2013 TDG Monitoring

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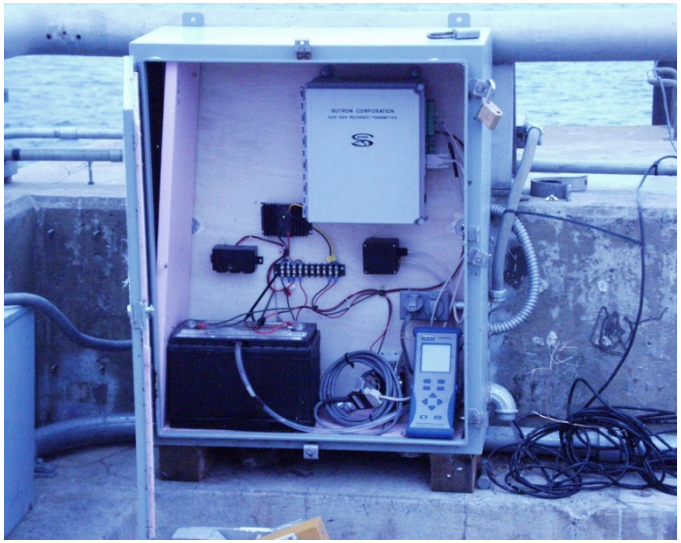
Carson Keeler

Biologist

Grant PUD



Overview

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I. Introduction
II. Fixed-Site Monitoring Stations (FSM Stations)
III. Calibration and QA/QC Methods
IV. Preliminary QA/QC Results
V. TDG Compliance Value Calculation
VI. Monitoring Results
VII. Conclusions

I. Introduction

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- Monitoring Requirements
  - April 2008 FERC License Order
  - 2008 NMFS BiOp
  - 2007 401 Water Quality Certification
    - WDOE-approved Quality Assurance Project Plan (QAPP)

- Monitoring parameters, Intervals, and Technology
  - Monitor Temperature and TDG, hourly/year-around
  - Monitor trend-data for DO, pH, and turbidity every two-three weeks
  - DataSonde 5x/5, 4a, or MiniSonde 5 multi-probes
  - Sutron Data Collection Platforms (DCP) at each site; data is transmitted through virtual COM-Ports and posted to web-site (~1 hr lag).

Wanapum Dam

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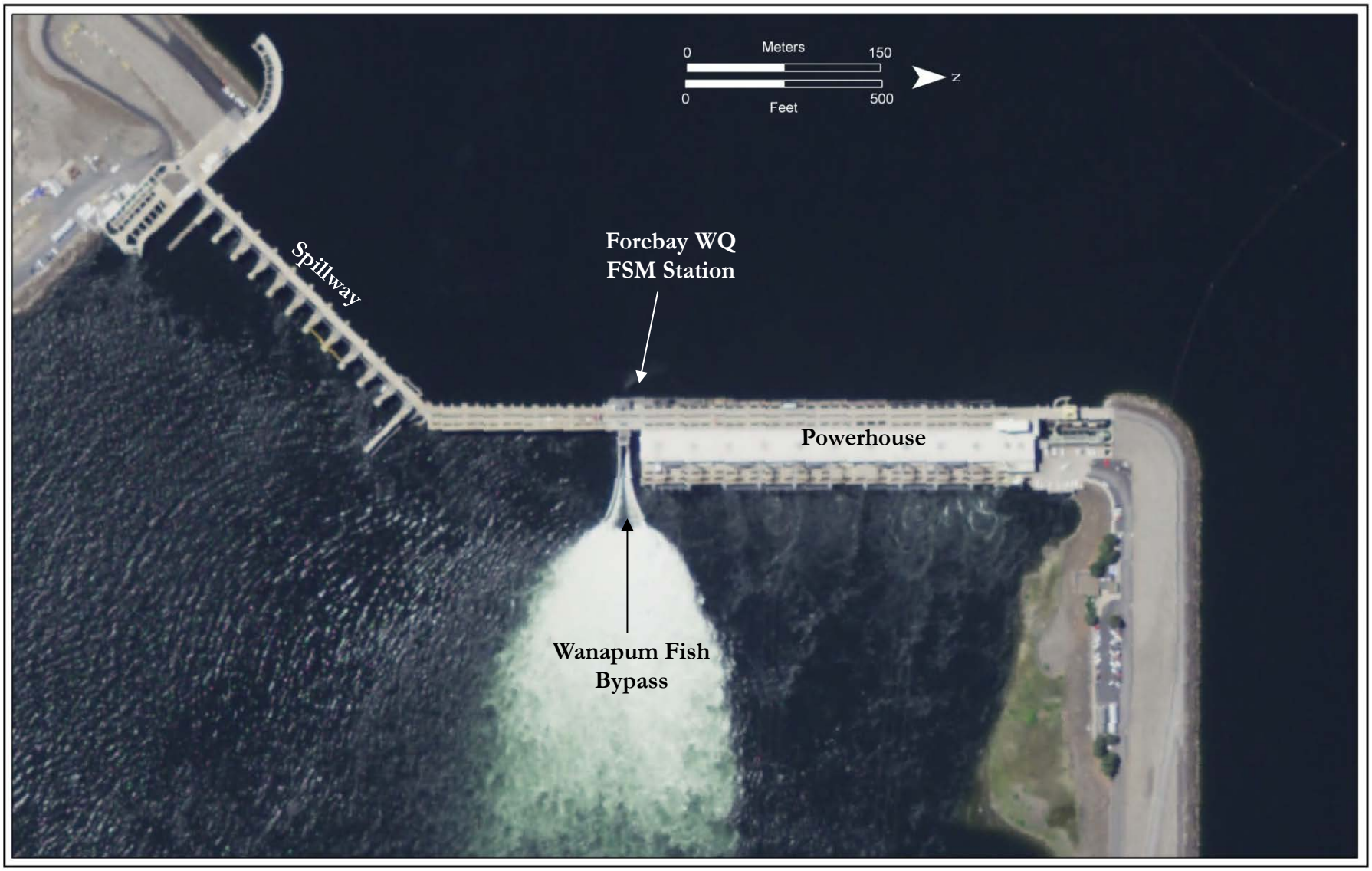

Priest Rapids Dam

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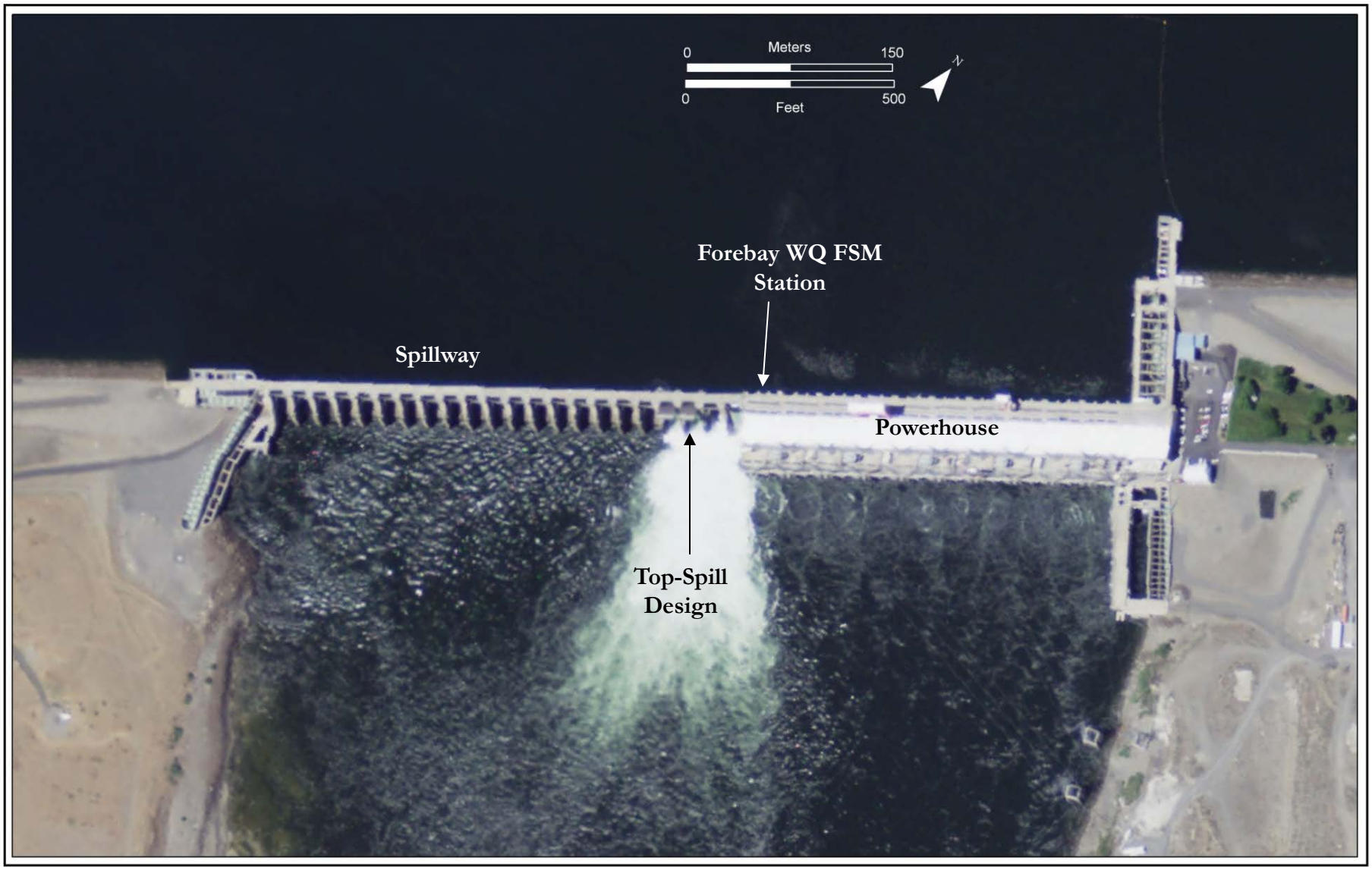

II. Fixed-Site Monitoring Stations–Wanapum Dam

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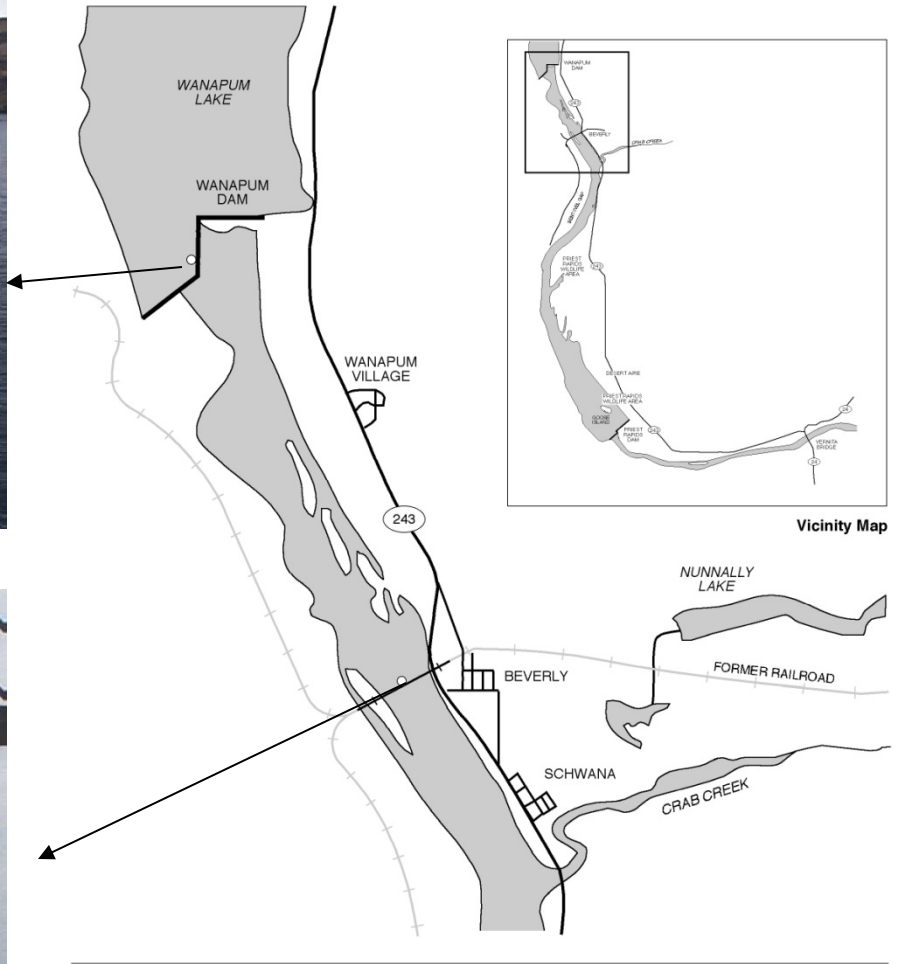

Figure 1
Location of Water Quality Fixed Site Monitoring Stations for Wanapum and Beverly

II. Fixed-Site Monitoring Stations–Priest Rapids Dam

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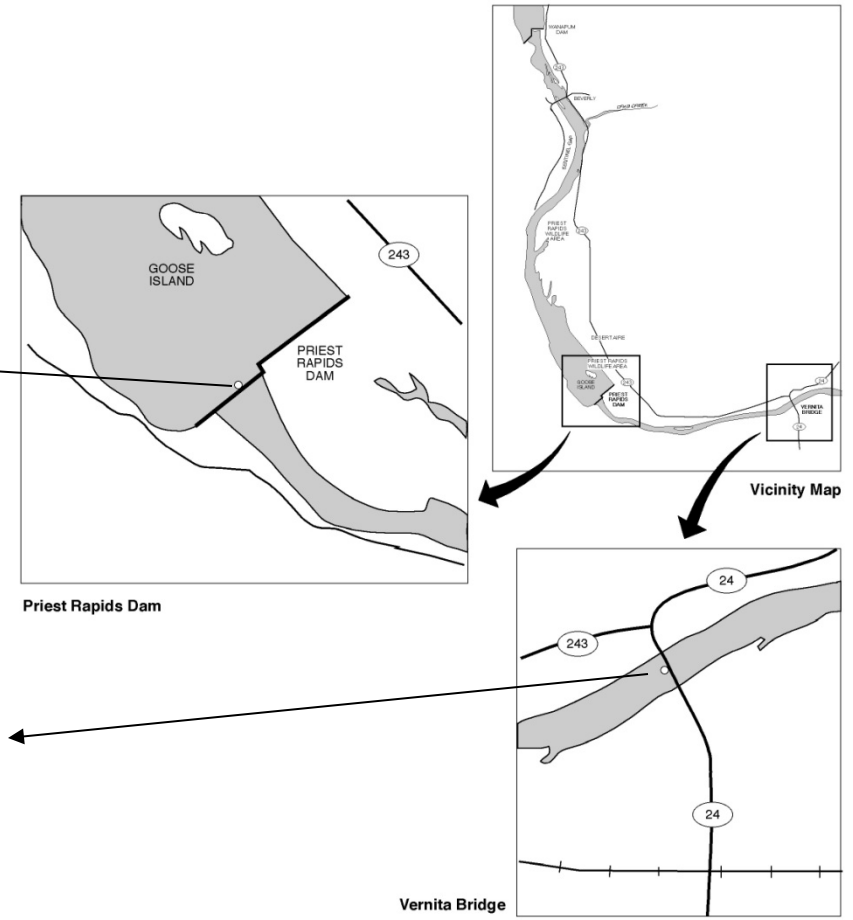

Parametrix 553-1542-037.04(035) GIS Services 8/03 (K)

N

NOT TO SCALE

○ Fixed Station

Figure 2
Location of Water Quality Fixed Site Monitoring Stations for Priest and Vernita

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- Section 401 Certification
- Aquatic Invasive Species
- Fish & Wildlife
- Shoreline Management
- Artifact Protection
- Renewable Energy
- Energy Efficiency

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WATER QUALITY MONITORING DATA

Water quality within the Priest Rapids Project area supports domestic, industrial and agricultural water supply, stock watering, wildlife habitat, fish spawning, migration and rearing. We currently operate and maintains four, fixed-site water quality stations within the Priest Rapids Project Area. These sites are located in the forebays and tailraces of Wanapum and Priest Rapids dams. A multi-probe water quality measuring device located at each station collects water temperature (Temp - Celsius - ° C), barometric pressure (mm/hg) and total dissolved gas (TDG - percent saturation) data on an hourly basis. Bi-weekly grab samples of turbidity, dissolved oxygen and pH are also collected from these sites. The data collected is used to document the status of key water quality variables within the Priest Rapids Project area and to comply with our 401 water quality certification.

Water Quality Data

- **Past 72 Hours Water Quality:** View Data »
- **2011 Water Quality Monitoring Report:** Download »
- Quality Assurance Project Plan
- Total Dissolved Gas Abatement Plan

Dissolved Gas Supersaturation Measurements

- **Hourly Data:** 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007
- **Monthly Summaries (xls):** 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007

http://www.grantpud.org/index.php/environment/water-quality/monitoring-data

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WATER QUALITY INFORMATION FOR PAST 72 HOURS

Water Quality Information

Priest Rapids Forebay

Starting Date:12/10/2013 11:00 End Date:12/07/2013 11:00

DateTime	Discharge	Spill	Spill%	Sat%	Temp	TDG	BARO
12/10/2013 11:00	114	0	0	93.9	8.54	715.0	761.7
12/10/2013 10:00	106	0	0	93.9	8.54	715.0	761.3
12/10/2013 09:00	80	0	0	94.0	8.56	715.0	761.0
12/10/2013 08:00	96	0	0	94.0	8.51	715.0	760.9
12/10/2013 07:00	130	0	0	94.0	8.50	715.0	760.7
12/10/2013 06:00	101	0	0	94.1	8.57	715.0	760.2
12/10/2013 05:00	107	0	0	94.1	8.57	715.0	759.8
12/10/2013 04:00	99	0	0	94.2	8.59	716.0	759.8
12/10/2013 03:00	102	0	0	94.2	8.61	716.0	759.8
12/10/2013 02:00	111	0	0	94.3	8.64	716.0	759.7
12/10/2013 01:00	124	0	0	94.2	8.63	716.0	759.8
12/10/2013 00:00	117	0	0	94.2	8.64	716.0	759.9
12/09/2013 23:00	94	0	0	94.2	8.62	716.0	759.6
12/09/2013 22:00	98	0	0	94.2	8.60	716.0	759.7
12/09/2013 21:00	105	0	0	94.2	8.63	716.0	760.0
12/09/2013 20:00	100	0	0	94.2	8.64	716.0	760.5
12/09/2013 19:00	103	0	0	94.1	8.60	716.0	760.5
12/09/2013 18:00	90	0	0	94.1	8.64	716.0	761.1
12/09/2013 17:00	90	0	0	94.0	8.66	716.0	761.5
12/09/2013 16:00	111	0	0	94.0	8.70	716.0	761.5

Priest Rapids Forebay
Priest Rapids Tailrace
Wanapum Forebay
Wanapum Tailrace

Water Quality Parameter Definitions

- **Discharge:** Project Discharge in kcfs
- **Spill:**

http://www.grantpud.org/index.php/environment/water-quality/monitoring-data/72-hour-water-quality-information

III. Calibration Methods

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- Bi-weekly schedule during spill-season; every three weeks during non-fish spill season
- Calibration and maintenance follows established guidelines by USGS, Hydrolab Corporation, and WDOE-approved QAPP.
- Calibration data recorded on Hydrolab PDA using Hydrolab pocket-PC software or using Hydras 3LT via PC
- Calibrations conducted in lab; newly calibrated probes deployed next day

III. Probe QA/QC Methods

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- QA/QC re-deployment methods follow established guidelines by USGS, WDOE-approved QAPP
- Calibration data recorded on Hydrolab PDA using Hydrolab pocket-PC software
- QA/QC data recorded on three different probes upon deployment of newly calibrated probe
  - Existing probe
  - QA/QC probe (also allows for grab-samples of DO, pH, and Turbidity)
  - Newly calibrated probe

III. Data QA/QC Methods

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Grant PUD employs three QA/QC methods:

1. Outlying or erroneous data highlighted as it is collected by pre-programmed software

2. Data is graphically displayed by Grant PUD staff to determine additional outlying or erroneous data

3. Maintenance and calibration of probes

IV. QA/QC- Results

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2012 spill season (April 1 – August 31) – QAPP goal of less than 5% data loss

- Probe breakdowns
  - Probe issues at WANF
  - TDG membrane issues at WANT

Overview of total dissolved gas dataset, 2013 fish-spill season.

Location	Available data collection hours	Number of omitted/lost hourly readings	Percent data loss (%)
WANF	3,672	48	1.3
WANT	3,672	141	3.8
PRDF	3,672	0	0
PRDT	3,672	0	0
Total	14,688	189	1.3

Note: WANF = Wanapum forebay, WANT = Wanapum tailrace, PRDF = Priest Rapids forebay, PRDT = Priest Rapids tailrace.

V. TDG Compliance Value Calculation Method

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- Using “rolling” average method creates “double-counting” issue
- Can cause same grouping of hourly TDG values to create TDG exceedance on two separate days
- Six instances of rolling average method creating double-exceedances in 2013
- Between 4/13 & 7/08
  - 2 @ WAN forebay site
  - 4 @ PRD forebay site

Date	Hour	Hourly TDG Value	Average of 12 previous hours	Highest 12-hr consecutive average for each day
4/12/2013	1500	117.1	117.3	
4/12/2013	1600	116.8	117.4	
4/12/2013	1700	116.2	117.5	
4/12/2013	1800	115.8	117.7	
4/12/2013	1900	115.8	117.8	
4/12/2013	2000	115.6	117.9	
4/12/2013	2100	115.5	117.9	
4/12/2013	2200	115.5	117.9	
4/12/2013	2300	115.8	117.9	
4/12/2013	2359	115.0	117.8	116.2
4/13/2013	0100	114.4	115.9	115.9
4/13/2013	0200	114.3	115.7	
4/13/2013	0300	114.2	115.4	
4/13/2013	0400	113.7	115.2	
4/13/2013	0500	113.4	114.9	
4/13/2013	0600	113.2	114.7	
4/13/2013	0700	113.1	114.5	
4/13/2013	0800	112.9	114.3	
4/13/2013	0900	112.8	114.0	
4/13/2013	1000	112.7	113.8	
4/13/2013	1100	112.6	113.5	
4/13/2013	1200	112.6	113.3	113.3
4/13/2013	1300	112.6	113.2	
4/13/2013	1400	112.6	113.0	
4/13/2013	1500	112.5	112.9	
4/13/2013	1600	112.4	112.8	
4/13/2013	1700	112.2	112.7	
4/13/2013	1800	112.0	112.6	
4/13/2013	1900	111.9	112.5	
4/13/2013	2000	111.7	112.4	
4/13/2013	2100	111.4	112.3	
4/13/2013	2200	111.3	112.2	
4/13/2013	2300	111.2	112.0	
4/13/2013	2359	111.3	111.9	

VI. TDG Monitoring Results

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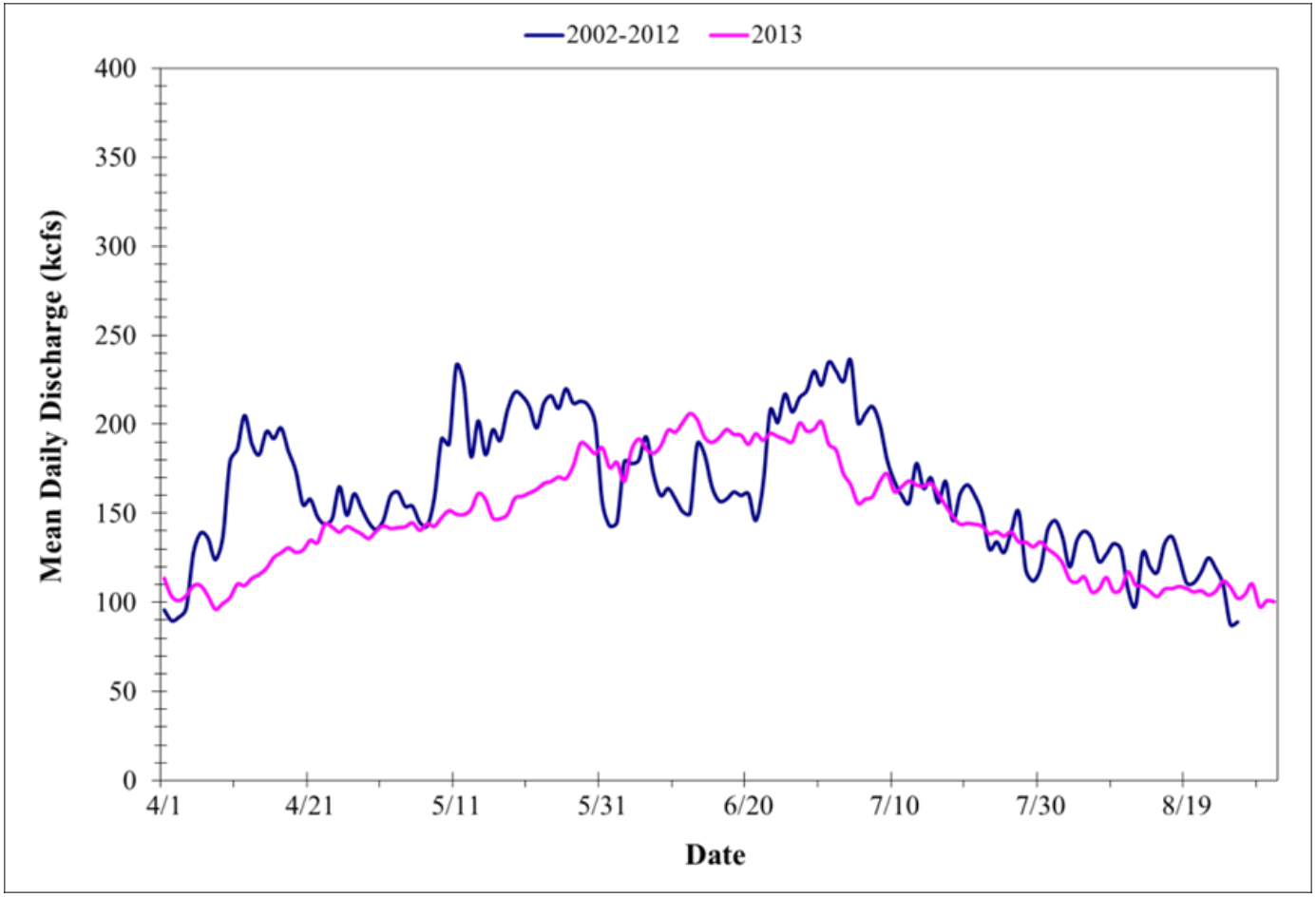

Comparison of 2013 vs. previous 10-year average (2002-2012) of mean daily discharge values as measured at the U.S. Geological Survey streamflow gage #12472800 located below Priest Rapids Dam, mid-Columbia River, WA. 2013 only 12% higher then 10-year average.

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Fish-spill program: Wanapum Dam

Date	Spill Program	Quantity[1]	Purpose
April 17, 2013	***Spring Spill Initiated***		
April 17-June 14	WFB (Open 24 Hours/Day)	Up to 20 kcfs	RPA 1 and terms and conditions of the Biological Opinion and as guided/approved by the PRCC
June 15, 2012	***End of Spring Spill/ Summer Spill Initiated***		
June 15-Aug 22	WFB (Open 24 Hours/Day)	Up to 20 kcfs	Priest Rapids Project Salmon and Steelhead Settlement Agreement and as guided/approved by the PRCC
August 22, 2013	***End of Summer Spill***		
[1]Actual quantity spilled is dependent on forebay and tailwater elevations.			

Fish-spill program: Priest Rapids Dam

Date	Spill Program	Quantity[1]	Purpose
April 18, 2013	***Spring Spill Initiated***		
April 18-June 14	Prototype top-spill: spill-gate 5 & 6 (full open); spill-gate 4 & 7 open 4 ft.	Up to 24 kcfs	RPA 1 and terms and conditions of the Biological Opinion and as guided/approved by the PRCC
June 15, 2012	***End of Spring Spill/ Summer Spill Initiated***		
June 15-Aug 23	Prototype top-spill: spill-gate 5 & 6 (full open); spill-gate 4 & 7 open 4 ft.	Up to 24 kcfs	Priest Rapids Project Salmon and Steelhead Settlement Agreement and as guided/approved by the PRCC
August 23, 2013	***End of Summer Spill***		
[1]Actual quantity spilled is dependent on forebay and tailwater elevations.			

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Number of 2013 fish-spill season total dissolved gas exceedances, Priest Rapids Project, mid-Columbia River, WA.

	Number of 115%/120% exceedances					Number of 125% hourly exceedances		
Location[1]	Spring Spill	Summer Spill	Total	Total # of days[2]	% above standard	Total	Total # of hrs[2]	% above standard
WANT	0	1	1	146	1%	0	3531	0%
PRDF	14	16	30	153	20%	0	3672	0%
PRDT	0	6	6	153	4%	0	3672	0%
PASCO	3	3	6	147	4%	0	3139	0%
Total	17	26	43	599	7%	0	14014	0%

[1]WANT = Wanapum tailrace, PRDF = Priest Rapids forebay, PRDT = Priest Rapids tailrace, PASCO = Pasco Fixed Site Monitor located upstream of McNary Dam (next downstream forebay), operated by the US Army Corps of Engineers.
[2]Based on total number of available days/hrs minus days/hrs omitted due to TDG membrane failures.

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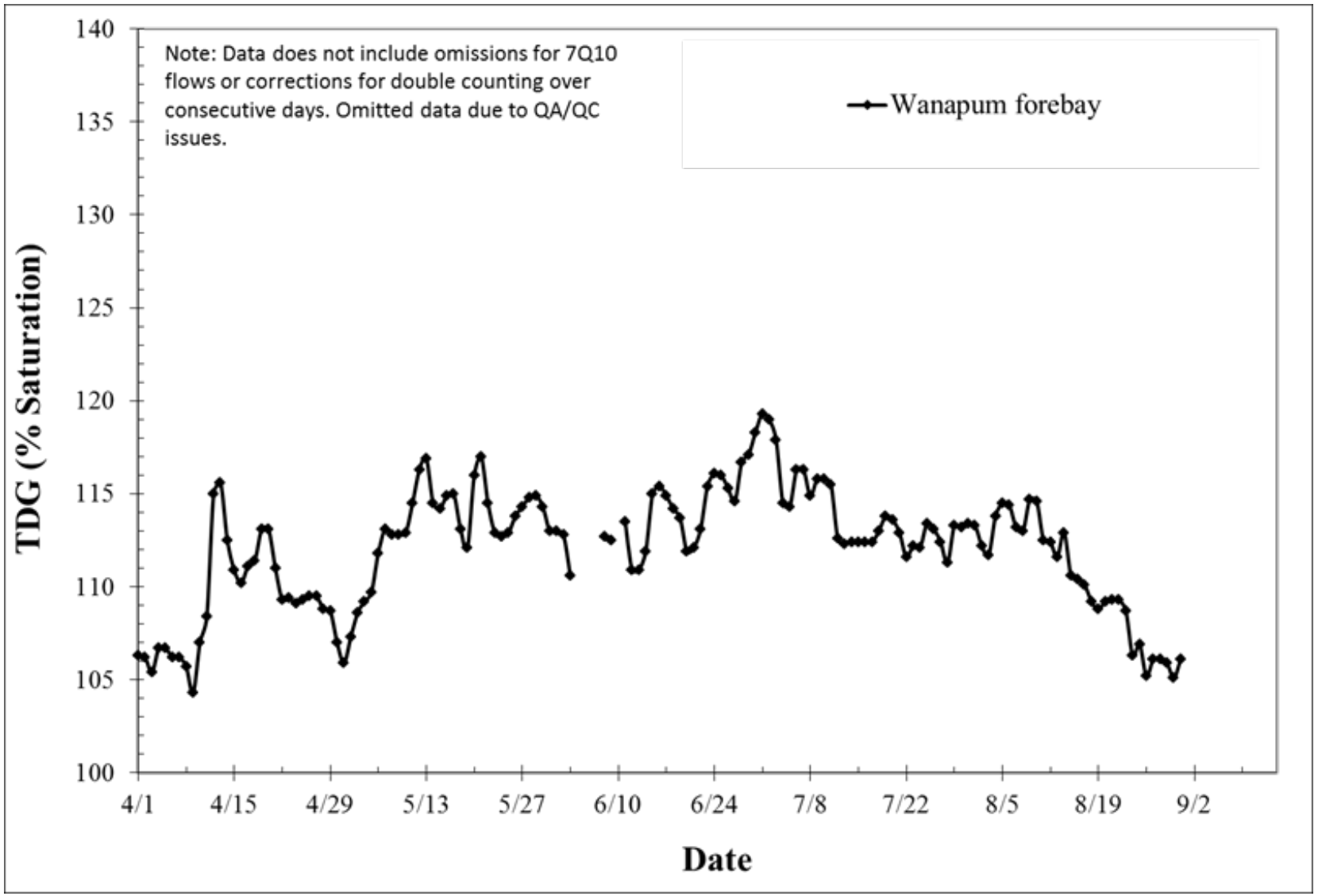

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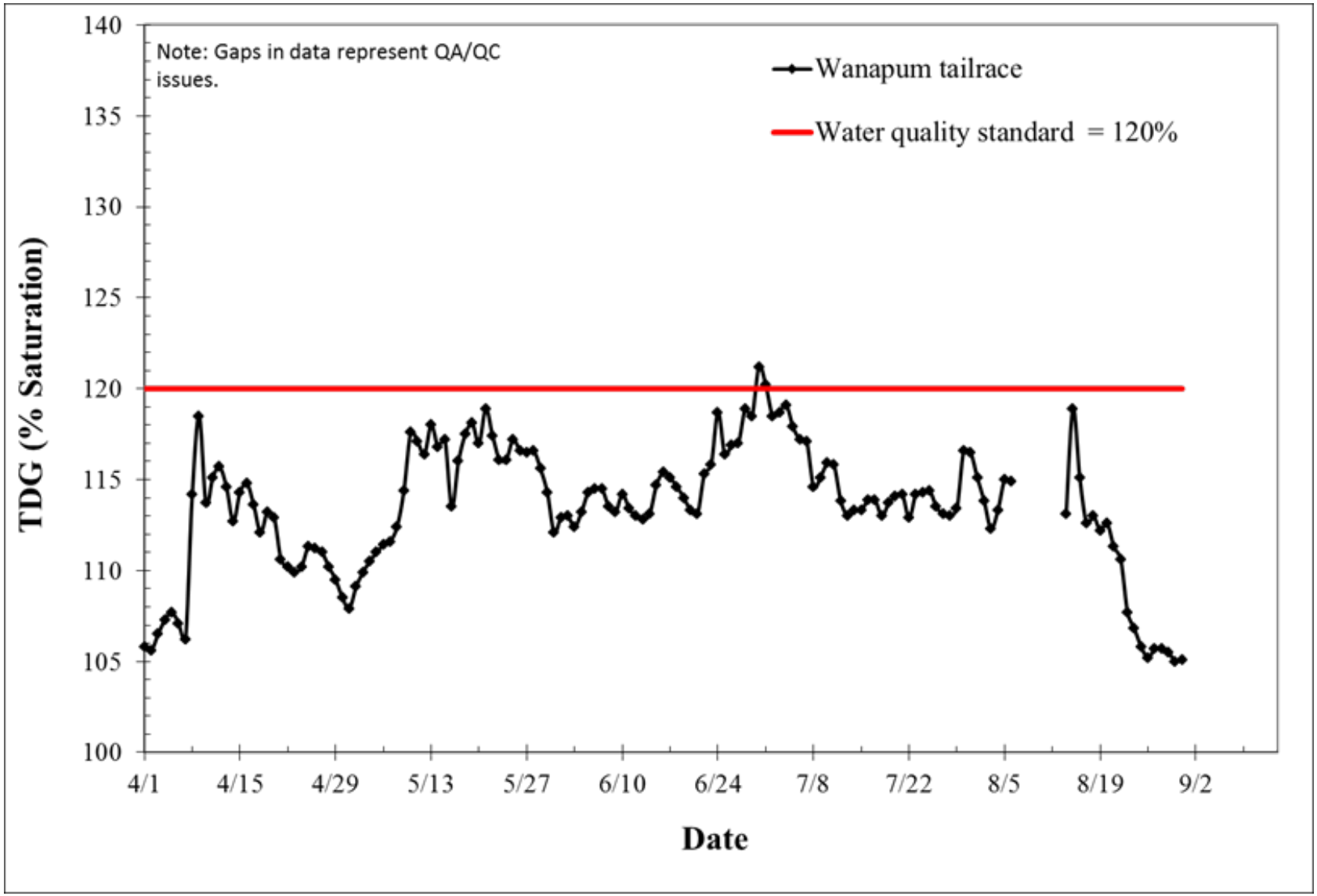

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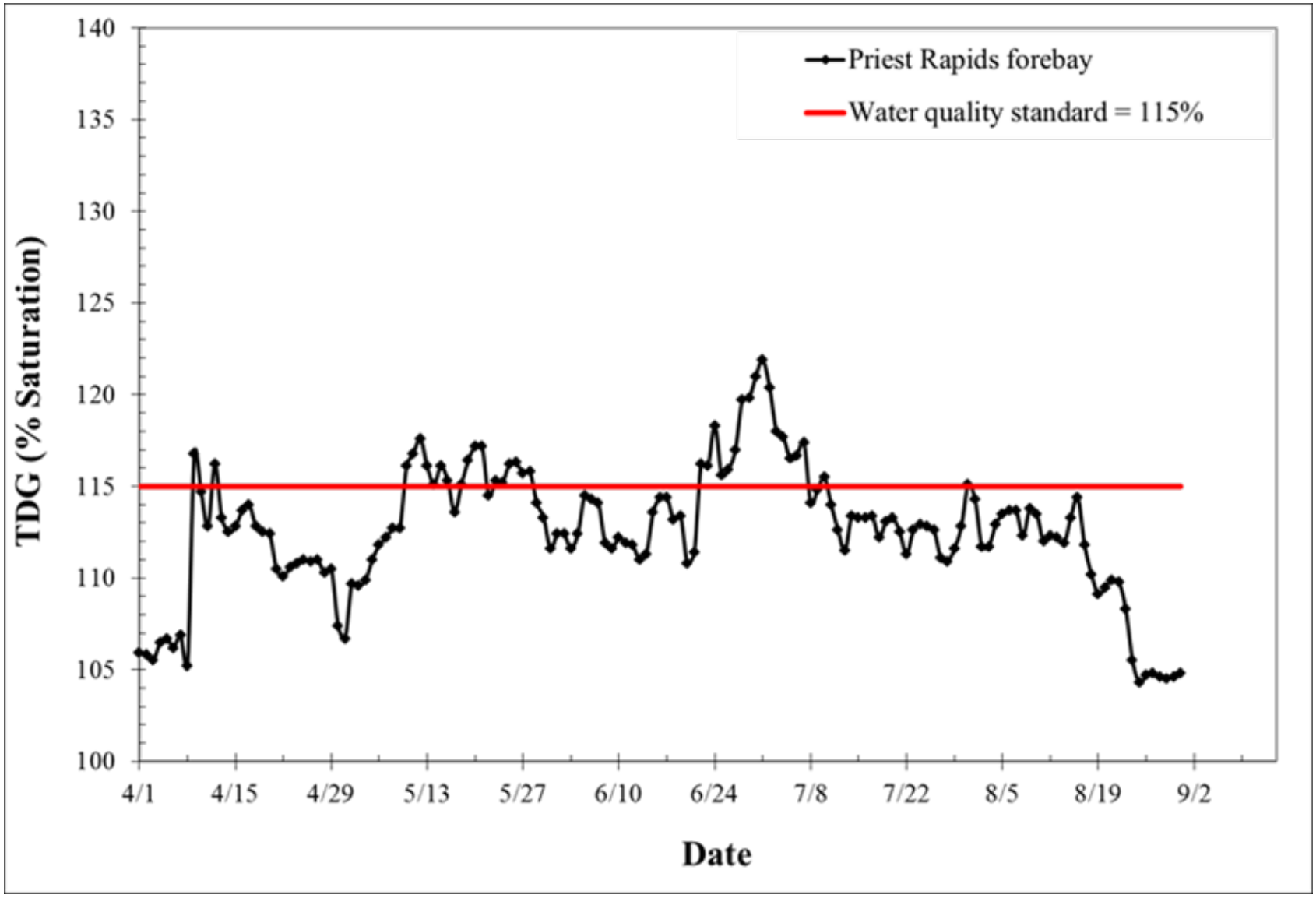

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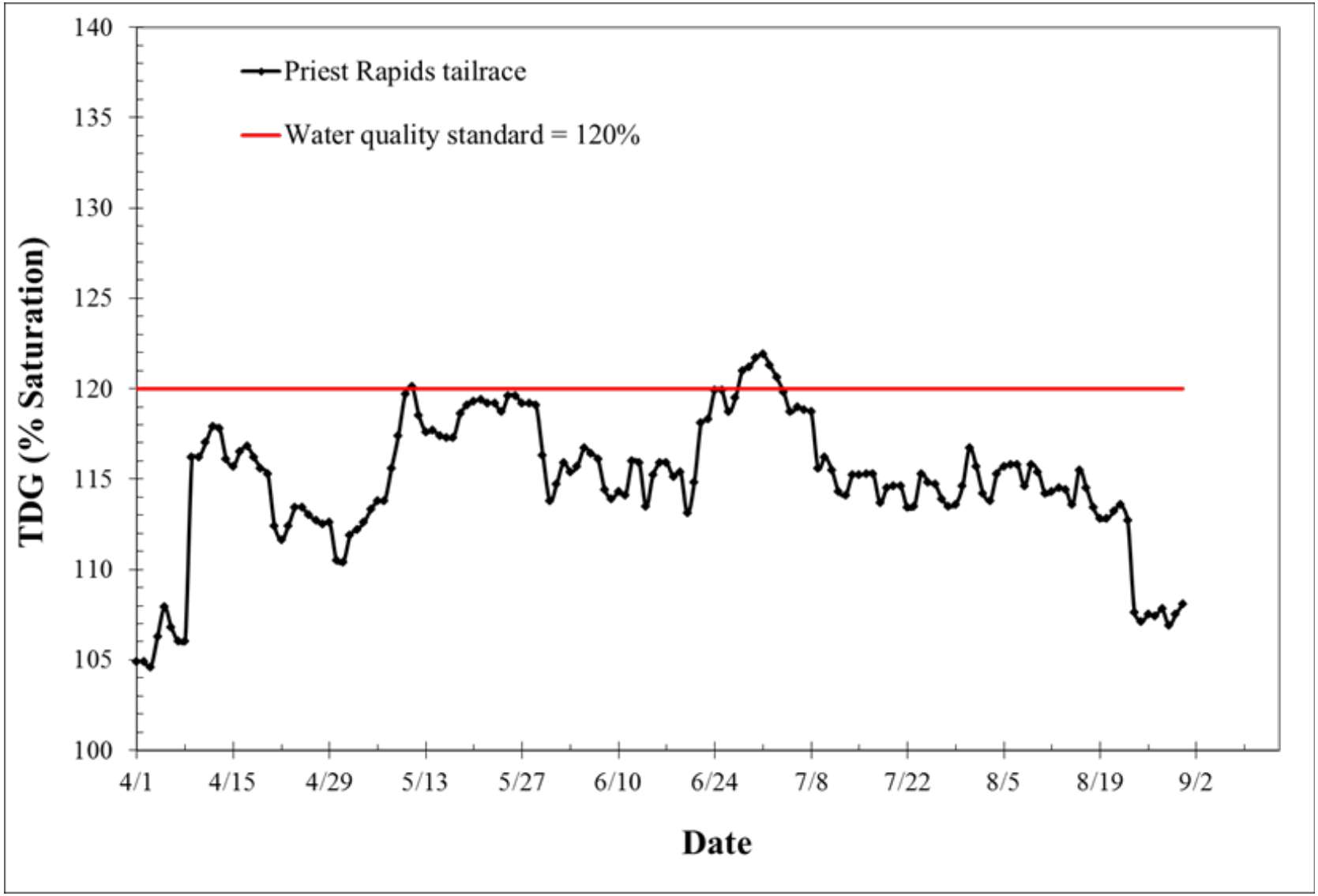

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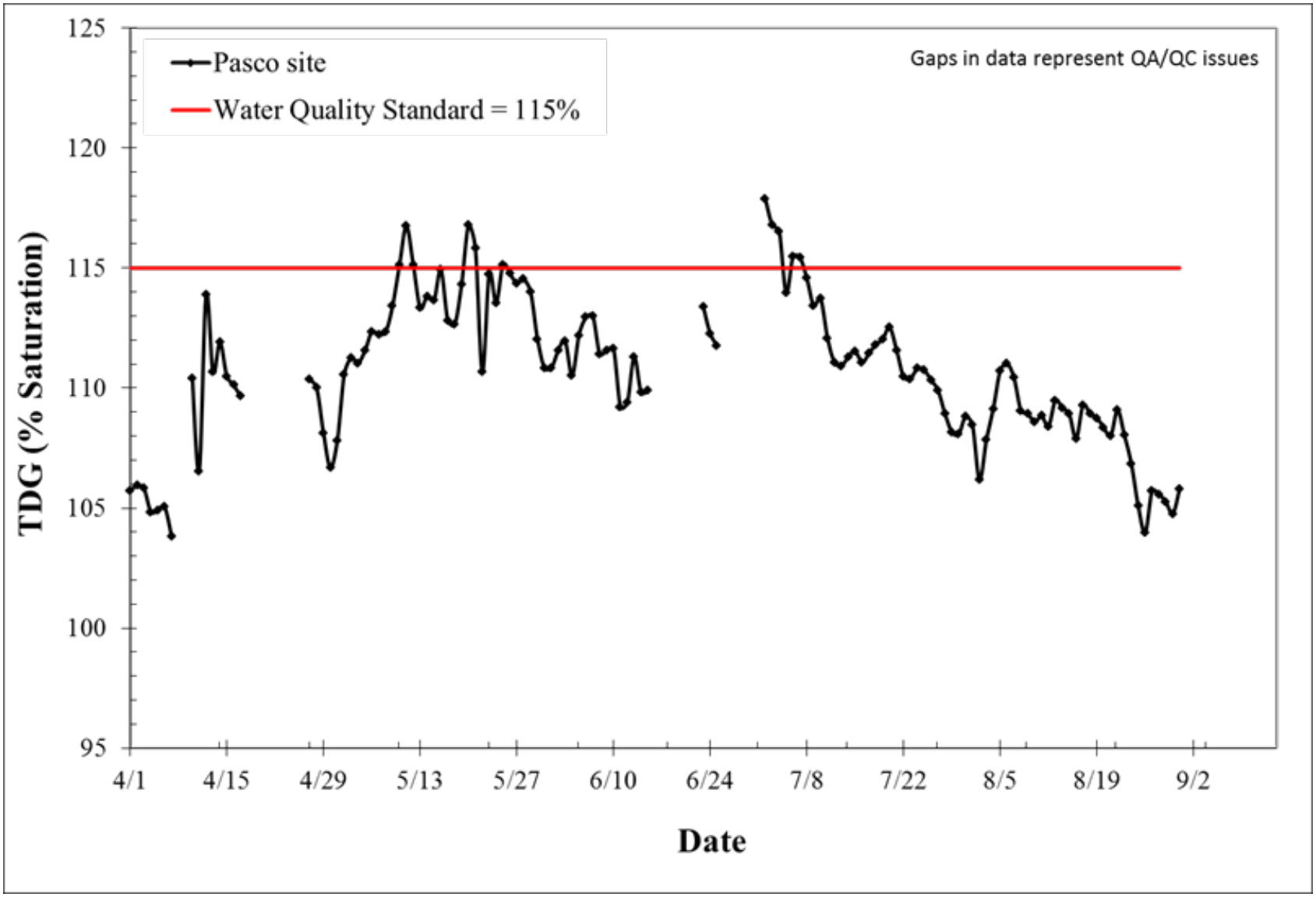

VII. Conclusions

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- Grant PUD will continue hourly TDG & temperature monitoring; bi-weekly trend monitoring of DO, pH, and turbidity – year around
- Continue to follow 401 certification conditions set forth by WDOE
  - Quality Assurance Project Plan (QAPP)
  - Annual Gas Abatement Plan (GAP)
  - Annual reports (TDG & Water Quality)
- Continue to follow established USGS guidelines for calibration, maintenance, and QA/QC procedures, as outlined in Grant PUD's QAPP
- On-going and proposed improvements to both PR and Wanapum Dams expected to decrease TDG issues
  - Wanapum Fish Bypass (operation began in 2008)
  - Wanapum Advanced Turbines will increase powerhouse capacity; (tenth unit was installed in Sept. 2013; TDG test in October of 2013 using all 10 turbine units. Results show no significant difference in TDG production using all 10 advanced turbines. Final results available by March 2014
  - PR top-spill fish bypass; started September 2011 (operational by fish-spill 2014, TDG testing after installation completed this Spring)
  - PR advanced turbines; studies on-going

Questions?

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