2.05
10/20/2016	na	1.92
12/30/2016	0.10	0.05
4/3/2016	1.00	2.30
4/20/2017	1.90	2.85
5/1/2017	0.10	0.43
5/18/2017	0.08	0.37
5/22/2017	0.10	0.46
6/19/2017	0.12	0.38
8/19/2017	0.00	0.00
9/21/2017	0.01	0.10
10/5/2017	0.03	0.15
10/24/2017	0.00	0.04
11/14/2017	0.10	1.19
11/17/2017	0.00	0.10
2/2/2018	0.17	0.30
4/7/2018	0.00	0.05
5/17/2018	0.08	0.36
1/2/2019	0.10	0.09
5/8/2019	0.25	0.38
6/25/2019	0.00	0.00
10/21/2019	0.10	0.09
2/26/2020	0.10	0.12
4/22/2020	0.19	0.38

Date Time	Contech MFS (ft)	Jellyfish (ft)
6/17/2020	0.10	0.11
8/7/2020	0.10	0.13
9/3/2020	0.10	0.24
11/4/2020	0.08	0.22
2/16/2021	0.06	0.22
3/22/2021	0.06	0.09
5/11/2021	0.10	0.11
6/9/2021	0.10	0.03
10/13/2021	0.06	0.09
10/26/2021	0.06	0.09
1/27/2022	0.00	0.09
3/30/2022	0.06	0.07
4/22/2022	0.06	0.09
5/18/2022	0.06	0.09
9/29/2022	0.15	0.09
10/25/2022	0.10	0.09
6/4/2023	0.10	0.00
6/18/2023	0.12	0.22
8/21/2023	0.08	0.09
11/1/2023	0.10	0.09
4/29/2024	0.10	0.11
5/6/2024	0.10	0.13
8/1/2024	0.00	0.00
9/25/2024	0.10	0.09
3/25/2025	0.10	0.11
6/10/2025	0.19	0.18
9/18/2025	0.10	0.09
10/28/2025	0	0

## Task 4: Final Report

### 1. Provide raw data

Final reporting for each water year is provided as part of the Annual Stormwater Monitoring Report (due March 31st of each year), but raw data can be viewed at any time on Acuity.

### 2. Provide treatment effectiveness analysis following formats outlined in the RSWMP FIG

Final reporting for each water year is provided as part of the Annual Stormwater Monitoring Report (due March 31st of each year) which includes treatment effectiveness evaluations for FSP, TN, and TP on a seasonal and annual basis as well as for sampled events. The data for FSP in the Annual Stormwater Monitoring Report is based on water quality samples and continuous turbidity. However, treatment effectiveness for FSP for WY26 is provided for all events to date for the Contech MFS in Table 4 and the Jellyfish in Table 5 based on continuous turbidity, a proxy measurement for FSP (2NDNATURE et al 2014). Removal efficiencies in red indicate that FSP was flushed from the system or that outflow turbidity sensors were inundated with accumulated sediment. A removal efficiency of 100% indicates no outflow from the Contech MFS vault, which occurs when influent volumes are less than 3,000 cubic feet (the approximate storage capacity of the Contech MFS vault) and the vault can accommodate the new flow. Sometimes the vault is full from a previous event and even small inflow volumes will result in outflow. The holding capacity of the Contech MFS is likely what allows it to generally be more efficient than the Jellyfish; not only because it often doesn't outflow, but also because sediment has the opportunity to settle out during the longer residence time in the vault.

During the fall/winter season of WY26, Contech MFS FSP removal efficiencies ranged from 15% to 98% for events with outflow (Table 4). The event with the poorest FSP removal efficiency was the rain event on February 24-25, 2026. It's possible that sensors and flumes have accumulated sediment from the winter runoff.

During the fall/winter season of WY26, Jellyfish FSP removal efficiencies ranged from -675% to 89% for events with outflow (Table 5). The event with the poorest FSP removal efficiency was the rain event on February 24-25, 2026 where the outflow FSP was greater than the inflow FSP. It's possible that sensors and flumes have accumulated sediment from the winter runoff.

Table 4 Contech MFS FSP removal efficiency for each event of fall/winter WY26.

CONTECH MFS WY26									
Runoff Start Date Time	Runoff End Date Time	Runoff Type	Event Duration	Influent Volume (cf)	Effluent Volume (cf)	Influent FSP (lbs)	Effluent FSP (lbs)	FSP Removal Efficiency	Volume Retained
10/1/25 6:45	10/3/25 17:35	Rain	58:50	2,395	1,046	11.674	2.792	76%	56%
10/13/25 10:10	10/15/25 11:35	Rain	49:25	2,210	984	6.154	1.400	77%	55%
10/22/25 20:45	10/22/25 21:35	Rain	0:50	51	7	0.468	0.008	98%	87%
10/26/25 3:55	10/26/25 15:00	Rain	11:05	431	143	4.479	0.678	85%	67%
11/5/25 8:45	11/5/25 21:00	Rain	12:15	804	740	6.358	3.475	45%	8%
11/13/25 17:25	11/14/25 12:15	Rain	18:50	1,695	1,547	3.909	2.845	27%	9%
11/15/25 19:15	11/18/25 8:45	Rain	61:30	1,045	851	1.980	0.676	66%	19%
11/20/25 8:50	11/20/25 16:35	Event Snowmelt	7:45	222	175	0.727	0.432	41%	21%
12/16/25 23:05	12/17/25 10:35	Rain	11:30	179	126	0.715	0.217	70%	30%
12/19/25 13:40	12/22/25 8:55	Rain	67:15	3,274	2,949	6.514	3.170	51%	10%
12/23/25 10:15	12/24/25 9:05	Event Snowmelt	22:50	164	117	1.410	0.368	74%	29%
12/27/25 12:55	12/27/25 15:05	Non-event Snowmelt	2:10	22	0	0.112	0.000	100%	100%
12/31/25 20:45	1/1/26 13:50	Rain on Snow	17:05	217	123	1.720	0.569	67%	43%
1/3/26 1:40	1/3/26 16:00	Rain on Snow	14:20	289	199	2.370	1.098	54%	31%
1/6/26 14:10	1/6/26 17:05	Non-event Snowmelt	2:55	44	15	0.173	0.046	73%	65%
2/6/26 15:15	2/6/26 17:10	Rain on Snow	1:55	67	39	0.494	0.182	63%	42%
2/11/26 10:10	2/11/26 14:25	Non-event Snowmelt	4:15	35	7	0.137	0.019	86%	79%
2/21/26 11:50	2/21/26 14:45	Event Snowmelt	2:55	55	1	0.113	0.003	98%	99%
2/24/26 10:05	2/25/26 6:25	Rain on Snow	20:20	1,058	800	3.261	2.758	15%	24%

Table 5 Jellyfish FSP removal efficiency for each event of fall/winter WY26.

JELLYFISH WY26									
Runoff Start Date Time	Runoff End Date Time	Runoff Type	Event Duration	Influent Volume (cf)	Effluent Volume (cf)	Influent FSP (lbs)	Effluent FSP (lbs)	Removal Efficiency	Volume Retained
10/1/25 6:45	10/3/25 20:35	Rain	61:50	2,881	1,832	8.018	2.968	63%	36%
10/13/25 10:10	10/15/25 11:50	Rain	49:40	2,531	1,637	3.280	1.260	62%	35%
10/16/25 12:40	10/16/25 17:05	Non-event Snowmelt	4:25	31	0	0.016	0.000	100%	100%
10/17/25 13:10	10/17/25 17:35	Non-event Snowmelt	4:25	38	0	0.014	0.000	100%	100%
10/18/25 10:50	10/18/25 13:40	Non-event Snowmelt	2:50	17	0	0.007	0.000	100%	100%
10/22/25 20:45	10/22/25 21:35	Rain	0:50	64	34	0.161	0.019	88%	47%
10/26/25 3:50	10/26/25 15:55	Rain	12:05	556	307	1.768	0.518	71%	45%
11/5/25 8:45	11/5/25 21:10	Rain	12:25	786	748	5.695	3.124	45%	5%
11/13/25 17:20	11/14/25 12:30	Rain	19:10	1,641	1,590	3.848	2.242	42%	3%
11/15/25 19:15	11/18/25 8:55	Rain	61:40	1,010	931	1.589	0.507	68%	8%
11/20/25 8:55	11/20/25 16:45	Event Snowmelt	7:50	215	185	0.574	0.322	44%	14%
12/16/25 23:05	12/17/25 10:35	Rain	11:30	185	140	0.446	0.100	78%	24%
12/19/25 13:40	12/22/25 8:35	Rain	66:55	3,223	2,967	4.189	3.124	25%	8%
12/23/25 10:15	12/24/25 9:05	Event Snowmelt	22:50	161	119	0.865	0.158	82%	26%
12/27/25 12:55	12/27/25 15:00	Non-event Snowmelt	2:05	17	4	0.048	0.005	89%	77%
12/31/25 23:10	1/1/26 13:35	Rain on Snow	14:25	169	138	0.830	0.440	47%	18%
1/3/26 2:00	1/3/26 15:55	Rain on Snow	13:55	252	209	1.606	1.189	26%	17%
1/6/26 14:15	1/6/26 17:00	Non-event Snowmelt	2:45	40	26	0.109	0.078	29%	34%
2/6/26 15:15	2/6/26 16:35	Rain on Snow	1:20	68	63	0.249	0.045	82%	8%
2/11/26 10:10	2/11/26 14:30	Non-event Snowmelt	4:20	36	32	0.035	0.020	43%	11%
2/21/26 11:50	2/21/26 14:45	Event Snowmelt	2:55	53	49	0.031	0.069	-126%	8%
2/24/26 10:10	2/25/26 6:20	Rain on Snow	20:10	981	1,043	1.170	9.073	-675%	-6%

In accordance with the RSWMP FIG section 2.1, monitoring for trends at urban catchment outfalls is important because it provides information needed for evaluating progress toward TMDL and other regulatory goals. The objective of the trends monitoring is to detect and report the cumulative load reduction benefits of all actions implemented within the catchment over long time frames and ultimately demonstrate a local and regional reduction in pollutant loading to the lake. This statement holds true for the inflow sites at SR431. For the outflow sites at SR431, trend analysis will give insight into the effectiveness of maintenance activities in sustaining FSP removal efficiencies of the treatment vaults.

Average annual loads for FSP, TN, and TP presented in this section are normalized by both catchment size (acres) and inches of precipitation to detect load reductions resulting from improved management activities within the catchment and for comparison between water years. Percent runoff (runoff coefficient) is a function of catchment size, the amount of rainfall received, and the volume measured at the catchment outfall. It represents the fraction of runoff that was measured at the outfall compared to what would theoretically be expected if all the rainfall that fell in the catchment were measured at the outfall as runoff.

Normalized average annual load charts for the SR431 catchment show whether there is an upward, downward, or neutral trend in average annual loading of FSP, TN, and TP at each site. Also presented is a table that shows average annual percent runoff and normalized seasonal and average annual loads and trend statistics. The trend statistics (Tau, p-value, and Theil slope) indicate if there has been a statistically significant upward, downward, or neutral trend in pollutant loading in the catchment. Tau is a non-parametric measure of the relationship between data when data does not have a normal distribution, similar to the  $r^2$  value in a regression on normally distributed data. Tau is a measure of the correspondence between two rankings, in this case are water year and pollutant load. Tau is a correlation coefficient that returns a value between -1 and 1 where 0 is no relationship, 1 is a perfect identical relationship and -1 is a perfect opposite relationship with regards to ranked pairs. The water years will always be ranked in order from 2014 through 2025. The pollutant loads are then ranked from least to most as well. The rankings of the pairs are then compared. If pollutant load steadily increases from year to year there will be a perfect identical ranking between the pairs, resulting in a Tau of 1. If pollutant load steadily decreases from year to year there will a perfect opposite ranking of the pairs, resulting in a Tau of -1. The p-value indicates the confidence

level in Tau; a p-value less than 0.05 ( $p < 0.05$ ) denotes a significant relationship. The Theil slope is similar to the slope for a regression on normalized data but used for data that is not normally distributed. Lastly, charts showing annual sediment and nutrient loads and annual precipitation totals for each site are included to help visualize how precipitation and loads have varied over the period of record for each site. Trends data is updated annually with the Annual Stormwater Monitoring Report, so data shown here is through the end of WY25.

Trends data for the Contech MFS inflow is shown in Figure 4 and Table 6. Trends data for the Contech MFS outflow is shown in Figure 5 and Table 7. Trends data for the Jellyfish inflow is shown in Figure 6 and Table 8. Trends data for the Jellyfish outflow is shown in Figure 7 and Table 9.

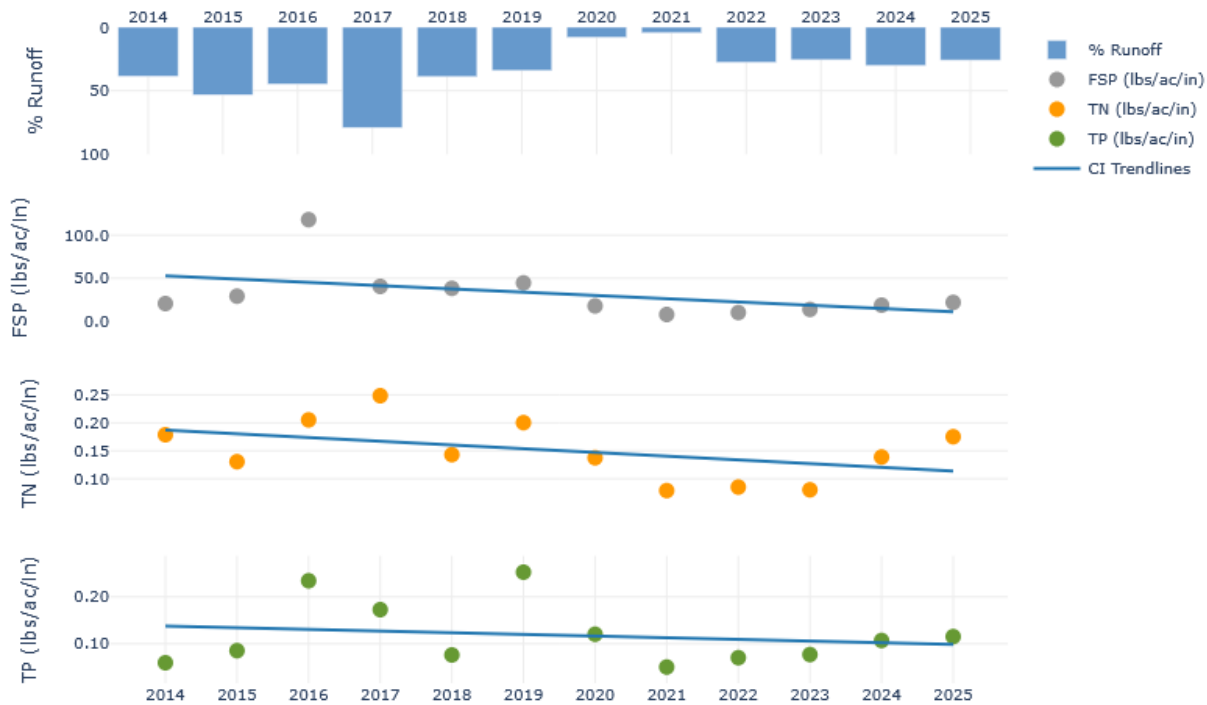


Figure 4 12-year rainfall normalized annual pollutant load trends in FSP, TN, and TP loads at the Contech MFS Inflow, WY14-25.

- Percent runoff varied between 4.4% in WY21 to 78.9% in WY17. Differences in % runoff between CI and JI are attributed to sediment accumulation in the splitter chamber that caused an unequal division of runoff to each vault.
- There is no significant trend in normalized annual FSP loads ( $p > 0.05$ ).
- There is no significant trend in normalized annual TN loads ( $p > 0.05$ ).
- There is no significant trend in normalized annual TP loads ( $p > 0.05$ ).

Table 6 12-year seasonal and annual rainfall normalized pollutant loads at the Contech MFS Inflow, WY14-25.

Year	% Runoff	FSP (lbs/acre/inch)				TN (lbs/acre/inch)				TP (lbs/acre/inch)			
		Fall/ Winter	Spring	Summer	Annual	Fall/ Winter	Spring	Summer	Annual	Fall/ Winter	Spring	Summer	Annual
2014	38.6%	8.358	43.467	23.094	20.612	0.065	0.230	0.386	0.179	0.021	0.122	0.079	0.060
2015	53.2%	29.875	41.461	7.517	29.122	0.127	0.164	0.086	0.130	0.097	0.110	0.015	0.086
2016	44.7%	84.812	183.564	0.000	118.153	0.179	0.260	0.000	0.205	0.149	0.399	0.000	0.234
2017	78.9%	19.239	139.993	20.235	40.646	0.178	0.611	0.048	0.248	0.064	0.688	0.035	0.173
2018	39.0%	23.391	51.881	20.808	38.173	0.136	0.116	0.554	0.143	0.083	0.068	0.113	0.076
2019	34.2%	11.578	153.825	8.569	44.624	0.083	0.565	0.227	0.200	0.066	0.866	0.070	0.253
2020	8.0%	9.896	26.907	39.794	17.783	0.040	0.148	0.723	0.138	0.068	0.175	0.288	0.120
2021	4.4%	2.493	22.475	23.756	8.003	0.010	0.130	0.671	0.079	0.016	0.132	0.185	0.051
2022	27.7%	3.203	44.055	10.439	10.133	0.050	0.191	0.184	0.085	0.030	0.267	0.076	0.070
2023	25.7%	2.939	45.010	7.690	13.743	0.025	0.150	0.209	0.080	0.022	0.230	0.054	0.077
2024	30.2%	11.214	36.125	14.671	18.802	0.106	0.148	0.507	0.139	0.072	0.188	0.086	0.107
2025	25.9%	12.339	40.674	31.677	21.994	0.051	0.159	0.677	0.175	0.062	0.179	0.227	0.115
Tau	na	-0.333	-0.273	0.182	-0.273	-0.364	-0.242	0.333	-0.273	-0.212	0.091	0.364	0.000
P-Value	na	0.131	0.217	0.411	0.217	0.100	0.273	0.131	0.217	0.337	0.681	0.100	1.000
Theil Slope (per year)	na	-2.051	-2.087	0.702	-2.095	-0.010	-0.006	0.033	-0.006	-0.003	0.003	0.009	0.000

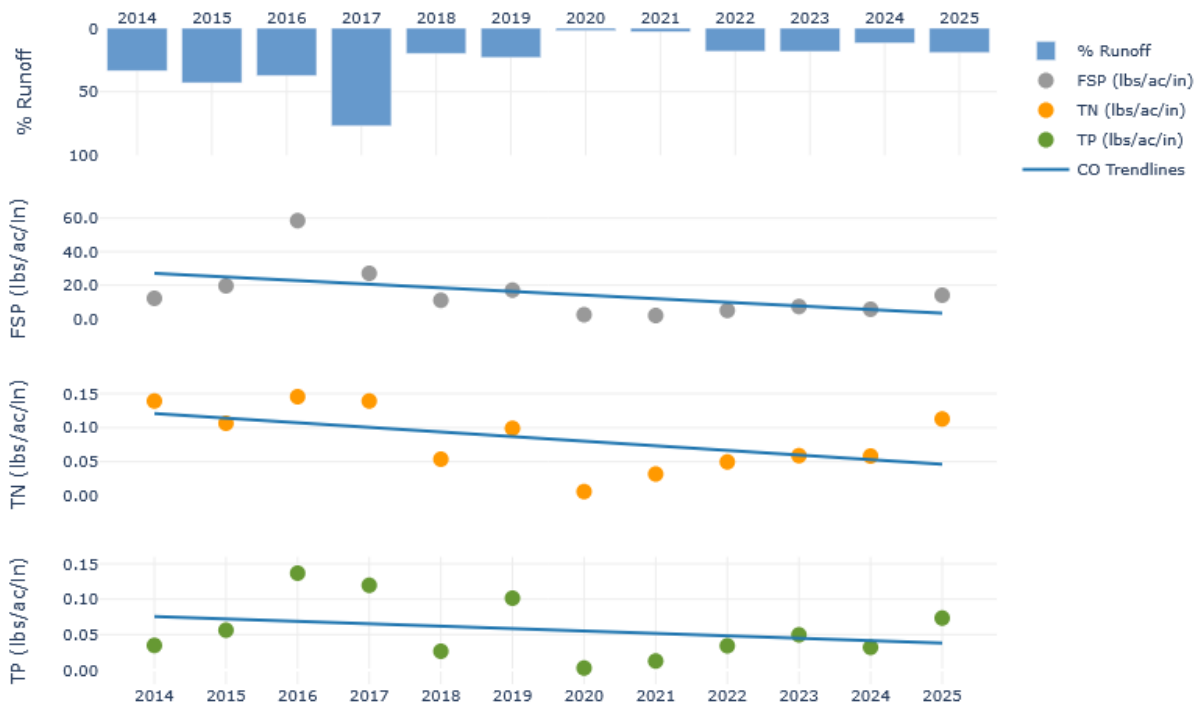


Figure 5 12-year rainfall normalized annual pollutant load trends in FSP, TN, and TP loads at the Contech MFS Outflow, WY14-25.

- Percent runoff varied between 1.9% in WY20 to 76.9% in WY17.
- There is no significant trend in normalized annual FSP loads ( $p > 0.05$ ).
- There is no significant trend in normalized annual TN loads ( $p > 0.05$ ).
- There is no significant trend in normalized annual TP loads ( $p > 0.05$ ).

Table 7 12-year seasonal and annual rainfall normalized pollutant loads at the Contech MFS Outflow, WY14-25.

Year	% Runoff	FSP (lbs/acre/inch)				TN (lbs/acre/inch)				TP (lbs/acre/inch)			
		Fall/ Winter	Spring	Summer	Annual	Fall/ Winter	Spring	Summer	Annual	Fall/ Winter	Spring	Summer	Annual
2014	33.4%	5.379	24.072	13.952	12.066	0.049	0.148	0.340	0.139	0.012	0.065	0.054	0.035
2015	43.0%	21.341	26.666	4.092	19.693	0.095	0.119	0.120	0.106	0.062	0.071	0.018	0.056
2016	37.3%	51.444	73.789	0.000	58.555	0.115	0.207	0.000	0.145	0.115	0.181	0.000	0.137
2017	76.9%	14.183	88.657	9.395	27.130	0.063	0.500	0.041	0.139	0.041	0.494	0.016	0.120
2018	19.8%	12.986	9.207	11.693	10.958	0.063	0.025	0.325	0.054	0.048	0.005	0.076	0.027
2019	23.1%	4.984	56.048	9.371	17.041	0.041	0.271	0.163	0.099	0.028	0.340	0.060	0.102
2020	1.9%	0.000	0.000	24.274	2.351	0.000	0.000	0.063	0.006	0.000	0.000	0.030	0.003
2021	2.7%	0.000	8.591	3.190	1.971	0.000	0.069	0.271	0.032	0.000	0.051	0.036	0.013
2022	18.3%	1.633	20.153	5.961	4.882	0.027	0.098	0.149	0.050	0.014	0.129	0.042	0.034
2023	18.4%	1.751	21.877	6.554	7.269	0.022	0.094	0.167	0.059	0.016	0.140	0.046	0.050
2024	11.6%	2.811	10.862	10.164	5.582	0.034	0.048	0.433	0.058	0.018	0.057	0.060	0.032
2025	19.3%	8.395	23.589	22.099	14.101	0.040	0.103	0.407	0.113	0.042	0.103	0.149	0.073
Tau	na	-0.351	-0.212	0.152	-0.333	-0.412	-0.242	0.333	-0.303	-0.168	-0.030	0.394	-0.152
P-Value	na	0.112	0.337	0.493	0.131	0.062	0.273	0.131	0.170	0.447	0.891	0.075	0.493
Theil Slope (per year)	na	-1.157	-1.126	0.616	-1.480	-0.005	-0.008	0.020	-0.007	-0.003	-0.001	0.005	-0.002

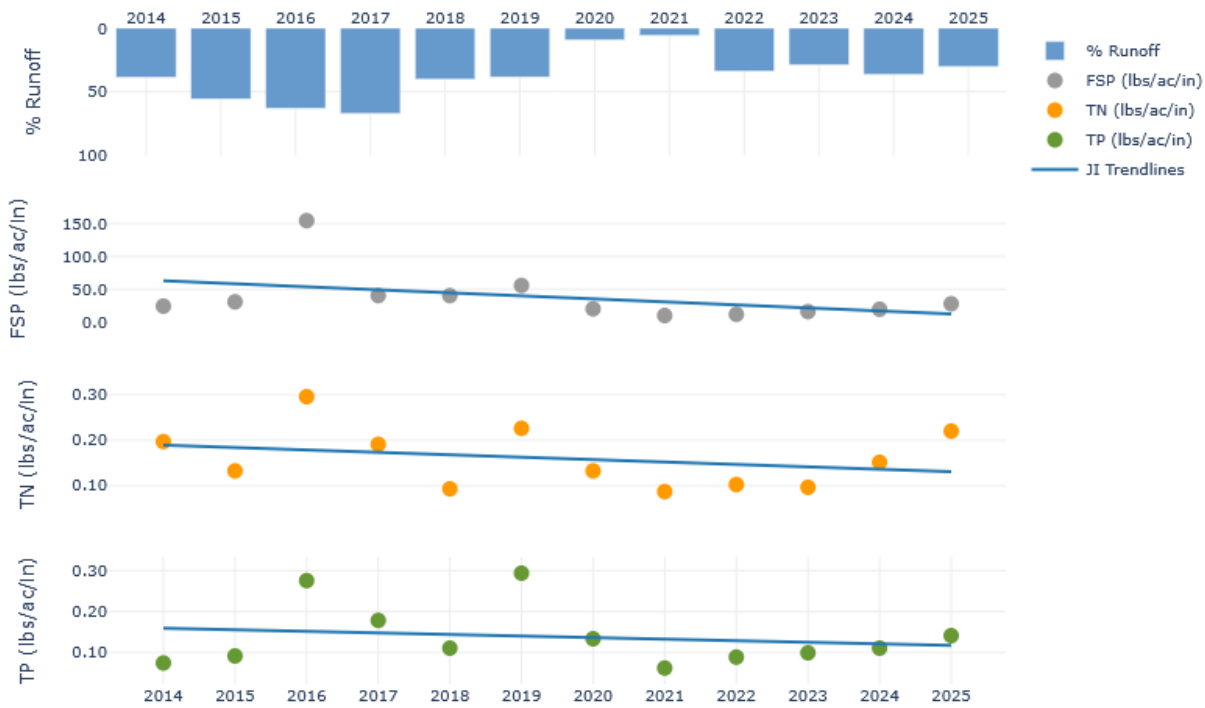


Figure 6 12-year rainfall normalized annual pollutant load trends in FSP, TN, and TP loads at the Jellyfish Inflow, WY14-25.

- Percent runoff varied between 5.7% in WY21 to 67.2% in WY17. Differences in % runoff between CI and JI are attributed to sediment accumulation in the splitter chamber that caused an unequal division of runoff to each vault.
- There is no significant trend in normalized annual FSP loads ( $p > 0.05$ ).
- There is no significant trend in normalized annual TN loads ( $p > 0.05$ ).
- There is no significant trend in normalized annual TP loads ( $p > 0.05$ ).

Table 8 12-year seasonal and annual rainfall normalized pollutant loads at the Jellyfish Inflow, WY14-25.

Year	% Runoff	FSP (lbs/acre/inch)				TN (lbs/acre/inch)				TP (lbs/acre/inch)			
		Fall/ Winter	Spring	Summer	Annual	Fall/ Winter	Spring	Summer	Annual	Fall/ Winter	Spring	Summer	Annual
2014	38.6%	13.733	51.563	18.989	24.558	0.060	0.313	0.384	0.197	0.033	0.160	0.075	0.075
2015	55.5%	30.438	46.614	8.065	31.038	0.116	0.174	0.109	0.132	0.095	0.133	0.017	0.092
2016	62.9%	117.285	228.200	0.000	154.437	0.214	0.457	0.000	0.296	0.223	0.385	0.000	0.276
2017	67.2%	19.818	137.664	15.455	40.456	0.096	0.643	0.061	0.191	0.065	0.714	0.033	0.179
2018	40.2%	20.067	59.455	18.262	40.577	0.072	0.076	0.526	0.093	0.070	0.146	0.105	0.111
2019	38.3%	12.118	199.427	9.225	55.670	0.090	0.649	0.263	0.227	0.059	1.068	0.071	0.294
2020	9.1%	7.699	43.672	29.192	20.335	0.034	0.172	0.630	0.132	0.057	0.263	0.221	0.134
2021	5.7%	2.562	32.779	26.575	10.351	0.011	0.166	0.672	0.087	0.016	0.183	0.197	0.062
2022	33.7%	3.405	54.860	11.002	11.978	0.060	0.253	0.189	0.102	0.039	0.331	0.094	0.089
2023	28.8%	3.350	54.324	8.714	16.387	0.033	0.181	0.235	0.096	0.028	0.300	0.069	0.100
2024	36.4%	9.552	41.981	16.938	19.578	0.094	0.203	0.582	0.152	0.061	0.223	0.097	0.111
2025	30.2%	20.110	48.042	30.813	28.303	0.075	0.205	0.802	0.220	0.092	0.213	0.223	0.141
Tau	na	-0.364	-0.303	0.242	-0.273	-0.303	-0.061	0.424	-0.152	-0.212	0.061	0.424	0.030
P-Value	na	0.100	0.170	0.273	0.217	0.170	0.784	0.055	0.493	0.337	0.784	0.055	0.891
Theil Slope (per year)	na	-1.950	-1.952	1.067	-1.663	-0.004	-0.003	0.040	-0.005	-0.003	0.005	0.010	0.001

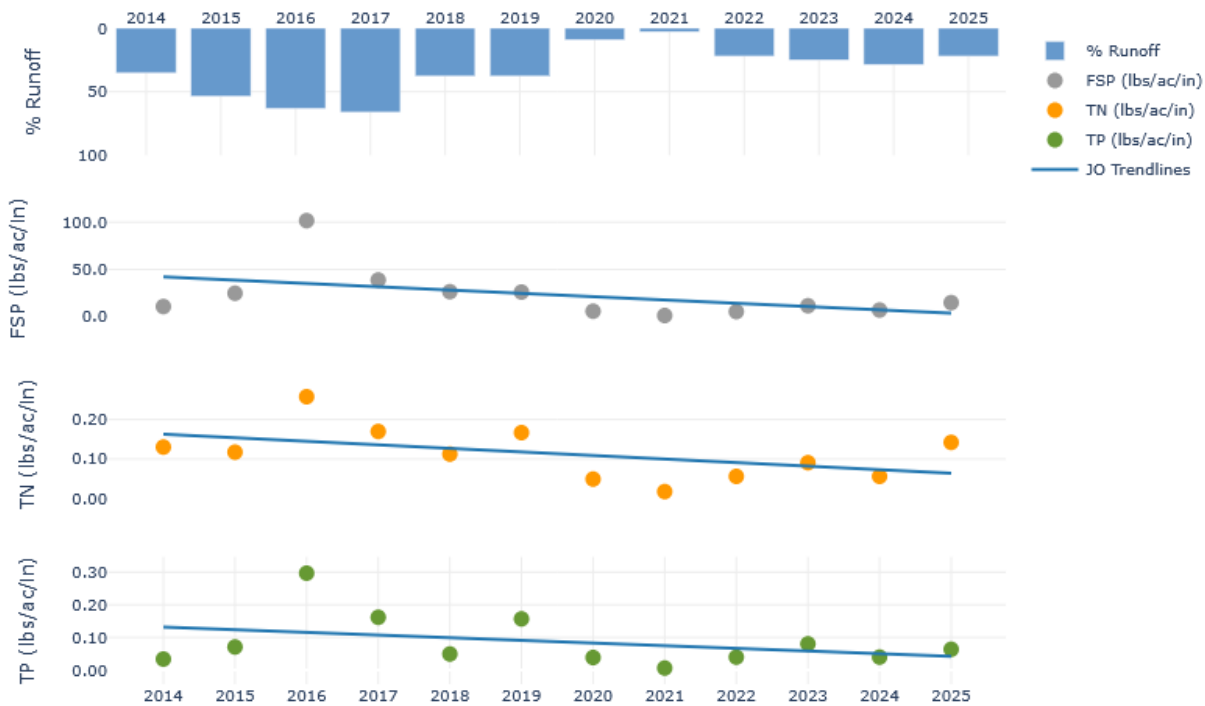


Figure 7 12-year rainfall normalized annual pollutant load trends in FSP, TN, and TP loads at the Jellyfish Outflow, WY14-25.

- Percent runoff varied between 2.7% in WY21 to 66.1% in WY17.
- There is no significant trend in normalized annual FSP loads ( $p > 0.05$ ), however, there is a significant decreasing trend in normalized fall/winter FSP loads ( $p = 0.02$  and  $\text{Tau} = -0.515$ ).
- There is no significant trend in normalized annual TN loads ( $p > 0.05$ ).
- There is no significant trend in normalized annual TP loads ( $p > 0.05$ ).

Table 9 12-year seasonal and annual rainfall normalized pollutant loads at the Jellyfish Outflow, WY14-25.

Year	% Runoff	FSP (lbs/acre/inch)				TN (lbs/acre/inch)				TP (lbs/acre/inch)			
		Fall/ Winter	Spring	Summer	Annual	Fall/ Winter	Spring	Summer	Annual	Fall/ Winter	Spring	Summer	Annual
2014	35.3%	3.083	22.706	15.463	10.860	0.031	0.134	0.355	0.130	0.008	0.062	0.062	0.034
2015	53.6%	25.300	36.630	4.932	24.843	0.090	0.172	0.110	0.118	0.075	0.094	0.020	0.070
2016	63.1%	71.162	161.372	0.000	101.704	0.149	0.465	0.000	0.257	0.142	0.593	0.000	0.297
2017	66.1%	17.727	138.446	14.408	38.923	0.085	0.578	0.036	0.170	0.054	0.673	0.014	0.162
2018	37.7%	17.617	34.894	17.625	26.646	0.092	0.104	0.432	0.113	0.059	0.036	0.110	0.049
2019	37.7%	9.904	80.714	5.312	26.244	0.078	0.424	0.300	0.166	0.051	0.509	0.043	0.157
2020	9.0%	3.712	11.625	2.770	5.942	0.024	0.079	0.123	0.050	0.023	0.074	0.025	0.038
2021	2.7%	0.384	2.610	10.160	1.492	0.004	0.044	0.090	0.018	0.003	0.016	0.017	0.006
2022	22.0%	0.979	26.726	5.394	5.332	0.025	0.148	0.147	0.056	0.013	0.167	0.041	0.039
2023	24.9%	2.625	37.267	7.401	11.641	0.026	0.148	0.280	0.090	0.021	0.247	0.053	0.080
2024	28.5%	0.000	22.896	10.185	7.333	0.000	0.117	0.431	0.057	0.000	0.120	0.065	0.039
2025	22.0%	9.462	23.807	24.305	15.151	0.032	0.112	0.608	0.142	0.045	0.103	0.083	0.064
Tau	na	-0.515	-0.242	0.212	-0.303	-0.424	-0.273	0.333	-0.303	-0.424	-0.030	0.333	-0.152
P-Value	na	0.020	0.273	0.337	0.170	0.055	0.217	0.131	0.170	0.055	0.891	0.131	0.493
Theil Slope (per year)	na	-2.525	-1.957	0.562	-1.897	-0.008	-0.011	0.025	-0.008	-0.006	-0.005	0.005	-0.003

### 3. Provide mass loading v. volume calculations for select events

Seasonal Progress Report #3 provides this analysis for events that occurred in the fall/winter and spring of water year 2016. Seasonal Progress Report #1 included a similar study based on four events that occurred in the late spring and early summer of water year 2015. Analyses have consistently shown that in general, turbidities (and thus FSP) mirror the flow and therefore no first flush phenomenon exists at SR431 with respect to FSP. This may indicate that the primary road serves as a constant source of sediment. Due to consistent results this analysis has not been repeated since Seasonal Progress Report #3. This analysis can be repeated upon request.

# Appendix A

Hydrographs, continuous turbidity, and sample distribution for all sampled events.

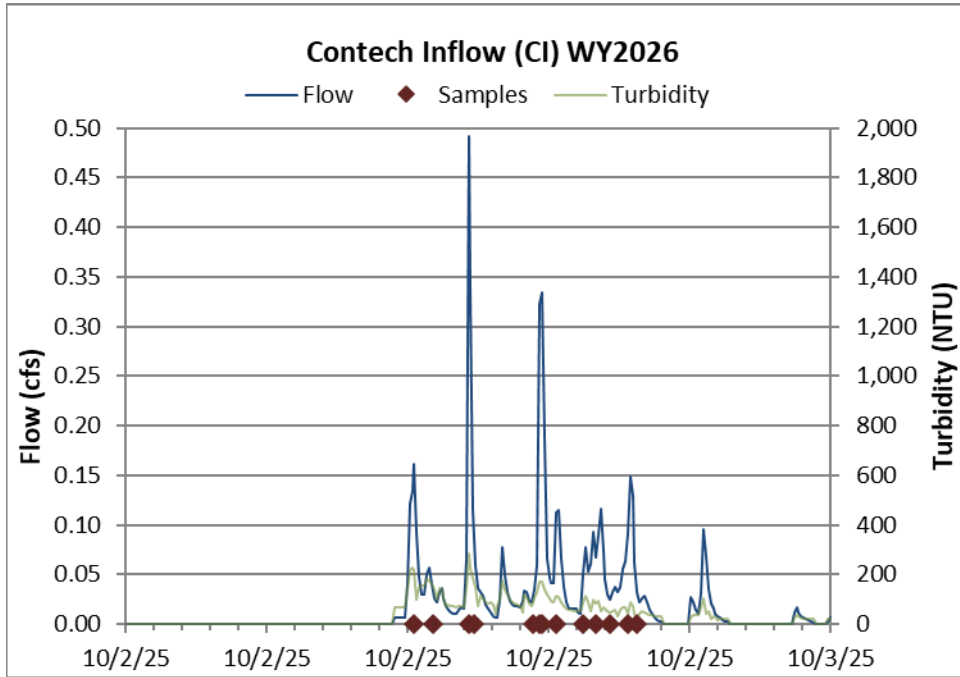


Figure 8 Hydrograph, continuous turbidity, and sample distribution at the Contech Inflow for the 10/2/2025 rain event.

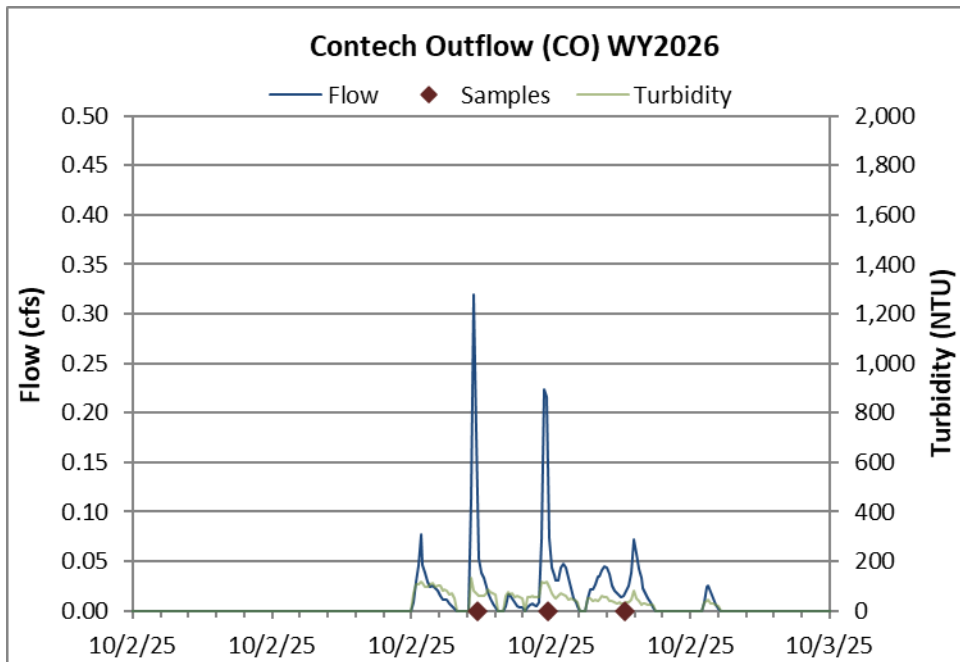


Figure 9 Hydrograph, continuous turbidity, and sample distribution at the Contech Outflow for the 10/2/2025 rain event.

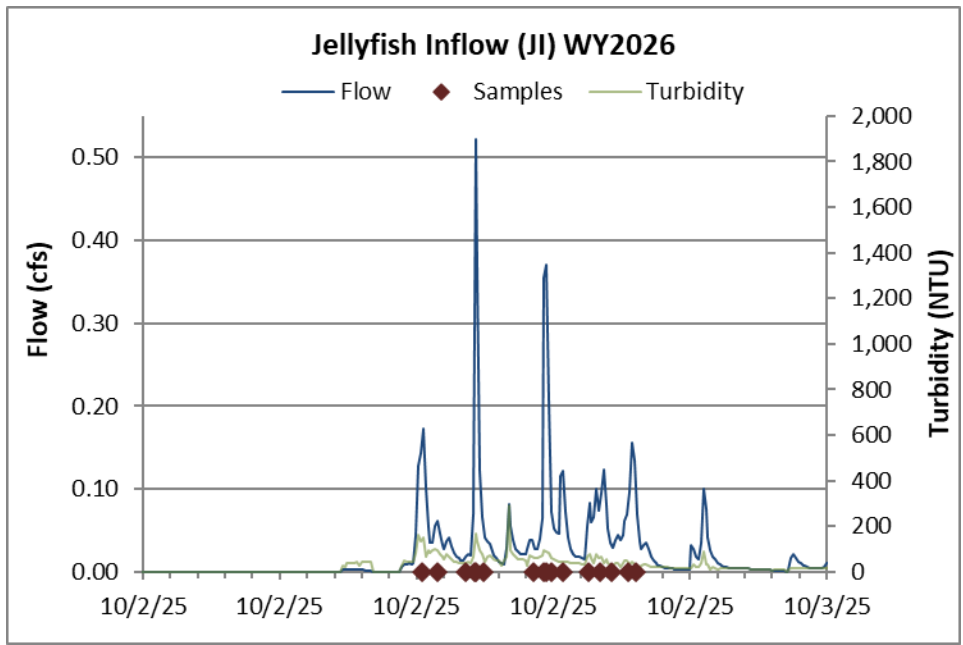


Figure 10 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Inflow for the 10/2/2025 rain event.

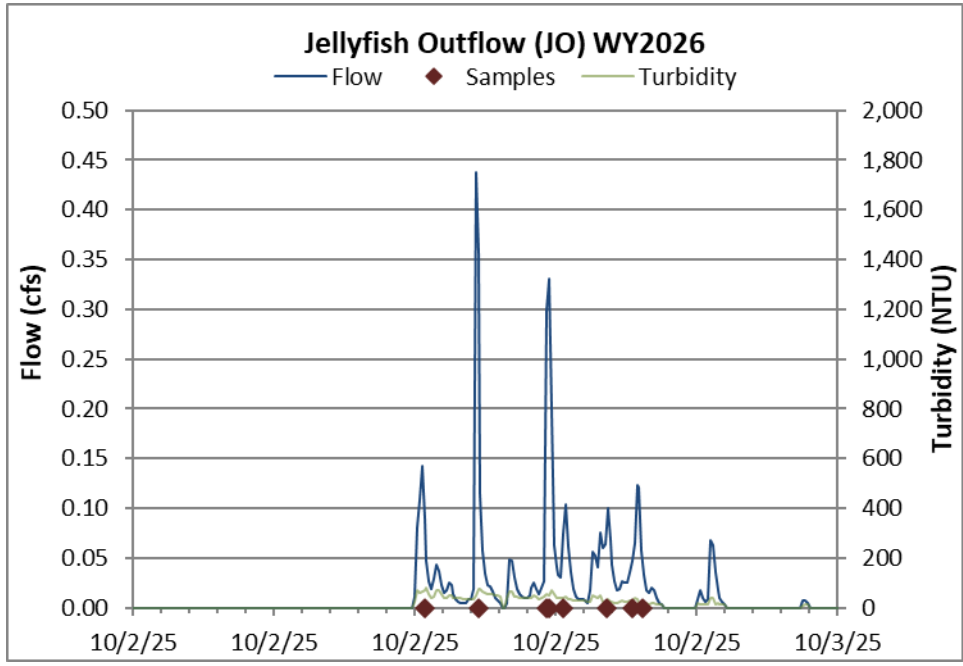


Figure 11 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Outflow for the 10/2/2025 rain event.

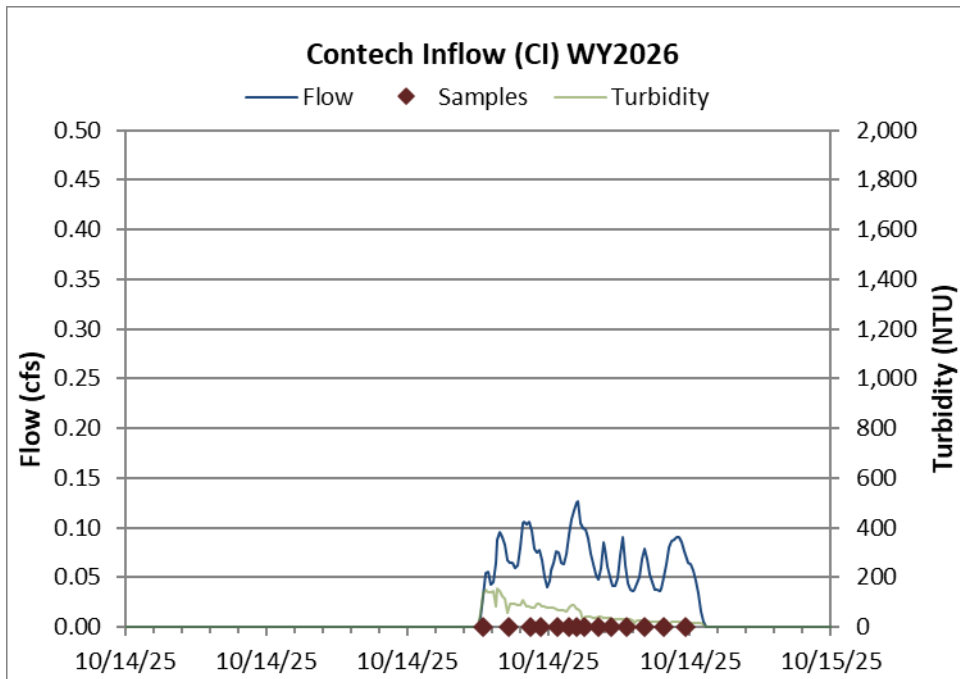


Figure 12 Hydrograph, continuous turbidity, and sample distribution at the Contech Inflow for the 10/14/2025 event snowmelt.

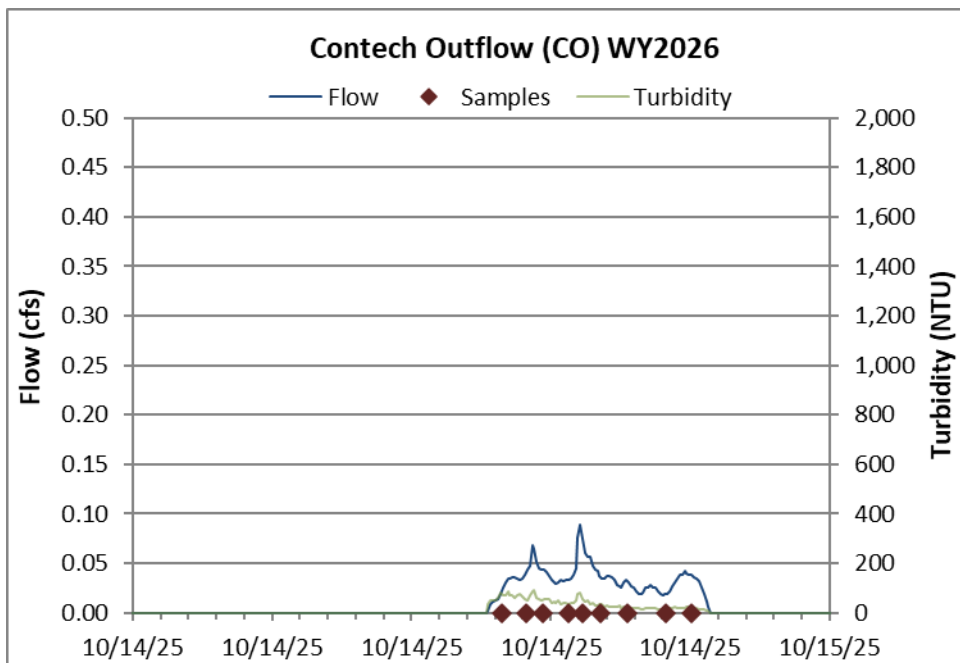


Figure 13 Hydrograph, continuous turbidity, and sample distribution at the Contech Outflow for the 10/14/2025 event snowmelt.

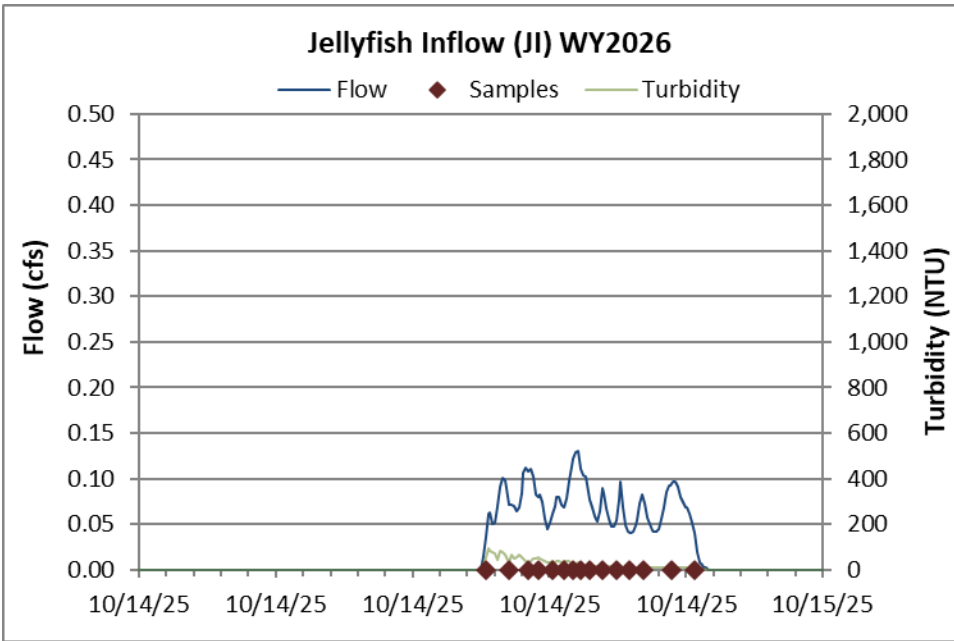


Figure 14 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Inflow for the 10/14/2025 event snowmelt.

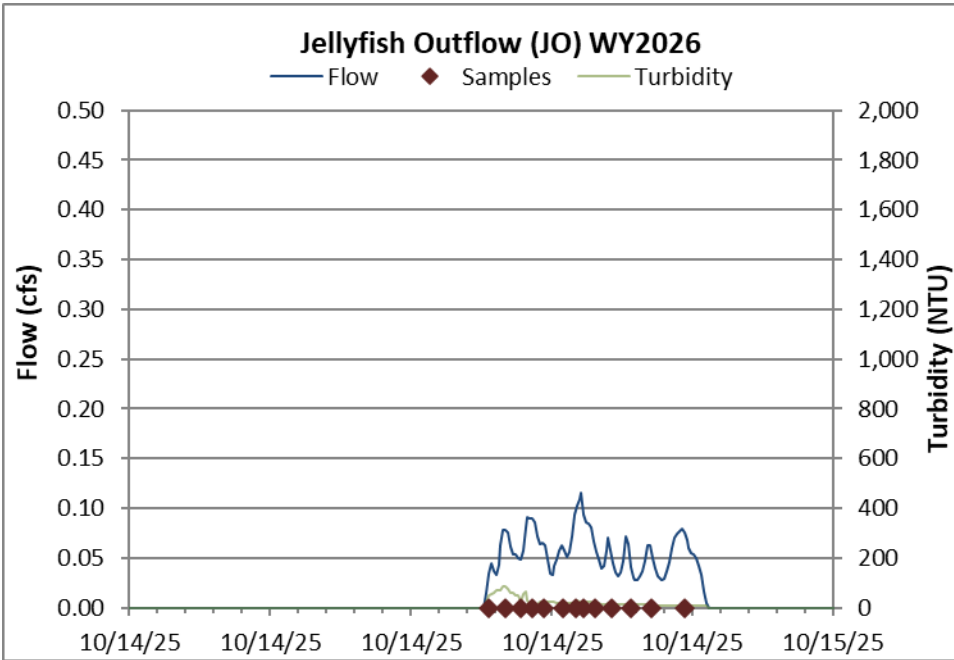


Figure 15 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Outflow for 10/14/2025 event snowmelt.

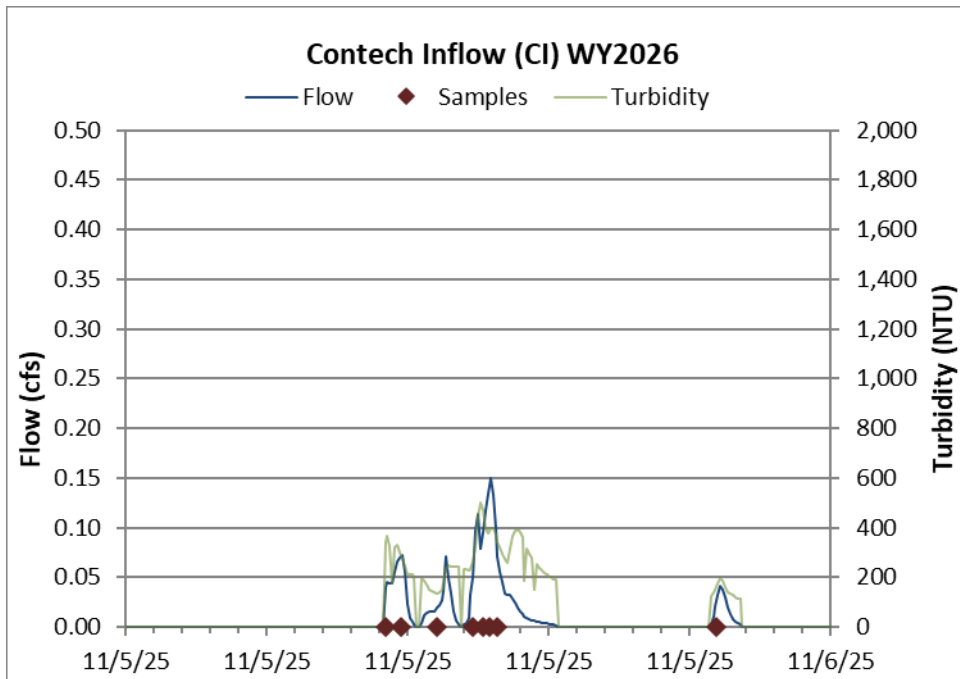


Figure 16 Hydrograph, continuous turbidity, and sample distribution at the Contech Inflow for the 11/5/2025 rain event.

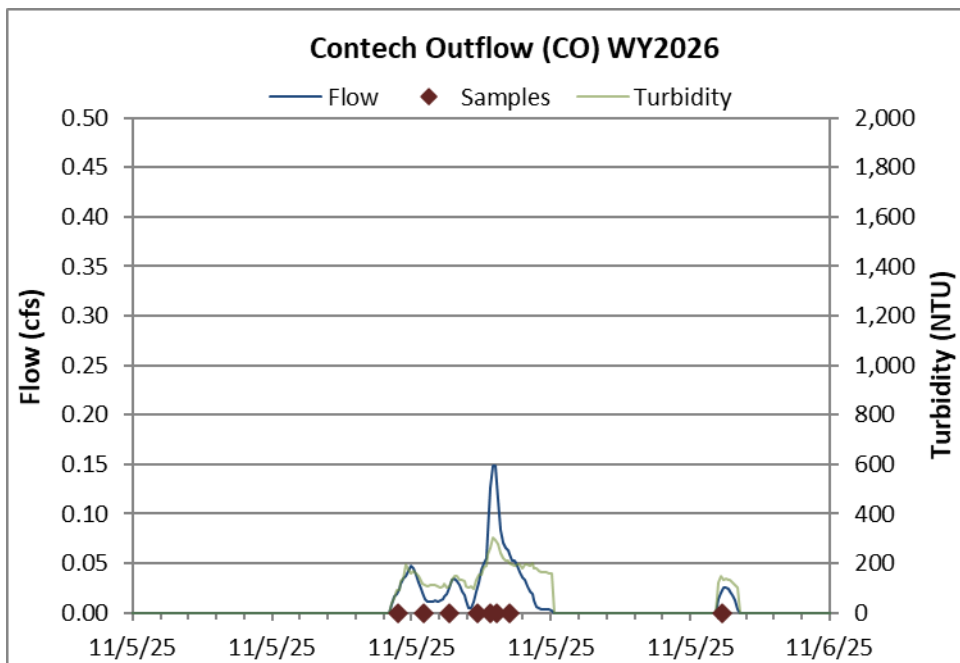


Figure 17 Hydrograph, continuous turbidity, and sample distribution at the Contech Outflow for the 11/5/2025 rain event.

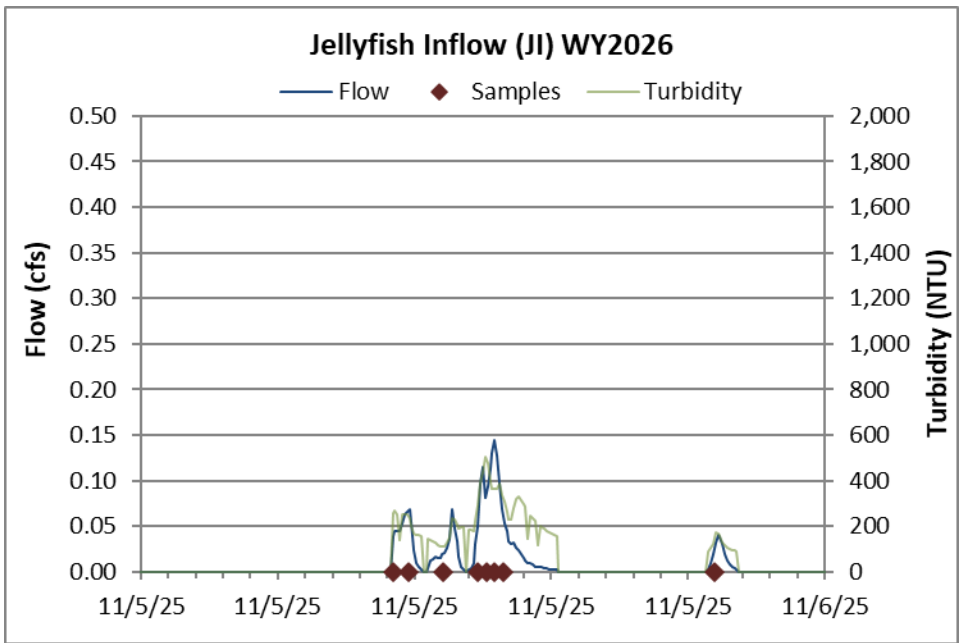


Figure 18 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Inflow for the 11/5/2025 rain event.

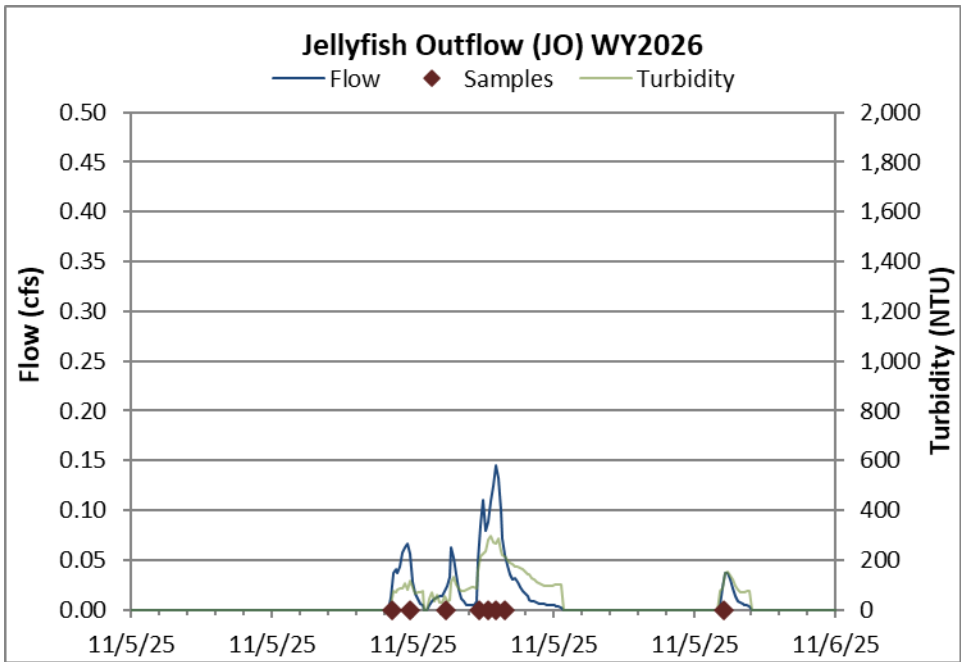


Figure 19 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Outflow for the 11/5/2025 rain event.

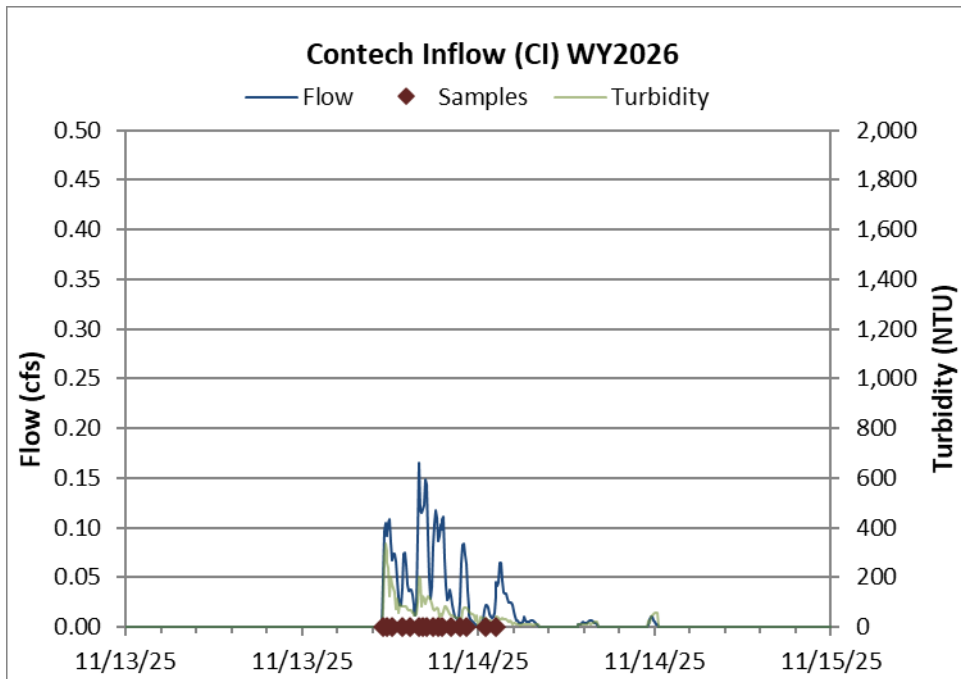


Figure 20 Hydrograph, continuous turbidity, and sample distribution at the Contech Inflow for the 11/14/2025 rain event.

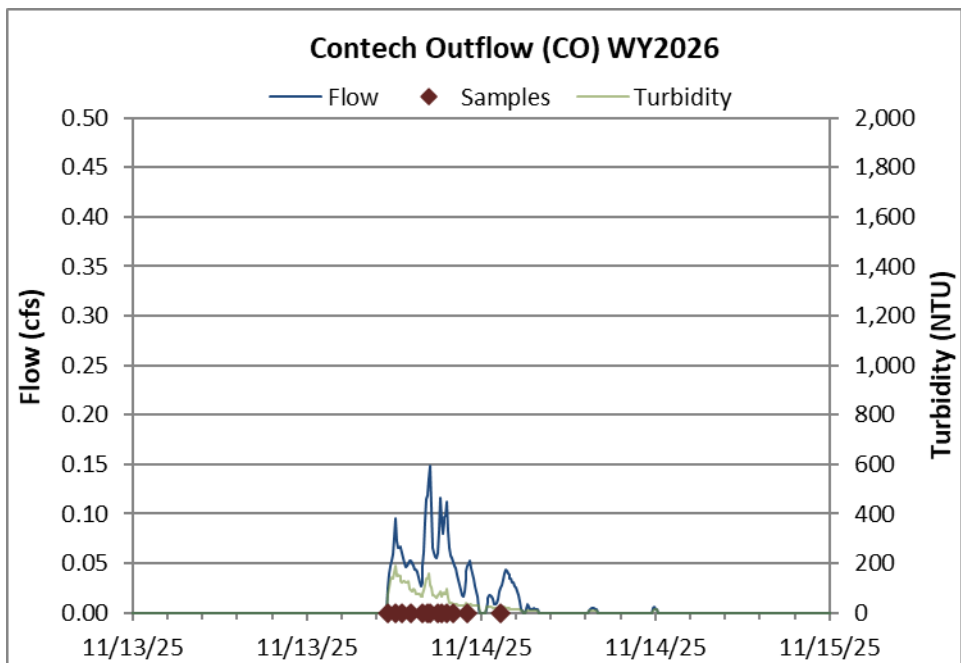


Figure 21 Hydrograph, continuous turbidity, and sample distribution at the Contech Outflow for 11/14/2025 rain event.

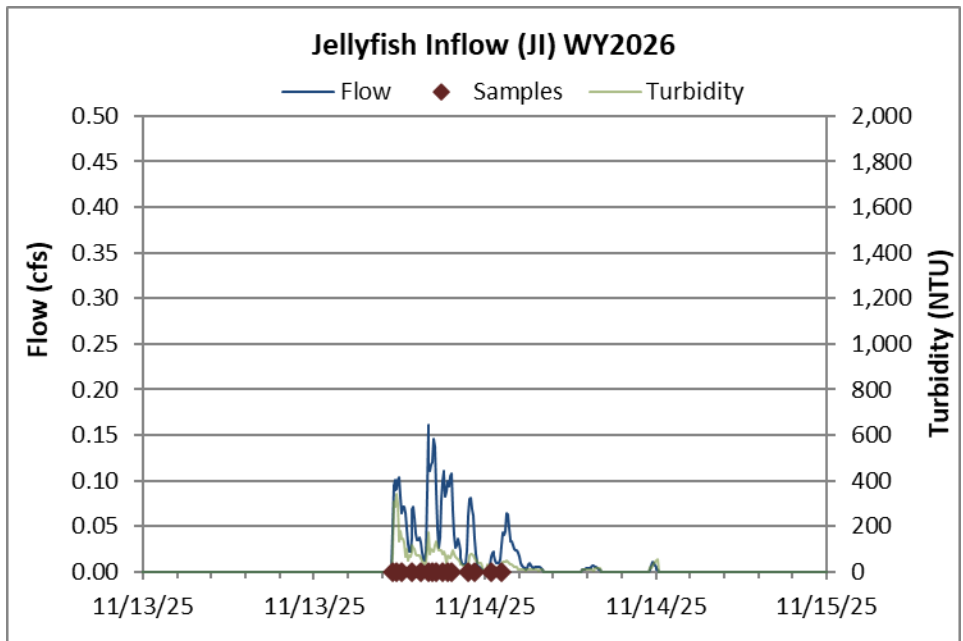


Figure 22 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Inflow for the 11/14/2025 rain event.

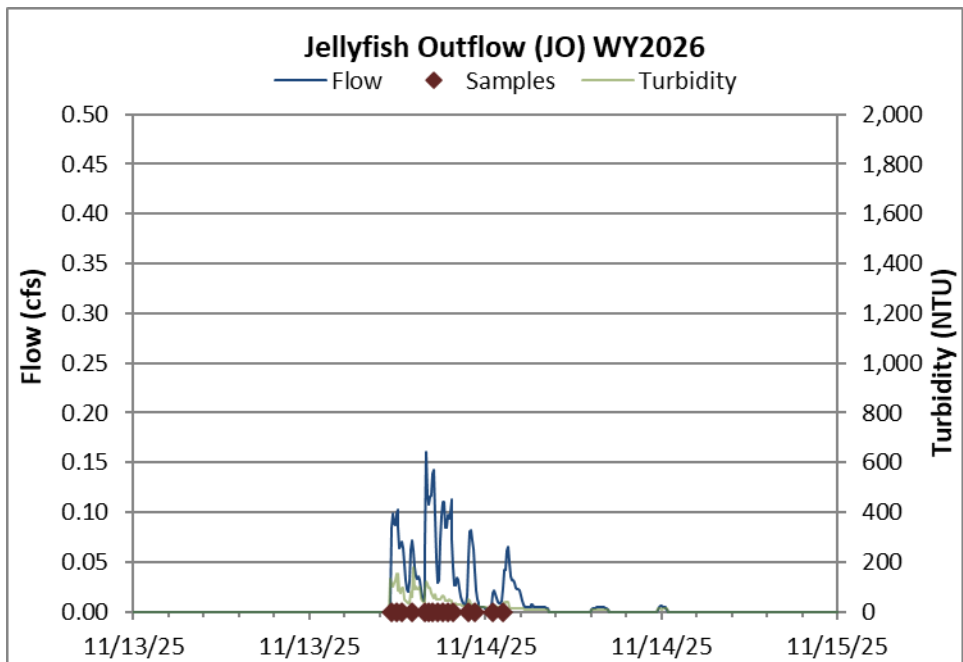


Figure 23 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Outflow for the 11/14/2025 rain event.

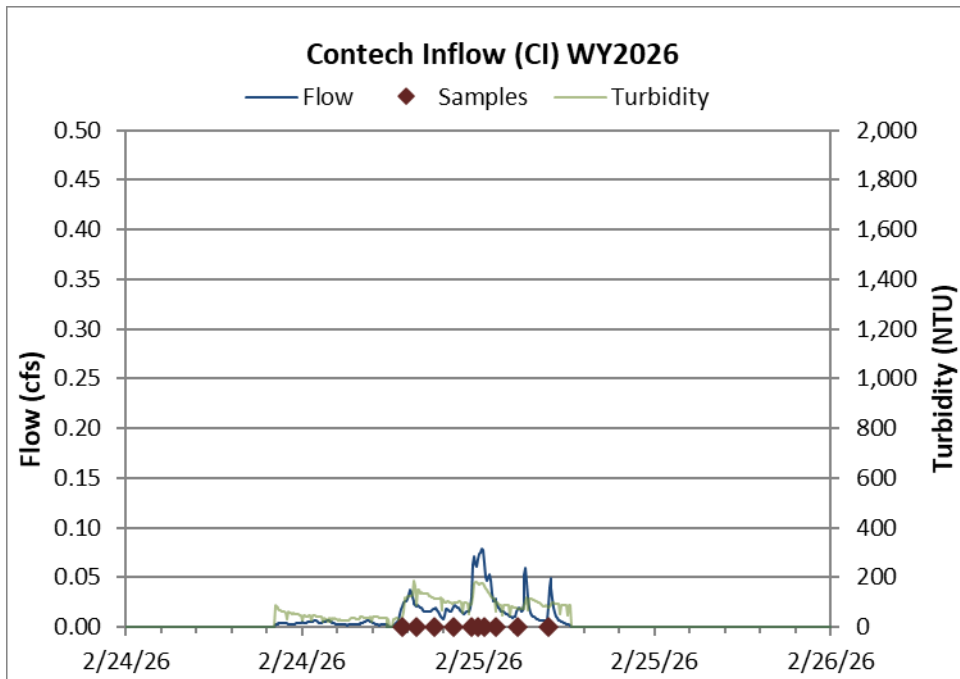


Figure 24 Hydrograph, continuous turbidity, and sample distribution at the Contech Inflow for the 2/24/2025 rain on snow event.

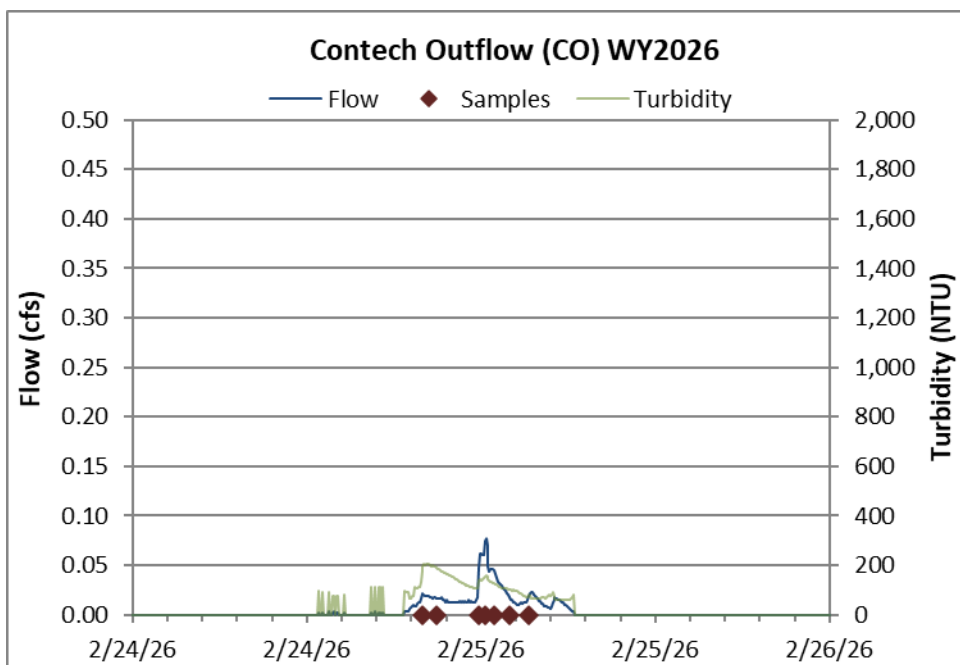


Figure 25 Hydrograph, continuous turbidity, and sample distribution at the Contech Outflow for the 2/24/2025 rain on snow event.

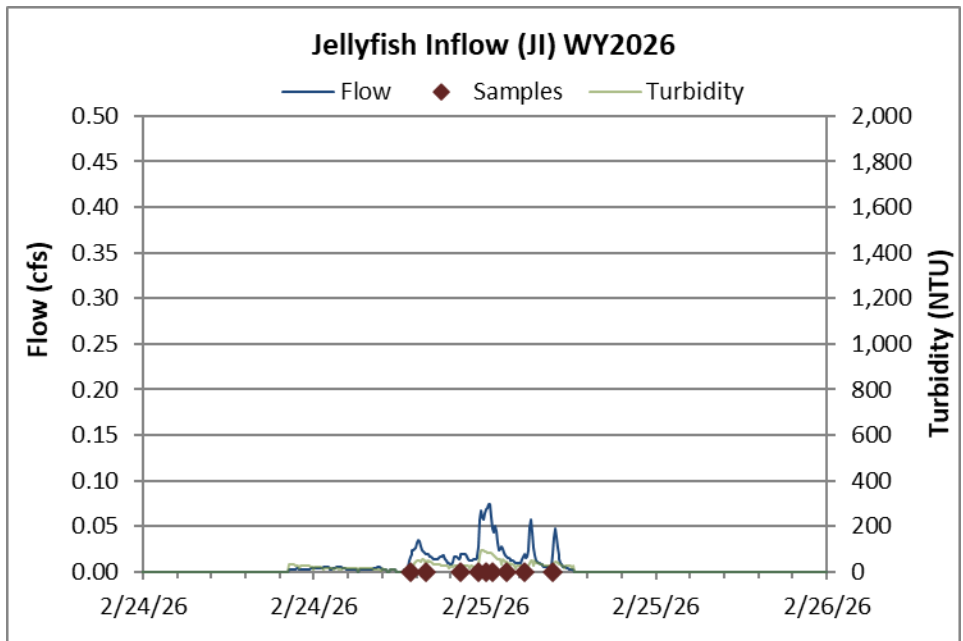


Figure 26 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Inflow for the 2/24/2025 rain on snow event.

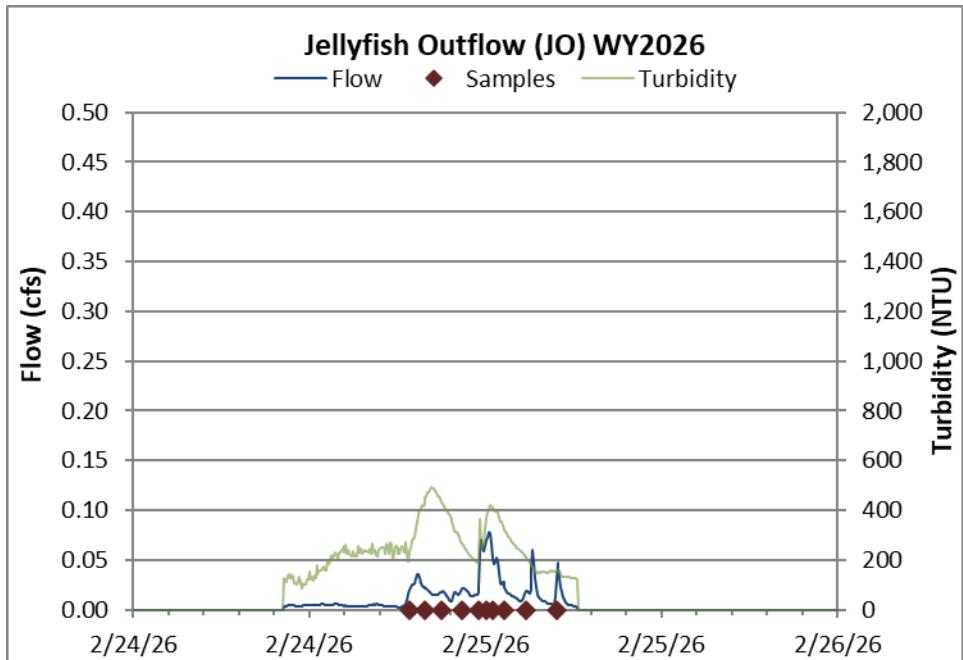


Figure 27 Hydrograph, continuous turbidity, and sample distribution at the Jellyfish Outflow for the 2/24/2025 rain on snow event.

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