

Appendix D

2019 Summary of TDG Exceedance Tracking

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INTRODUCTION

The U.S. Army Corps of Engineers (Corps) tracks the number of instances when the percent TDG exceeds the Oregon (set by Oregon Department of Environmental Quality, ODEQ) and Washington (set by Washington Department of Ecology, WDOE) water quality standards (WQS) as described in Part 1.5 of this report. During spring spill, WDOE's and ODEQ's WQSs use the same method for calculating a daily value of TDG: the average of the 12 highest hourly readings in a calendar day. During summer spill, ODEQ maintains the same method, while WDOE's WQS uses an average of the 12 highest consecutive hourly readings in any one day. At each project, the 'regulatory' TDG value is reported based on the applicable calculation method. When and where multiple calculation methods apply, 'regulatory' represents the calculation that results in the greater value, indicating the most restrictive standard was applied.

This appendix provides the TDG tracking system results during the 2019 fish passage season from April 1 through August 31. A description of each table follows.

Table D-1 provides a definition of TDG instances (including exceedance types, 7Q10 flows, and data quality events) with the associated color used to identify the type in Table D-2.

Table D-2 identifies the daily TDG regulatory value and exceedance type if applicable (as defined in Table D-1) by project forebay and tailwater.

Tables D-3A and D-3B provide the total number of TDG exceedances by type for each project for the lower Snake River projects and lower Columbia River projects, respectively.

Both the ODEQ and WDOE spring WQS state that TDG must not exceed a two-hour instantaneous level of 125 percent of saturation for any two hours during the twelve highest hourly measurements per calendar day as measured in the fixed-monitoring sites in the tailrace of each dam. Table D-4 breaks down the maximum hourly percent TDG value, the number of hours that exceed 125 percent TDG, and the number of days on which the 125 percent daily WQS is exceeded.

Table D-5 provides a list of TDG gauges that malfunctioned during the 2019 spill season, which resulted in six hours or more of either missing or erroneous data. Malfunctioning gauge TDG instances are noted as data quality event in Tables D-2, D-3A and D-3B.

**TABLE D-1
TDG Instance Definitions**

Type 1 exceedance	TDG levels exceed the TDG standard due to exceeding powerhouse capacity at run-of-river projects resulting in spill above the BiOp fish spill levels. This condition type includes:
	<ul style="list-style-type: none"> • High runoff flows and flood risk management efforts. • Periods when BPA load requirements are lower than actual powerhouse capacity or project is carrying system-wide reserves. • Involuntary spill at Mid-Columbia River dams resulting in high TDG levels entering the lower Columbia River. • Involuntary spill at Snake River dams resulting in high TDG levels entering the lower Columbia River.
<u>Type 1a exceedance</u>	Planned and unplanned outages of hydro power equipment including generation unit, intertie line, or powerhouse outages.
Type 2 exceedance	TDG instances due to the operation or mechanical failure of non-generating equipment. This exceedance type includes:
	<ul style="list-style-type: none"> • Spill gates stuck in open position or inadvertently left open. • Increased spill in a bulk spill operation to pass debris or other special operations. • Communication errors, such as teletype were transmitted but change was not timely made or misinterpretation of intent of teletype by Project operator.
<i>Type 3 exceedance</i>	TDG WQS exceedance due to uncertainties when using best professional judgment, SYSTDG model and forecasts. This instance type includes:
	<ul style="list-style-type: none"> • Uncertainties when using best professional judgment to apply the spill guidance criteria, e.g., travel time, degassing, and spill patterns. • Uncertainties when using the SYSTDG model to predict the effects of various hydro system operations, temperature, degassing, and travel time. • Uncertainties when using forecasts for flows, temperature and wind. • Unanticipated sharp rise in water temperature (a 1.5 degree F. or greater change in a day).
Data Quality Event (-)	Malfunctioning FMS gauge that resulted in missing or erroneous data. The TDG cannot be evaluated for these days.
High TDG During 7Q10 Flow (*)	TDG above the WQS during project flow higher than 7Q10 flows. These instances are not counted towards the total number of exceedances.

TABLE D-2

Daily TDG Instances, Values Computed using the Regulatory Method, April 2019

Station:	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW	
4/1/2019	103	103	102	102	102	103	104	113	110	109	108	107	107	108	108	110	
4/2/2019	104	105	102	103	103	104	104	110	110	110	109	107	107	109	109	111	
4/3/2019	104	118	103	118	103	119	103	115	110	109	108	107	107	107	108	112	
4/4/2019	103	118	103	119	103	120	103	116	109	109	108	108	107	107	108	113	
4/5/2019	103	119	104	119	112	120	112	116	109	109	109	108	108	108	107	113	
4/6/2019	102	119	109	119	116	121	116	117	108	107	108	108	107	107	106	111	
4/7/2019	102	119	113	119	116	120	116	117	108	107	108	107	107	107	106	110	
4/8/2019	101	119	114	119	117	121	117	121	108	110	107	107	106	106	106	111	
4/9/2019	102	124	114	124	119	124	117	125	108	115	107	113	105	106	105	112	
4/10/2019	101	128	112	129*	125	128*	119	133*	108	120	104	121	112	117	105	122	
4/11/2019	104	121	117	124	129	124	124	128	117	120	104	119	111	117	116	121	
4/12/2019	105	121	117	119	124	122	123	122	118	120	104	118	111	119	116	120	
4/13/2019	105	120	116	119	121	121	121	120	117	118	106	118	111	124	116	120	
4/14/2019	105	120	114	119	118	120	117	119	113	117	108	118	113	124	117	120	
4/15/2019	104	120	113	120	119	120	116	120	110	117	111	118	115	125	121	120	
4/16/2019	104	120	112	120	120	120	116	119	108	117	111	118	115	126	120	119	
4/17/2019	103	120	113	119	118	119	116	119	109	117	110	118	114	124	119	119	
4/18/2019	103	120	113	120	120	120	117	120	109	117	109	118	117	123	120	119	
4/19/2019	105	120	115	120	122	120	119	120	113	119	110	118	118	123	123	120	
4/20/2019	105	121	116	120	121	121	119	121	114	117	110	118	116	121	118	120	
4/21/2019	104	124	115	122	120	121	117	124	112	119	110	118	114	120	114	120	
4/22/2019	104	124	116	123	123	121	118	124	113	119	112	119	114	119	115	120	
4/23/2019	106	124	118	123	124	121	119	124	114	119	113	119	116	120	116	120	
4/24/2019	105	123	118	121	123	121	119	122	114	120	112	120	116	120	116	122	
4/25/2019	106	124	119	124	124	124	120	125	116	120	114	120	117	121	119	123	
4/26/2019	106	121	120	122	126	123	121	124	117	120	113	119	116	121	118	120	
4/27/2019	105	120	118	122	122	120	121	124	116	120	113	120	114	119	115	120	
4/28/2019	104	120	112	120	120	120	117	121	112	120	111	119	116	121	116	120	
4/29/2019	105	120	114	120	121	120	118	121	113	120	111	120	117	122	119	121	
4/30/2019	106	120	115	120	121	119	118	120	113	119	111	120	117	122	121	120	
Exceedances:		11		9		13		14				1		13		5	66
Data Quality Events:																	0

TABLE D-2

Daily TDG Instances, Values Computed using the Regulatory Method, May 2019

Station:	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	ISDW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW	
5/1/2019	106	120	115	121	121	119	118	119	113	120	112	120	117	121	120	120	
5/2/2019	105	120	114	120	120	119	117	119	112	119	112	120	115	119	116	119	
5/3/2019	105	120	114	120	120	120	117	119	112	119	113	120	116	120	113	119	
5/4/2019	106	120	116	120	122	120	119	121	113	119	114	120	119	123	116	120	
5/5/2019	107	120	117	120	122	120	119	120	115	118	114	120	119	122	117	120	
5/6/2019	106	120	117	120	121	120	119	120	115	119	115	120	120	122	119	120	
5/7/2019	105	119	117	120	122	120	119	120	115	119	117	119	119	122	118	120	
5/8/2019	105	120	117	120	121	120	118	121	115	120	118	120	119	121	117	120	
5/9/2019	104	120	116	120	122	120	118	122	115	119	118	120	121	123	119	120	
5/10/2019	105	120	117	120	122	120	118	120	115	119	118	120	122	123	120	120	
5/11/2019	105	120	118	120	122	120	119	120	116	119	120	119	121	123	121	120	
5/12/2019	106	120	117	120	122	121	119	120	116	119	119	119	118	121	118	120	
5/13/2019	105	120	116	120	121	120	118	120	115	119	117	119	117	120	115	120	
5/14/2019	105	120	115	120	120	121	117	120	113	119	116	119	117	120	116	120	
5/15/2019	105	120	115	121	121	121	118	122	113	119	115	120	118	122	118	121	
5/16/2019	106	120	115	120	123	121	119	124	115	120	115	120	118	121	121	121	
5/17/2019	105	120	114	120	121	121	118	122	114	120	113	119	114	119	116	119	
5/18/2019	104	123	112	125	121	124	117	129	113	120	113	121	117	122	117	121	
5/19/2019	106	121	115	122	126	121	119	125	117	120	112	121	116	121	120	121	
5/20/2019	106	120	116	120	123	121	120	121	117	120	111	122	114	119	117	120	
5/21/2019	105	120	115	120	121	120	119	121	115	120	114	120	117	121	118	121	
5/22/2019	104	119	114	119	120	119	117	120	114	120	114	120	116	121	117	120	
5/23/2019	104	119	114	120	121	120	118	120	116	120	115	120	118	122	117	120	
5/24/2019	105	120	114	120	122	119	118	120	115	120	114	119	116	120	115	119	
5/25/2019	105	120	113	120	120	120	117	120	113	120	112	119	116	120	114	119	
5/26/2019	105	120	116	120	121	119	118	120	112	120	112	119	117	121	117	120	
5/27/2019	105	120	116	120	121	120	118	120	114	120	112	119	117	120	117	119	
5/28/2019	105	120	115	120	122	120	119	120	114	120	111	119	115	120	114	119	
5/29/2019	105	120	116	120	122	120	119	120	114	120	114	120	116	120	114	120	
5/30/2019	106	120	115	120	122	120	119	120	116	120	115	119	117	121	116	120	
5/31/2019	106	120	116	120	121	122	119	121	115	120	116	119	118	122	118	121	
Exceedances:		2		4		9		11				3		20		6	55
Data Quality Events:																	0

TABLE D-2

Daily TDG Instances, Values Computed using the Regulatory Method, June 2019

Station:	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW	
6/1/2019	106	120	116	123	122	124	120	123	116	120	118	120	118	122	118	121	
6/2/2019	107	120	117	124	124	125	121	124	117	120	119	119	117	121	117	120	
6/3/2019	107	120	116	124	123	124	121	124	116	120	116	119	114	119	114	121	
6/4/2019	106	120	114	126	123	126	120	125	114	120	114	119	114	119	114	121	
6/5/2019	107	120	115	124	125	125	123	123	115	120	113	119	115	120	115	120	
6/6/2019	107	120	115	121	123	123	121	121	115	120	112	119	114	119	115	120	
6/7/2019	106	120	113	119	119	122	119	120	110	119	110	118	113	117	113	119	
6/8/2019	104	119	111	120	117	120	115	119	108	119	108	118	112	117	111	119	
6/9/2019	104	119	111	120	118	119	116	119	110	119	108	118	117	120	114	119	
6/10/2019	106	119	114	120	122	119	118	118	113	124	108	118	117	121	118	119	
6/11/2019	106	120	116	120	122	119	118	118	114	124	110	118	117	120	118	120	
6/12/2019	107	120	118	120	122	119	120	117	116	123	115	118	119	121	119	120	
6/13/2019	107	119	119	121	123	119	121	118	116	119	118	118	118	121	119	120	
6/14/2019	106	119	117	120	121	119	119	118	114	119	116	118	113	118	113	119	
6/15/2019	105	120	117	120	120	120	118	118	113	118	117	118	116	118	110	119	
6/16/2019	104	120	116	120	121	120	118	117	113	117	117	117	117	119	110	118	
6/17/2019	104	120	117	120	121	119	118	117	113	117	117	116	115	118	110	117	
6/18/2019	104	120	117	120	120	119	118	117	112	117	114	115	112	116	110	117	
6/19/2019	104	119	115	120	118	118	116	116	112	117	109	115	109	115	108	117	
6/20/2019	103	119	112	120	116	119	115	115	110	116	107	114	106	113	106	117	
6/21/2019	103	116	111	119	115	117	113	114	108	117	106	114	107	114	106	117	
6/22/2019	101	114	111	111	114	114	113	115	107	116	105	114	108	114	107	117	
6/23/2019	101	113	111	111	115	112	113	115	106	116	104	113	108	114	107	117	
6/24/2019	102	114	111	111	113	113	112	114	108	116	104	114	106	114	108	117	
6/25/2019	103	115	111	111	111	113	112	114	109	117	104	114	108	115	109	117	
6/26/2019	103	116	111	111	111	113	113	114	109	-	104	114	108	115	110	117	
6/27/2019	103	116	110	111	111	113	113	113	109	-	105	114	107	-	110	117	
6/28/2019	103	116	111	112	110	114	111	113	108	-	105	114	108	-	111	117	
6/29/2019	103	116	112	111	110	117	111	112	108	-	105	114	108	-	111	117	
6/30/2019	102	116	112	111	111	117	111	112	109	-	107	115	109	-	112	117	Total
Exceedances:				7		7		6		3	2		1	5		3	34
Data Quality Events:										5				4			9

TABLE D-2

Daily TDG Instances, Values Computed using the Regulatory Method, July 2019

Station:	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW	
7/1/2019	103	116	113	111	112	117	113	113	111	-	107	115	109	-	112	117	
7/2/2019	104	116	114	112	113	117	114	113	111	-	107	114	109	115	110	117	
7/3/2019	104	116	113	111	113	118	114	113	110	116	106	115	106	114	108	117	
7/4/2019	105	116	113	110	112	117	113	113	109	115	106	115	107	114	107	117	
7/5/2019	105	116	112	111	112	117	113	113	108	115	106	115	108	114	107	117	
7/6/2019	103	116	113	111	113	117	113	114	109	115	106	114	107	114	107	117	
7/7/2019	102	116	114	111	113	117	114	113	109	115	105	114	107	113	107	117	
7/8/2019	102	115	114	111	113	118	114	113	109	116	105	114	107	114	107	117	
7/9/2019	102	115	113	111	112	117	114	113	109	116	104	115	108	114	108	117	
7/10/2019	101	115	112	111	113	117	114	113	109	116	104	114	109	115	110	117	
7/11/2019	101	116	112	111	113	118	114	114	110	116	104	114	109	115	110	117	
7/12/2019	102	116	112	111	113	117	115	114	110	116	105	114	109	115	110	117	
7/13/2019	102	116	113	111	113	117	116	114	110	117	105	114	109	115	110	117	
7/14/2019	102	116	112	110	113	117	116	114	110	116	105	115	107	114	109	117	
7/15/2019	103	116	112	110	112	117	115	113	110	116	106	115	108	114	108	117	
7/16/2019	103	116	112	111	112	117	114	113	109	116	106	115	109	115	109	117	
7/17/2019	103	116	112	114	112	117	114	113	109	116	106	114	108	114	109	117	
7/18/2019	102	115	112	115	112	117	114	113	108	116	106	114	107	114	108	117	
7/19/2019	102	116	111	114	111	117	112	112	106	116	105	115	106	113	106	117	
7/20/2019	101	116	110	114	110	117	111	112	105	116	105	115	108	115	107	117	
7/21/2019	101	116	109	114	109	117	111	112	107	115	105	115	110	116	110	118	
7/22/2019	101	116	108	114	111	117	112	112	108	116	106	115	110	116	110	118	
7/23/2019	103	116	108	113	112	117	112	113	108	117	105	114	109	115	110	117	
7/24/2019	102	116	109	111	112	116	112	112	108	116	104	114	106	113	106	117	
7/25/2019	103	116	110	110	111	118	112	112	107	117	105	114	109	115	108	117	
7/26/2019	104	116	110	110	111	118	112	112	108	116	105	114	109	115	110	117	
7/27/2019	104	116	110	110	110	118	112	112	107	116	105	114	109	115	110	117	
7/28/2019	101	116	110	110	108	118	111	112	107	115	105	114	106	113	108	117	
7/29/2019	102	117	111	111	109	118	113	113	108	117	105	114	109	115	108	117	
7/30/2019	102	116	111	111	108	118	113	112	108	116	105	114	109	114	108	117	
7/31/2019	102	116	111	111	107	118	112	112	108	117	105	114	106	113	106	117	Total
Exceedances:							2										2
Data Quality Events:										2				1			3

TABLE D-2

Daily TDG Instances, Values Computed using the Regulatory Method, August 2019

Station:	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW		
8/1/2019	102	116	111	112	108	118	114	113	108	117	106	115	108	115	107	117		
8/2/2019	101	116	111	111	108	118	114	113	108	117	106	114	108	115	108	117		
8/3/2019	101	117	111	111	108	117	112	113	108	117	105	115	108	115	110	117		
8/4/2019	102	116	111	111	108	117	113	112	109	117	107	115	110	116	112	117		
8/5/2019	102	117	112	115	108	117	113	113	109	117	108	115	110	116	112	117		
8/6/2019	102	117	113	116	108	116	114	113	110	117	109	115	111	116	112	117		
8/7/2019	102	112	113	117	109	117	115	113	110	117	109	116	110	116	109	117		
8/8/2019	103	112	113	116	109	117	115	113	110	117	109	116	109	115	106	117		
8/9/2019	103	116	113	113	111	117	114	113	110	116	108	116	107	114	104	117		
8/10/2019	103	116	113	111	112	116	114	112	109	116	108	116	108	-	104	114		
8/11/2019	102	115	113	110	112	114	113	111	107	114	108	115	108	-	104	114		
8/12/2019	102	114	111	110	111	113	112	111	105	113	105	115	106	-	105	114		
8/13/2019	102	115	109	110	110	113	111	107	106	115	106	115	110	115	106	117		
8/14/2019	101	114	109	109	108	114	110	107	106	116	106	114	110	115	109	117		
8/15/2019	101	114	109	109	107	113	110	107	107	116	105	114	109	115	108	117		
8/16/2019	101	114	108	109	107	113	109	107	108	115	105	114	107	113	106	114		
8/17/2019	100	112	108	109	107	113	110	107	108	115	104	114	105	112	105	114		
8/18/2019	101	109	108	110	107	111	111	107	108	114	104	114	106	113	103	114		
8/19/2019	101	108	108	109	107	112	111	107	108	114	104	114	106	113	103	113		
8/20/2019	101	112	108	109	106	114	109	107	106	115	104	-	108	114	105	117		
8/21/2019	101	112	108	109	106	114	109	107	107	116	104	-	108	114	105	117		
8/22/2019	100	112	107	109	106	113	108	107	106	116	104	115	107	-	105	117		
8/23/2019	101	110	108	109	106	113	108	107	106	115	104	115	108	-	107	117		
8/24/2019	101	109	108	109	106	111	108	-	106	116	104	115	108	114	107	117		
8/25/2019	101	110	106	108	106	110	108	107	105	114	103	113	107	113	106	112		
8/26/2019	100	113	105	109	105	112	108	107	106	113	103	113	105	112	105	113		
8/27/2019	99	111	105	109	107	113	109	108	107	114	105	114	110	115	105	114		
8/28/2019	101	109	106	109	107	113	109	108	108	115	106	114	111	116	108	114		
8/29/2019	101	109	107	109	106	111	109	108	106	115	105	114	111	116	109	117		
8/30/2019	100	109	106	109	107	111	108	107	104	115	104	115	109	115	110	117		
8/31/2019	101	109	105	109	107	-	109	108	104	115	105	114	107	114	108	115	Total	Yearly Total
Exceedances:																	0	157
Data Quality Events:						1		1				2		5			9	21

TABLE D-3A¹
Total Fish Passage Season Exceedances by Project and Type for the Lower Snake River

TDG Exceedance Type	Lower Granite Forebay	Lower Granite Tailwater	Little Goose Forebay	Little Goose Tailwater	Lower Monumental Forebay	Lower Monumental Tailwater	Ice Harbor Forebay	Ice Harbor Tailwater	Total
1	0	12	0	17	0	19	0	17	65
1a	0	0	0	1	0	0	0	5	6
2	0	1	0	0	0	2	0	2	5
3	0	0	0	2	0	8	2	7	19
Total	0	13	0	20	0	29	2	31	95

TABLE D-3B
Total Fish Passage Season Exceedances by Project and Type for the Lower Columbia River

TDG Exceedance Type	McNary Forebay	McNary Tailwater	John Day Forebay	John Day Tailwater	The Dalles Forebay	The Dalles Tailwater	Bonneville Forebay	Bonneville Tailwater	Total
1	0	0	0	0	0	0	0	6	6
1a	0	0	0	0	0	0	0	0	0
2	0	3	0	0	0	0	0	0	3
3	0	0	2	4	1	38	0	8	53
Total	0	3	2	4	1	38	0	14	62

¹ TDG thresholds are 120% Tailwater during Spring Spill and 115% Forebay; 120% Tailwater during Summer Spill

TABLE D-4²
**Maximum Hourly Percent TDG Above 125% TDG, Number of Hours Above 125%,
and 125% Exceedance Days at Project Tailwater**

Station	Gauge ID	Maximum % TDG	Hours Over 125%	Exceedance Days
Lower Granite Tailwater	LGNW	135.3	17	1
Little Goose Tailwater	LGSW	126.1	10	2
Lower Monumental Tailwater	LMNW	126.0	20	2
Ice Harbor Tailwater	IDSW	130.5	42	7
McNary Tailwater	MCPW	---	0	0
John Day Tailwater	JHAW	---	0	0
The Dalles Tailwater	TDDO	127.2	18	4
Bonneville Tailwater	CCIW	---	0	0
		TOTAL HOURS:	107	16

² April through August were assessed for TDG values greater than 125%. TDG instances were not included when project flow exceeded 7Q10 flows.

TABLE D-5³
Malfunctioning TDG gauges, 2019

Project	Gauge ID	Dates	Days of Missing or Erroneous Data	Reason for Erroneous Data	Effects on % TDG Reading
Lower Monumental Tailwater	LMNW	8/31	1	Wildfire	Missing data.
Ice Harbor Tailwater	IDSW	8/24	1	Defective membrane	TDG levels drifted upward by 25%.
McNary Tailwater	MCPW	6/26-7/2	7	Defective membrane	TDG levels drifted upwards by 5%.
John Day Tailwater	JHAW	8/20-8/21	2	Ruptured Membrane	TDG levels drifted upwards by 22%.
The Dalles Tailwater	TDDO	6/27-7/1	5	Defective membrane	TDG levels drifted upwards by 18%.
The Dalles Tailwater	TDDO	8/10-8/12	3	Ruptured membrane.	TDG levels drifted upwards by 15%.
The Dalles Tailwater	TDDO	8/22-8/23	2	Ruptured membrane.	TDG levels drifted upwards by 17%.
Total Days: 21					

³ Table E-5 includes only days when there is 6 hours or more of either missing or erroneous gauge data.