2022 Fish Passage Plan

Chapter 5 – McNary Dam

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McNary Dam *

Project Acronym	MCN
River Mile (RM)	Columbia River – RM 292
Reservoir	Lake Wallula
Minimum Instantaneous Flow (kcfs)	Dec–Feb: 12.5 kcfs \ Mar–Nov: 50 kcfs
Forebay Normal Operating Range (ft)	337’ – 340’
Tailrace Rate of Change Limit (ft)	1.5’/hour
Powerhouse Length (ft)	1,422’
Powerhouse Hydraulic Capacity (kcfs)	232 kcfs
Turbine Units (#)	14 Main Units (S. Morgan Smith Kaplan)
Turbine Unit Generating Capacity (MW)	Rated: 980 MW (70 MW/unit) \ Maximum: 1,127 MW (80.5 MW/unit)
Gatewell Orifice Diameter (in)	Two 12” orifices per gatewell (6 per unit)
Spillway Length (ft)	1,310’
Spillway Hydraulic Capacity (kcfs)	2,200 kcfs
Spillbays (#)	22
Spillway Weirs (#)	2 (Bays 19-20)
Navigation Lock Length x Width (ft)	650’ x 84’ (Usable Space)
Navigation Lock Maximum Lift (ft)	75’
FISH STRUCTURE/OPERATION START DATE	
Fish Lock	1953 (1st Generation)
Adult Fish Counts – WA Shore & OR Shore	1954
Juvenile Bypass System (JBS)	1980 (1st Generation); 1994 (current); Bypass Outfall Flume relocated 2012
Submersible Traveling Screens (STS)	1980 (Prototype Mesh)
Extended-Length Submersible Bar Screens (ESBS)	1997
Juvenile Fish Transportation Program - Corps	1981-2012
Temporary Spillway Weirs (TSW)	2007

* More information for McNary Dam is available on the Corps Walla Walla District website at: www.nww.usace.army.mil/Locations/District-Locks-and-Dams/McNary-Lock-and-Dam/

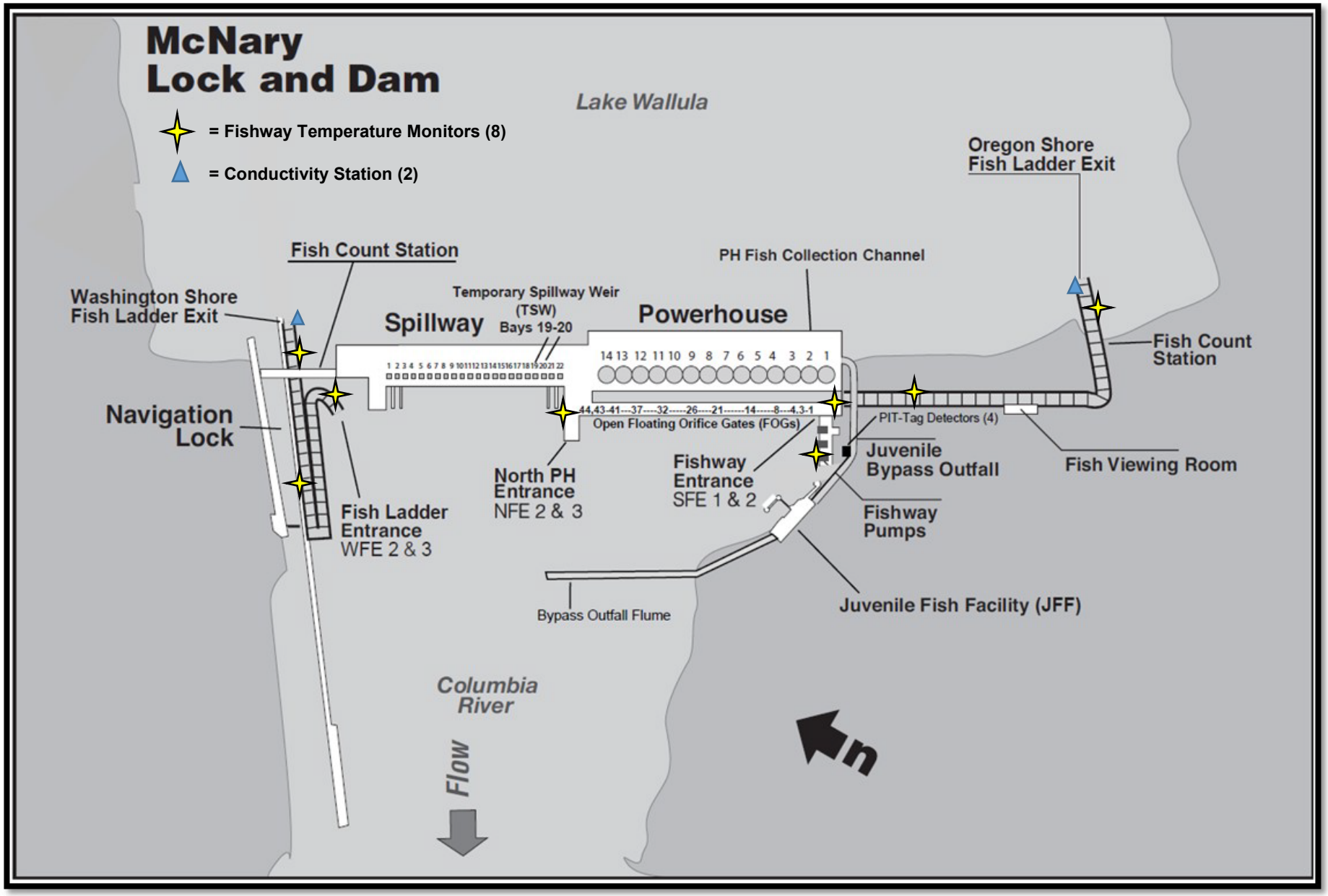
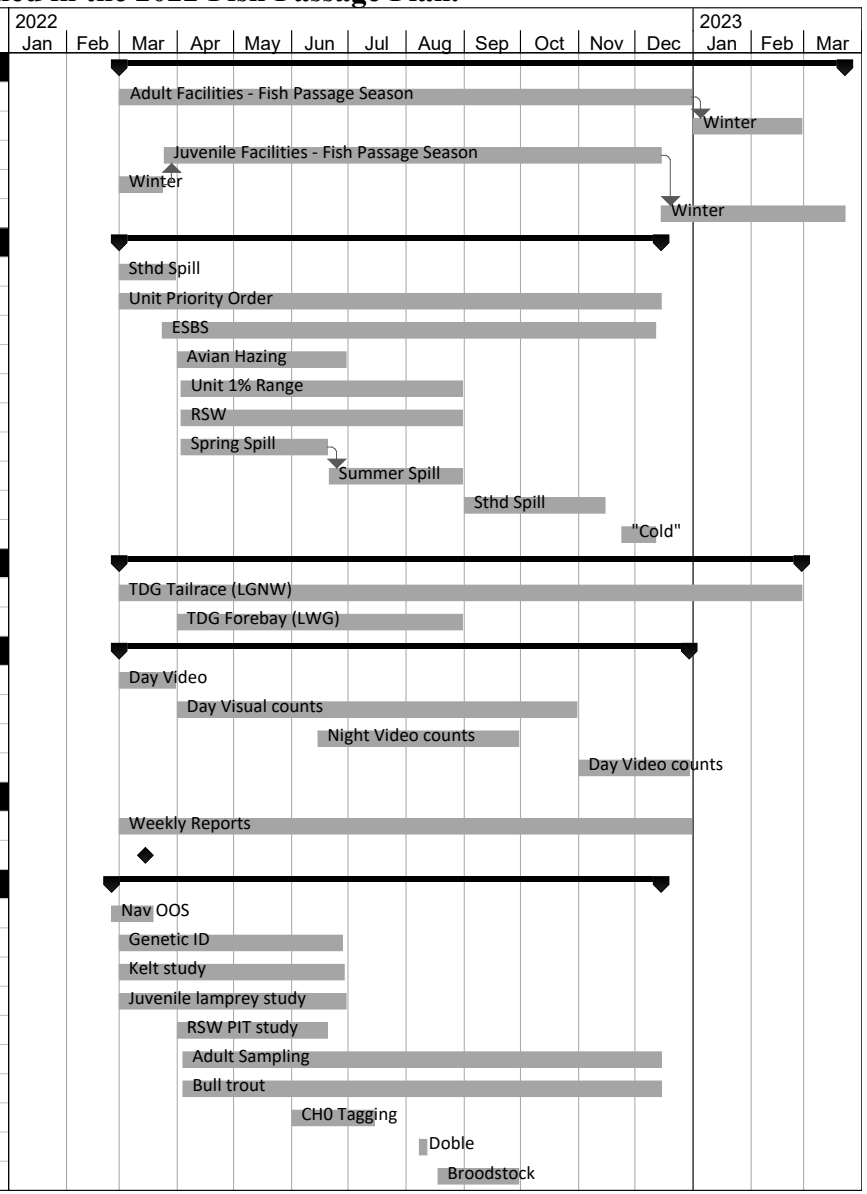


Figure MCN-1. McNary Lock & Dam General Site Plan.

Table MCN-1. McNary Dam Schedule of Operations and Actions Defined in the 2022 Fish Passage Plan.

Task Name	Start	End	FPP Section
FISH PASSAGE FACILITIES	**Tue 3/1/22**	**Thu 3/23/23**	
Adult Facilities - Fish Passage Season	Tue 3/1/22	Sat 12/31/22	2.4.2
Adult Facilities - Winter Maintenance	Sun 1/1/23	Tue 2/28/23	2.4.1
Juvenile Facilities - Fish Passage Season	Fri 3/25/22	Thu 12/15/22	2.3.2
Juvenile Facilities - Winter Maintenance	Tue 3/1/22	Thu 3/24/22	2.3.1
	Thu 12/15/22	Thu 3/23/23	
PROJECT OPERATIONS FOR FISH PASSAGE	**Tue 3/1/22**	**Thu 12/15/22**	
RSW Spill for Adult Steelhead	Tue 3/1/22	Thu 3/31/22	2.2.2
Turbine unit priority order	Tue 3/1/22	Thu 12/15/22	4.1
ESBSs	Thu 3/24/22	Mon 12/12/22	2.3.1.2, 2.3.2.2
Avian hazing	Fri 4/1/22	Thu 6/30/22	Appendix L
Turbine unit 1% operating range	Sun 4/3/22	Wed 8/31/22	4.2
RSW Spill	Sun 4/3/22	Wed 8/31/22	2.3.2.6
Spring Spill	Sun 4/3/22	Mon 6/20/22	Appendix E (FOP)
Summer Spill	Tue 6/21/22	Wed 8/31/22	Appendix E (FOP)
RSW Spill for Adult Steelhead	Thu 9/1/22	Tue 11/15/22	2.2.2
ESBS removal during cold weather	Thu 11/24/22	Mon 12/12/22	2.3.2.2
TDG MONITORING	**Tue 3/1/22**	**Tue 2/28/23**	
TDG Monitoring - Tailrace (LGNW)	Tue 3/1/22	Tue 2/28/23	2.2.4
TDG Monitoring - Forebay (LWG)	Fri 4/1/22	Wed 8/31/22	2.2.4
ADULT FISH COUNTING	**Tue 3/1/22**	**Fri 12/30/22**	
Day Video 0400-2000 PST (0500-2100 PDT)	Tue 3/1/22	Thu 3/31/22	1.2.2
Day Visual 0500-2100 PDT	Fri 4/1/22	Mon 10/31/22	1.2.2
Night Video 2100-0500 PDT	Wed 6/15/22	Fri 9/30/22	1.2.2
Day Video 0400-2000 PST (0500-2100 PDT)	Tue 11/1/22	Fri 12/30/22	1.2.2
REPORTS	**Tue 3/1/22**	**Sat 12/31/22**	
Weekly Reports	Tue 3/1/22	Sat 12/31/22	2.5.2
Annual Report due (for previous year)	Tue 3/15/22	Tue 3/15/22	2.5.2
SPECIAL OPS & STUDIES (Appendix A)	**Fri 2/25/22**	**Thu 12/15/22**	
Navigation Lock OOS	Fri 2/25/22	Sat 3/19/22	App A 1.4
Genetic Stock ID	Tue 3/1/22	Tue 6/28/22	App A 9.2
Kelt Study	Tue 3/1/22	Wed 6/29/22	App A 9.2
Juvenile Lamprey Assessment	Tue 3/1/22	Thu 6/30/22	App A 9.2
RSW PIT Evaluation	Fri 4/1/22	Mon 6/20/22	App A 9.2
Adult Sampling	Mon 4/4/22	Thu 12/15/22	App A 9.2
Bull Trout PIT-tagging and Genetic Sampling	Mon 4/4/22	Thu 12/15/22	App A 9.2
Subyearling Parentage-Based Tagging	Wed 6/1/22	Fri 7/15/22	App A 9.2
Doble Testing	Mon 8/8/22	Fri 8/12/22	App A 1.5 & 9.1
Broodstock Collection (end date TBD)	Thu 8/18/22	Fri 9/30/22	App A 9.2



1. FISH PASSAGE INFORMATION

Fish passage facilities at McNary Lock & Dam are shown in **Figure MCN-1**. The annual schedule of project operations, maintenance, and other actions described in this Fish Passage Plan (FPP) and Appendices is included in **Table MCN-1**.

1.1. Juvenile Fish Facilities and Migration Timing

1.1.1. Juvenile Facilities. Maintenance of juvenile fish facilities that may impact fish or facility operations should be conducted during the winter maintenance period. Juvenile fish passage structures and facilities at McNary Dam consist of:

i. Extended-length submersible bar screens (ESBSs) with flow vanes.

ii. Vertical barrier screens (VBSs).

iii. Gatewell orifices.

iv. Concrete collection channel with emergency bypass outlets.

v. Primary and secondary dewatering structures.

vi. Pipeline/corrugated metal flume for routing juvenile fish to the sampling facilities or bypassing them back to the river.

vii. Full-flow PIT tag detection and deflection system.

viii. Separator to separate adults from juvenile fish, and juvenile fish by size.

ix. Covered raceways and tanks for holding sampled fish.

x. Sampling facilities, office, and sampling building with fish marking facilities.

1.1.2. Juvenile Migration Timing. Juvenile fish passage timing at McNary Dam is shown in **Table MCN-2**, based on juvenile fish collection data over the most recent 10-year period (does not reflect bypass (FGE) or spillway passage). Salmon, steelhead, bull trout, lamprey, and other species are routinely counted.

Table MCN-2. Juvenile Salmonid Passage Timing at McNary Dam for Most Recent 10 Years (based on daily & yearly collection data).

Year	10%	50%	90%	# Days	10%	50%	90%	# Days
	Yearling Chinook (wild & hatchery)				Subyearling Chinook (wild & hatchery)			
2012	29-Apr	11-May	25-May	26	22-Jun	18-Jul	22-Aug	61
2013	1-May	9-May	29-May	28	16-Jun	4-Jul	22-Jul	36
2014	27-Apr	11-May	19-May	22	22-Jun	4-Jul	26-Jul	34
2015	27-Apr	7-May	19-May	22	14-Jun	2-Jul	10-Jul	26
2016	23-Apr	3-May	13-May	20	8-Jun	26-Jun	2-Jul	24
2017	23-Apr	5-May	19-May	26	6-Jun	2-Jul	22-Jul	46
2018	27-Apr	7-May	17-May	20	21-May	26-Jun	18-Jul	58
2019	19-Apr	9-May	21-May	32	4-Jun	22-Jun	14-Jul	40
2020*	21-Apr	7-May	21-May	30	2-Jun	18-Jun	12-Jul	40
2021*	25-Apr	13-May	23-May	28	12-Jun	24-Jun	4-Jul	22
10-Yr MEDIAN	**26-Apr**	**8-May**	**20-May**	**26**	**10-Jun**	**29-Jun**	**16-Jul**	**38**
10-Yr MIN	**19-Apr**	**3-May**	**13-May**	**20**	**21-May**	**18-Jun**	**2-Jul**	**22**
10-Yr MAX	**1-May**	**13-May**	**29-May**	**32**	**22-Jun**	**18-Jul**	**22-Aug**	**61**
	Unclipped Steelhead				Clipped Steelhead			
2012	24-Apr	5-May	25-May	31	23-Apr	1-May	17-May	24
2013	23-Apr	11-May	2-Jun	40	25-Apr	3-May	19-May	24
2014	23-Apr	7-May	19-May	26	25-Apr	5-May	15-May	20
2015	1-May	15-May	27-May	26	27-Apr	9-May	27-May	30
2016	19-Apr	3-May	23-May	34	21-Apr	1-May	15-May	24
2017	21-Apr	5-May	29-May	38	19-Apr	29-Apr	13-May	24
2018	19-Apr	5-May	27-May	38	19-Apr	1-May	13-May	24
2019	14-Apr	27-Apr	23-May	39	11-Apr	19-Apr	9-May	28
2020*	11-Apr	9-May	25-May	44	21-Apr	3-May	21-May	30
2021*	21-Apr	9-May	29-May	38	21-Apr	29-Apr	19-May	28
10-Yr MEDIAN	**21-Apr**	**6-May**	**26-May**	**38**	**21-Apr**	**1-May**	**16-May**	**24**
10-Yr MIN	**11-Apr**	**27-Apr**	**19-May**	**26**	**11-Apr**	**19-Apr**	**9-May**	**20**
10-Yr MAX	**1-May**	**15-May**	**2-Jun**	**44**	**27-Apr**	**9-May**	**27-May**	**30**
	Coho (wild & hatchery)				Sockeye (wild & hatchery)			
2012	7-May	23-May	4-Jun	28	1-May	11-May	21-May	20
2013	3-May	21-May	8-Jun	36	29-Apr	15-May	27-May	28
2014	1-May	17-May	2-Jun	32	3-May	17-May	23-May	20
2015	5-May	21-May	4-Jun	30	27-Apr	17-May	25-May	28
2016	29-Apr	13-May	25-May	26	29-Apr	11-May	19-May	20
2017	1-May	19-May	29-May	28	27-Apr	13-May	25-May	28
2018	29-Apr	11-May	27-May	28	5-May	11-May	17-May	12
2019	19-Apr	19-May	29-May	40	29-Apr	19-May	6-Jun	38
2020*	21-Apr	11-May	31-May	40	5-May	17-May	27-May	22
2021*	29-Apr	19-May	2-Jun	34	1-May	15-May	27-May	26
10-Yr MEDIAN	**30-Apr**	**19-May**	**1-Jun**	**31**	**30-Apr**	**15-May**	**25-May**	**24**
10-Yr MIN	**19-Apr**	**11-May**	**25-May**	**26**	**27-Apr**	**11-May**	**17-May**	**12**
10-Yr MAX	**7-May**	**23-May**	**8-Jun**	**40**	**5-May**	**19-May**	**6-Jun**	**38**

*Passage dates in 2020 and 2021 include early start of McNary sampling on March 1st.

1.2. Adult Fish Facilities and Migration Timing.

1.2.1. Adult Fish Passage Facilities. McNary Dam adult passage facilities consist of separate north and south shore facilities, described below. Maintenance of adult facilities is scheduled for January–February, typically one shore at a time, to minimize impacts on upstream migrants.

1.2.1.1. North Shore Adult Fish Facility. The north shore facilities are comprised of a fish ladder with counting station, submerged orifice PIT-tag antennas in the ladder, a small collection system, and a gravity-flow auxiliary water supply system that has a turbine unit on it operated by North Wasco County PUD. The gravity-flow auxiliary water supply system takes water from the forebay through two conduits, passes the water through a turbine unit (or through a bypass/energy dissipater when the turbine is not in operation) and distributes the water through a diffuser system at the bottom of the ladder and in the transportation channel. The north shore collection system has three downstream entrances (two of which are used during normal operation) and a side entrance into the spillway basin.

1.2.1.2. South Shore Adult Fish Facility. The south shore facilities are comprised of a fish ladder with counting station, submerged orifice PIT-tag antennas in the ladder and antennas at the counting station, two south shore entrances, a powerhouse collection system, and gravity and pumped auxiliary water supply systems.

1.2.1.3. Powerhouse Collection System. The powerhouse collection system contains three downstream entrances and one side entrance into the spillway basin at the north end of the powerhouse, twelve operating floating orifices, and a common transportation channel. At the north end of the powerhouse, two of the downstream entrances are used during normal operation with the other downstream and side entrances closed. The gravity-flow auxiliary water is provided by one conduit from the forebay and supplies the diffusers at the bottom of the ladder at tailwater level. The pumped auxiliary water is supplied by three electric pumps with variable-pitched blades. Two pumps can provide the required flow when the third pump is bulkheaded to prevent water from flowing back through the pump to the river. The electric pumps supply the auxiliary water for the diffusers at the entrances and in the transportation channel. Excess water from the primary dewatering structure in the juvenile fish collection channel is routed to the adult collection system at the north end of the powerhouse.

1.2.2. Adult Fish Migration Timing & Counting.

1.2.2.1. Upstream migrants are present throughout the year and adult fish facilities are operated year-round. Adult salmon, steelhead, bull trout, shad, and lamprey are counted per the schedule in **Table MCN-3** and daily counts are posted online.[1] The presence of other species (e.g., sturgeon, grass carp, Atlantic salmon, etc.) are recorded as comments and reported in the *Annual Fish Passage Report*.

1.2.2.2. Yearly counts through the most recent passage year are used to determine the earliest and latest dates of peak adult fish passage defined in **Table MCN-4**.

[1] Daily adult salmon counts: https://www.fpc.org/currentdaily/HistFishTwo_7day-ytd_Adults.htm

1.2.2.3. Time-of-day (diel) distributions of adult salmonid activity at McNary Dam fishway entrances and exits are shown in **Figure MCN-2**.

Table MCN-3. McNary Dam Adult Fish Counting Schedule for 2022.

Count Period	Counting Method and Hours *
March 1 – 31	Day Video 0400–2000 hours (PST)
April 1 – October 31	Day Visual 0500–2100 hours (PDT)
June 15 – September 30	Night Video 2100–0500 hours (PDT)
November 1 – end of February	Day Video 0400–2000 hours (PST)

*PST = Pacific Standard Time; PDT = Pacific Daylight Time, in effect during daylight saving time 3/13/22–11/6/22.

Table MCN-4. McNary Dam Adult Fish Count Period and Peak Passage Timing (based on yearly counts from 1954 through most recent count year).

Species	Count Period	Earliest Peak	Latest Peak
Spring Chinook	Apr 1 – Jun 8	Apr 20	May 26
Summer Chinook	Jun 9 – Aug 8	Jun 13	Jul 26
Fall Chinook	Aug 9 – Oct 31	Sep 6	Sep 28
Steelhead	Apr 1 – Oct 31	Jul 9	Oct 13
Sockeye	Apr 1 – Oct 31	Jun 24	Oct 11
Coho	Apr 1 – Oct 31	Jun 27	Oct 5
Lamprey	Apr 1 – Oct 31	Jun 21	Aug 18

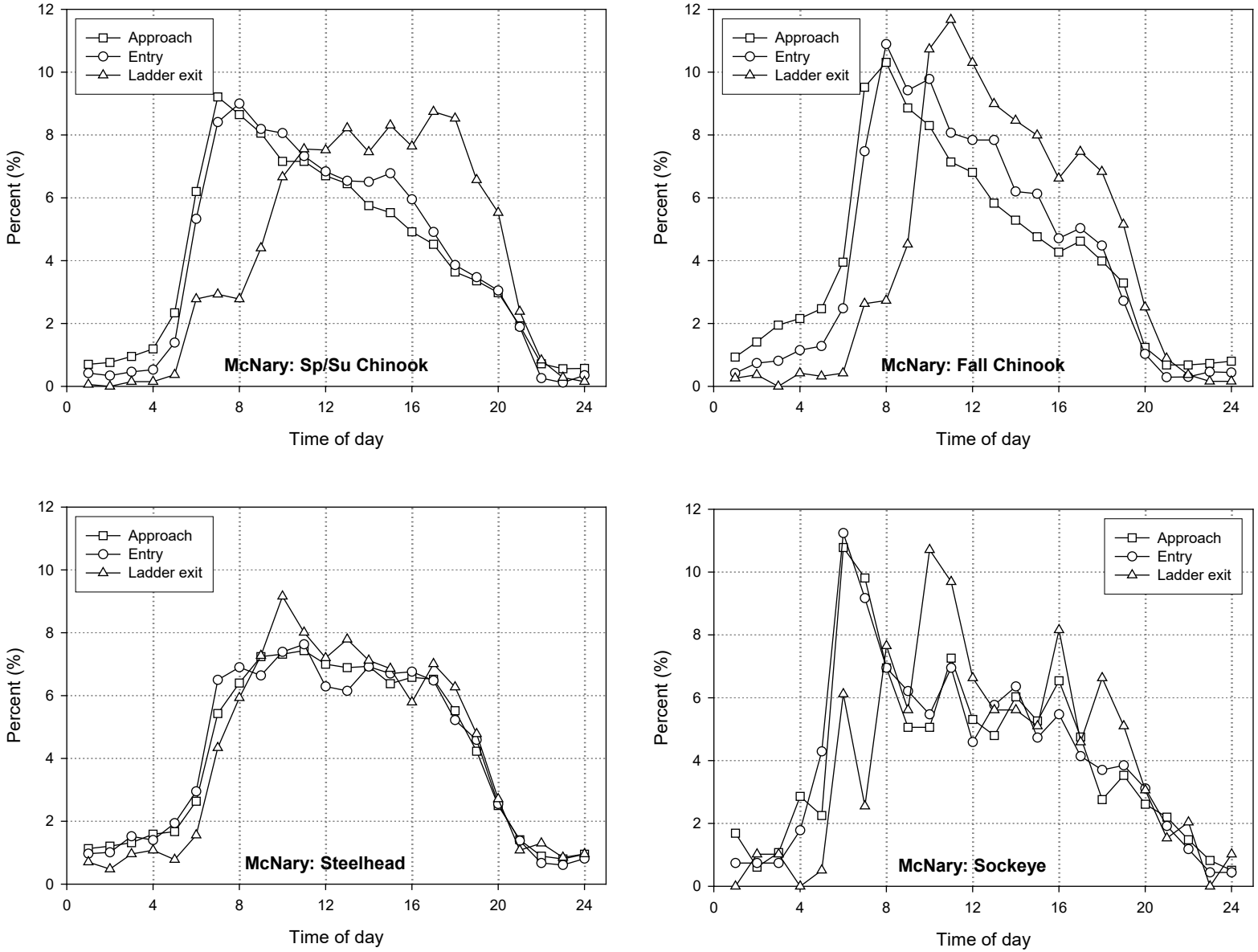


Figure MCN-2. Diel Distribution of Adult Salmonids at McNary Dam Fishway Entrances and Exits (*Keefer & Caudill 2008*). Report and summary letter available online at: pweb.crohms.org/tmt/documents/FPOM/2010/2013_FPOM_MEET/2013_JUN/

2. FISH FACILITIES OPERATIONS

2.1. General

2.1.1. Yearly special operations related to research are described as currently coordinated in **Appendix A - Special Project Operations & Studies**.

2.1.2. Research, non-routine maintenance activities and construction will not be conducted within 100 feet of any fishway entrance or exit, within 50 feet of any other part of the adult fishway, or directly in, above or adjacent to any fishway, unless coordinated by the Project, Walla Walla District (NWW) Operations and/or Planning or Construction office through FPOM or FFDRWG. Currently coordinated special operations related to research are described in *Special Project Operations & Studies* (**Appendix A**). These distances are approximate and will be updated after data are collected and analyzed to understand where the threshold for adversely impacting adult fish behavior occurs. Alternate actions will be considered by District and Project biologists in conjunction with the regional fish agencies on a case-by-case basis.

2.1.3. Emergency situations should be dealt with immediately by the Project in coordination with the Project and/or District biologist. If unavailable, the biologists will be informed of steps taken to correct the situation immediately following the incident. All activities within boat restricted zones (BRZ) will be coordinated with the Project at least 2 weeks in advance unless it is deemed an emergency (see **FPP Chapter 1 - Overview** for coordination guidance). On a monthly basis, as appropriate, the Project biologist will provide a summary of emergency actions undertaken for review by FPOM.

2.2. Spill Management

2.2.1. Spring and summer spill operations for juvenile fish passage are defined in the *Fish Operations Plan* (FOP), included in the Fish Passage Plan as **Appendix E**. Spill at McNary Dam will be distributed in spill patterns defined in **Tables MCN-7, -8, -9, -10** (except as noted below in **section 2.2.1.1**).

2.2.1.1. Spillway Hoist Operation - Minimization of Unsafe Operating Practices.

As of July 2022, McNary spillway hoists will be separated into two control groups: Macro Spill (manual/dogged) and Micro Spill (auto). There are 3 spillbays that are manually adjusted – Bays 2, 6, and 16. Two of the remaining 19 spillbays serve TSW1 and TSW2 until they are removed (typically in early June). This provides a total of 17 spillbays with functioning hoists until early June, then 19 spillbays for the remaining of the spill season that can be rotated through "Macro/Micro" assignments, as described below. During spring and summer spill season, April 10–August 31, four or five (during June) of these spillbays will be operated in auto/micro-adjusted mode each month according to the rotation schedule shown below. The change will occur during the first full week of the month. Hoists will initially be set to the average openings identified in the applicable spill pattern in **Table MCN-11**. Gate operation categories are as follows:

i. Macro Gates – Macro gates will be set at the mid-point of the 50 kcfs spill block associated with the current flow level and manually dogged and will not be

adjusted for 30 days or until there is a delta of 50 kcfs (+/- 25 kcfs) of current settings. All Macro gates will be raised or lowered with a safety observer stationed at the spillway deck, in the event of sustained flow increases more than the difference of designated spill limits, when one or more of the following occur:

A. Present for more than 72 hours.

B. All Micro Gate openings exceed an increase of 2+ "stops" per Micro Gate beyond normal flow settings of Spillway Gate stops identified in Spill Pattern Table settings and if flows are expected to increase for 72 hours or more.

C. Expected flows are at peak delta and are predicted to rise beyond a max spill delta of 30 kcfs.

ii. Micro Gates – Micro gates will be set at the pattern associated with the current spill and flow rate in **Table MCN-11** and will be left in auto-response mode for approximately 30 days before being rotated to the next spillway gate assignment. (See gate rotation schedule below.)

iii. Rotation schedule for gates in macro and micro adjustment modes:

			Crane 7				No Hoist										Crane 6			TSW	TSW		
Mode	First week of:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Macro/Dogged	April																			Open	Open		
Micro/Auto	May																			Open	Open		
	June																			Open	Open		
	July																						
	Aug																						

2.2.2. Surface spill will be implemented at McNary and the four lower Snake River dams as a means of providing non-powerhouse downstream passage for adult steelhead that overshoot natal tributaries prior to spawning or that strive to repeat a subsequent reproduction cycle (iteroparity). This operation is pursuant to non-discretionary terms and conditions in the 2020 NOAA Fisheries Columbia River System (CRS) Biological Opinion[2], which calls for surface spill via the spillway weir at each of the five projects from March 1 through March 30 and from October 1 through November 15, three times each week on non-consecutive days for four hours in the morning (generally between 05:00 and 11:00). This operation is also considered in the 2020 USFWS CRS Biological Opinion[3] as a means of providing safe and effective downstream passage for adult steelhead and other fish.

i. In 2022, surface spill in the fall will begin September 1 (instead of October 1) to comply with the Agreement for short-term operations of the Columbia River System (CRS).[4] As such, in 2022, surface spill for adult steelhead will occur March 1–30 and September 1–November 15.

[2] NOAA CRS BiOp, section 2.17.4.G, "*Reduce Take of Overshoot Adult Steelhead*": https://www.fisheries.noaa.gov/webdam/download/109136871

[3] USFWS CRS BiOp, section 5.7.4, "*Off-season Surface Spill for Downstream Passage of Adult Steelhead*": https://ecos.fws.gov/tails/pub/document/17101031

[4] See Term Sheet, section B (PDF page 7): http://pweb.crohms.org/tmt/JointMotion_TermSheet_CourtOrder_OCT2021.pdf

2.2.3. Involuntary spill is the result of river flow above powerhouse capacity, insufficient load (lack of load), turbine unit outages (forced or scheduled), or failure of a key component of the juvenile fish passage facility which forces spill to provide juvenile fish passage.

2.2.4. Total dissolved gas (TDG) is monitored at McNary Dam during the periods defined in **Table MCN-1**, pursuant to the Corps' annual *TDG Management Plan* and the current *Dissolved Gas Monitoring Plan of Action*.[5]

2.3. Operating Criteria – Juvenile Fish Facilities

2.3.1. Juvenile Fish Facilities - Winter Maintenance Period (December 16 – March 31*).

**In 2022, the bypass system will begin operations March 1, as described below.*

2.3.1.1. Prior to January 16, inspect or rake up to four trashracks to assess debris levels. Prioritize raking trashracks at units with known debris issues and longer run times, ensuring that raked units are distributed evenly across the powerhouse to the extent practicable.

2.3.1.2. Forebay Area and Intakes.

i. Remove debris from forebay and trashracks.

ii. Rake trashracks.

iii. Remove debris from gatewell slots.

iv. Measure and log drawdown in gatewell slots.

v. Inspect and repair gatewell dip net as needed.

2.3.1.3. ESBSs, Flow Vanes, and VBSs.

In 2022, screens will be installed by March 1 in the first three operational units in the priority order (Table MCN-5**).*

i. Remove ESBSs beginning on the Monday of the third week in December. After ESBSs are removed, inspect for juvenile salmonid mortalities and all other incidental fish mortalities. Inspect ESBSs within a week after removal, or as soon as practical. Count all mortalities (or make best estimate) for each ESBS and report to CENWW-OD-T.

ii. Complete maintenance on all ESBSs.

[5] TDG Management Plan (Appendix 4 of the WMP): pweb.crohms.org/tmt/documents/wmp/
TDG Monitoring Plan of Action: www.nwd.usace.army.mil/Missions/Water/Columbia/Water-Quality/

iii. Inspect ESBSs for good running order and operate debris cleaner one trial run (dogged off at deck level).

iv. Inspect flow vanes to ensure they are in good condition and all surfaces are smooth. Repair as needed.

v. Inspect all VBSs at least once per year by either raising the VBS and visually inspecting or with an underwater video camera.

2.3.1.4. Collection Channel.

i. Maintain orifice lights in operational condition.

ii. Maintain orifices clean and valves operating correctly.

iii. Ensure the orifice air backflush system works correctly.

iv. Maintain the netting over handrails and orifice chutes in good condition.

v. Maintain the plastic covers over orifice chutes in good condition and clean so orifice flow is visible.

2.3.1.5. Dewatering Structure and Flume.

i. Maintain the inclined and side dewatering screens clean and in good condition with no gaps between screen panels, no damaged panels, and no missing silicone.

ii. Maintain the cleaning brush systems operating correctly.

iii. Maintain all valves in good condition and operating correctly.

iv. Maintain stilling well water level sensing device operating correctly.

v. Maintain flume and pipe interiors smooth with no rough edges.

vi. Maintain full-flow PIT-tag system as required. Coordinate with PSMFC.

2.3.1.6. Sampling Facilities.

**In 2022, the bypass system will begin operations March 1 and sampling will occur every other day.*

i. Maintain the flume switch gate in operational condition.

ii. Ensure the flume, perforated plate, and bar screen edges are smooth with no rough edges.

iii. Maintain the wet separator and fish distribution system operating as designed.

iv. Maintain brushes on all crowders in good condition or new.

v. Maintain crowders operating properly.

vi. Maintain all valves, slide gates, and switch gates operating correctly.

vii. Ensure raceway and tank retainer screens are set in place with no holes or sharp wires protruding.

viii. Maintain all sampling equipment operating correctly.

ix. Maintain juvenile PIT-tag system as required (see "*Columbia Basin PIT-tag Information System, General Gate Maintenance and Inspection, Walla Walla District*", February 2003). Coordinate with PSMFC.

2.3.1.7. Record all maintenance and inspections.

2.3.1.8. Inspect bird wires, water cannon, and other predation deterrent devices and repair or replace as needed. Where possible, install additional bird wires or other deterrent devices to cover areas of known avian predation activity. Prepare avian abatement contract as needed. For information on avian management at McNary Dam, see the *Predation Monitoring and Deterrence Action Plans* in **Appendix L** (Table 2 and section 6).

2.3.2. Juvenile Fish Facilities – Fish Passage Season (April 1* – December 15).

******In 2022, the bypass system will begin operations March 1, as described below.*

Operate April 1*– November 30 for juvenile fish bypass and sampling (*except in 2022 when bypass operations begin March 1*), and December 1–15 for adult fallback bypass. Operate according to criteria below and in the *Smolt Facility Operating Protocols* (**Appendix J)** for juvenile salmonid bypass and collection (for research purposes).

2.3.2.1. Forebay Area and Intakes.

i. Remove debris from forebay.

ii. Inspect gatewell slots daily for debris, fish buildup, and contaminating substances (particularly oil). Clean gatewells before they become 50% covered with debris. If the volume of debris precludes the ability to keep the gatewell at least 50% clear, clean at least once daily. If flows through an orifice or fish conditions give indications that an orifice may be partially obstructed with debris, close and backflush the orifice to remove the obstruction. If the obstruction cannot be removed, close the orifice and operate the alternate orifice for that gatewell slot. If both orifices become obstructed or plugged with debris, do not operate the turbine unit until the gatewell and orifices are clear of debris.

iii. If a visible accumulation of contaminating substances (e.g., oil) is detected in a gatewell and cannot be removed within 24 hours, immediately close the gatewell

orifices and shut down the turbine unit within one hour until the material has been removed and any problems corrected. The preferred method for removing oil from the water surface is to install absorbent socks, booms, or pads capable of encapsulating the material, tied off with a rope for later disposal. Take action as soon as possible to remove oil from the gatewell so the orifice can be reopened to allow the fish to exit the gatewell. Do not close orifices for longer than 48 hours.

iv. Remove debris from forebay and trashracks as required to minimize fish impacts. Generally, this will result in removing debris from trashracks at least four times per year – just prior to fish passage season and monthly for the first three months. Raking may be required when heavy debris loads are present in the river. Fish quality and trashrack differential may also be an indicator of debris buildup on the trashracks. Project biologist shall determine when trash raking is required.

v. Coordinate cleaning efforts with personnel operating juvenile collection facilities.

vi. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for dewatering bulkhead slot.

2.3.2.2. ESBSs and VBSs.

i. *In 2022, install ESBSs by March 1 in the first three available priority units in* ***Table MCN-5****.* Installation of the remaining ESBSs may begin as early as April 2 starting at the lowest priority units (least likely to operate) and must be completed by no later than April 15.

ii. Operate ESBSs with flow vanes attached.

iii. Operate ESBSs with debris cleaners in automatic mode. Set cleaning frequency to 60 minutes. Increase or decrease frequency if needed to maintain clean screens.

iv. Inspect ESBSs weekly by underwater video in at least three operating turbine units. Spot-check VBSs at the same time.

v. Conduct additional ESBS inspections if fish condition warrants it.

vi. If an ESBS is damaged or fails during juvenile fish passage season, follow procedures in **section 3.2.2.2**. *In no case should a turbine unit be operated with a missing or known non-operational or damaged ESBS or VBS.* Units with ESBSs in place and closed orifices shall not operate for more than 10 hours, and preferably less than 3 hours. Minimize orifice closure by efficiently planning and implementing repairs (e.g., have equipment, materials, and personnel ready before closing orifices).

vii. Measure head differentials across VBSs daily during times of debris. Clean and inspect VBS when head differentials reach 1.5'. When a head differential of 1.5' is reached and the VBSs cannot be cleaned within 8 hours, operate the respective turbine unit at a reduced generation loading to minimize loading on the VBS and potential fish impingement.

viii. Between the spring and summer periods, inspect at least four VBSs in two different turbine units that were operated frequently during the spring. If debris accumulation is noted, inspect other VBSs and clean debris as necessary.

ix. Inspect all VBSs at least once per year and when pulled for cleaning. Repair as needed.

x. At the end of the season, make formal determination as to adequacy of bar screen panels and debris cleaner brushes and replace components as necessary.

2.3.2.3. Collection Channel.

i. Maintain orifices clean and operating. Operate at least one orifice per gatewell slot (preferably the south orifice). If orifices must be closed to repair any part of the facility, see **section 3.2.2.4** to determine if the unit must be shut down and if fish must be dipped from the gatewell(s).

ii. Maintain orifice lights operational and lighted on open orifices. Orifice lights and area lights may be turned off the evening before the channel is dewatered at the end of the season (on or after December 16) to encourage fish to exit the channel volitionally. Area lights can be turned on briefly if needed for access.

iii. Replace all burned out orifice lights within 24 hours of notification. Orifice lights shall remain lighted 24 hours/day.

iv. Maintain orifice jets hitting no closer than 3' from back wall and collection channel full.

v. Operate orifice valves either fully open or closed.

vi. Cycle orifices at least once per day and more frequently if required. During periods of high fish and debris passage, April 1* through August 15 *(*except in 2022 when bypass operations begin March 1)*, inspect and cycle orifices twice daily, or more frequently as determined by the Project biologist, to keep orifices clean. If debris is causing continual orifice plugging problems in a particular gatewell, the respective turbine unit generation may be reduced to the lower end of the 1% efficiency range to minimize orifice plugging problems.

vii. Maintain netting along handrails in good condition (no holes or gaps).

viii. Maintain plastic covers over orifice chutes in good condition.

2.3.2.4. Dewatering Structure.

i. Ensure no gaps between panels or missing silicone in side and inclined screens.

ii. Maintain the trash sweeps operating correctly. The Project biologist shall determine the frequency of operation of the trash sweeps. The sweeps should operate at a frequency to maintain a clean screen given debris loads present. Frequency of operation may vary from once every 15 minutes to once every 2 or more hours. This frequency should coincide with the ESBS cycle time.

iii. If problems occur with the automated cleaning system, operate cleaners at least once per shift unless otherwise determined by the Project biologist.

iv. The dewatering structure may be dewatered twice during the season, during low fish passage periods in June and September, and for inspection and cleaning of the dewatering screens. Before dewatering occurs, the Project biologist must notify CENWW-OD-T who will coordinate the proposed action with NOAA Fisheries and other FPOM participants.

v. Turn off lights at the dewatering structure at night (unless needed for personnel access) to encourage fish to move downstream volitionally.

2.3.2.5. Sampling Facilities. [Note: normal operations when not sampling fish is to operate the juvenile bypass facilities in full flow bypass to the river. During this operation, fish may be periodically routed through the sampling facilities to sample fish for the Smolt Monitoring Program or for routine sampling to monitor facility descaling and fish condition. Sampling during full flow bypass operations will be coordinated on an as-needed basis. Sampling during the juvenile fish bypass season is normally done every other day, per **Appendix J**.**]**

**In 2022, the bypass system and every-other-day sampling will begin March 1.*

i. There should be no holes or gaps between screen panels. Maintain all silicone sealer in good condition.

ii. Maintain the crowder screen brushes in good operating condition.

iii. Ensure that retainer screens in raceways and tanks are clean with no holes or protruding wires.

iv. Operate wet separator and fish distribution system as designed.

v. To prevent debris plugging in the spring, release ice blocks through each 10” bypass line, 1-3 times per day, as warranted by woody debris loads. Pass additional ice blocks down the pipelines during high debris periods as needed to keep the pipes debris free. Continue releasing ice blocks through the pipes during the summer when transporting fish, as determined by the Project biologist to keep the pipelines debris free.

vi. Inform PSMFC in advance if possible of situations that cause the PIT-tag system to become inoperable (e.g., power outages) or that could result in confounding the interpretation of PIT-tag data (e.g., bypassing fish from raceways to the river, operating in primary bypass mode without an operational full-flow detector, emergency dewatering).

2.3.2.6. Temporary Spillway Weirs (TSW).

i. McNary Dam has two temporary, or top, spillway weirs (TSWs) in spillbays 19 and 20 that provide surface routes for fish passage.

ii. The spill rate through each TSW is approximately 9.6 kcfs (19.2 kcfs total).

iii. Spring spill for juvenile fish passage will begin with both TSWs open per spill patterns in **Table MCN-7,** or the relevant Micro/Macro spill patterns in **Table MCN-11** (see **section 2.2.1.1**).

iv. The TSWs can be opened and closed from the control room (unless they are attached to a crane, then a crane operator is required). The process to remove the TSWs and re-install standard spill gate sections may take up to 5 workdays, as described below in section **v**.

v. Both TSWs will be in service April 10 through June 7, then closed and removed starting on June 8 or the next workday (unless coordinated differently via FPOM). The process to remove the TSWs and install standard spill gate sections may take up to 5 workdays, depending on weather conditions and crane status. During this time, spill will be maintained at the FOP target level and distributed in patterns in **Table MCN-10**. To ensure worker safety, all bays being worked in and adjacent bays will be closed, including bays where gate sections are stored. Therefore, daily from about 0630–1700 hours, Bays 14–21 will be closed so gate sections can be retrieved and installed safely in Bays 19 and 20. During this time, spill will be averaged across Bays 1–13 and 22. At 1700 hours, Bays 14–18 and 21 will be re-opened.

vi. After both TSWs are removed and standard spill gate sections are installed, Bays 19 and 20 will be operated as conventional (deep) spillbays for the remainder of juvenile fish passage spill season per patterns with no TSWs in **Table MCN-9**, or the Micro/Macro spill patterns w/ NO TSWs in **Table MCN-11** (see **section 2.2.1.1**).

2.3.2.7. Emergency Bypass.

i. Freezing Conditions. Between November 1 and December 15, if the National Weather Service forecast for Umatilla, OR[6] is a daily high temperature below

[6] NWS weather forecast for Umatilla, OR: https://forecast.weather.gov/MapClick.php?lat=45.917680000000075&lon=-119.34202999999997

32°F or a daily low temperature below 20°F, the McNary Fisheries staff may place the JFF channel in emergency bypass mode until the beginning of the winter maintenance period when the channel is fully dewatered.

ii. Late Season Mechanical Failure. After November 30, if a mechanical failure forces the JFF juvenile channel into emergency bypass mode, the McNary Fisheries staff may leave the juvenile channel in emergency bypass mode until the beginning of winter maintenance when the channel is fully dewatered.

iii. If the project installs a proposed "X" or "Y" valve in the south trash sluiceway that eliminates the need for emergency bypass, the fisheries staff may shut down water supply to the JFF after November 1 until the JFF is re-watered the following March, unless earlier re-watering is required for testing or maintenance.

2.3.2.8. Inspect all facilities according to the fish facilities monitoring plan. Report findings per **section 2.5**.

2.3.2.9. Avian Predation Management. Operate in accordance with the *Predation Monitoring and Deterrence Action Plans* for McNary Dam in **Appendix L** (Table 2 and section 6). Monitor bird wires and other avian deterrent devices to ensure good condition and replace any broken wires or devices as soon as possible. Implement harassment program to deter avian predation in areas actively used by birds and not covered by bird wires or other devices. Routinely monitor project areas to determine areas of active avian predation and, if possible, adjust harassment program to cover these areas or install bird wires or other deterrent devices to discourage avian predation activities. Grebes should be routinely captured in the juvenile fish channel and released below the dam, in coordination with USDA/Wildlife Services.

2.4. Operating Criteria - Adult Fish Facilities

2.4.1. Adult Fish Facilities - Winter Maintenance Period (January 1 – end of February).

2.4.1.1. Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Fish ladder exit trashracks must have smooth surfaces where fish pass and must have downstream edges that are adequately rounded or padded. Inspect all diffuser gratings and chambers annually by dewatering or by using divers or video inspection techniques. All diffuser gratings and chambers are to be dewatered and physically inspected at least every 3 years. Repair deficiencies.

2.4.1.2. Minimize outage periods to the extent practicable. Only one ladder may be out of service or operating out of standard operating criteria at any one time, unless specifically coordinated with CENWW-OD-T and FPOM.

2.4.1.3. Inspect all staff gauges and water level indicators. Repair and/or clean where necessary. Calibrate all water level measuring devices as necessary for proper operations.

2.4.1.4. Inspect fish ladder exits for debris and clean as necessary.

2.4.1.5. Maintain all trashracks and picketed leads clean and installed correctly.

2.4.1.6. Inspect all spill gates and ensure they are operable.

2.4.1.7. Maintain fish pumps ready for operation.

2.4.1.8. Maintain adult PIT-tag system as required. Coordinate with PSMFC.

2.4.2. <u>Adult Fish Facilities – Adult Fish Passage Season (March 1 – December 31).</u>

2.4.2.1. Maintain all staff gauges in readable condition at all water levels encountered during the fish passage season. Repair or clean as necessary.

2.4.2.2. Maintain water depth over fishway ladder weirs in the range of 1.0'–1.3'.

2.4.2.3. Maintain head on all fishway entrances in the range of 1'–2'.

2.4.2.4. North Shore Entrances (WFE 2 & 3). Operate two downstream gates. Maintain weir depth at 8' or greater below tailwater.

2.4.2.5. North Powerhouse Entrances (NFE 2 & 3). Operate two downstream gates. Maintain weir depth at 8' or greater below tailwater.

2.4.2.6. South Shore Entrances (SFE 1 & 2). Operate two downstream gates. Maintain weir depth at 8' or greater below tailwater.

2.4.2.7. Channel Velocity.

> **i.** Maintain water velocities in the adult collection channel in the range of 1.5–4.0 feet per second (fps), which is the optimum velocity for returning adult salmon and steelhead to migrate upstream though the fishway. Complete velocity readings three times per week and include in required fishway inspections and in weekly and annual reports.
>
> **ii.** Measure surface water velocities in the open access area near the south shore entrance by using a large piece of woody debris (stick, bark) timed over a marked fixed distance. A Doppler meter location near the same location measures sub-surface flow. The measurement of water velocity at this location represents the slowest velocity conditions throughout the length of the channel.

2.4.2.8. Operate twelve FOGs: 1, 3, 4, 8, 14, 21, 26, 32, 37, 41, 43, and 44

2.4.2.9. Correctly install trashracks and picketed leads. Maximum head on ladder exits and picketed leads is 0.5'. Normal head differential on clean leads is 0.3'.

2.4.2.10. Inform PSMFC, in advance if possible, of situations that cause the PIT-tag system to become inoperable (e.g., power outages) or that could result in confounding the interpretation of PIT-tag data (e.g., emergency dewatering).

2.4.2.11. Counting Windows.

i. Maintain all equipment in good condition. Clean the counting window and backboard as needed to maintain good visibility.

ii. Crowder ranges at MCN are:

- Washington Shore = 19 $^{3}/_{16}$" (not adjustable)
- Oregon Shore downstream = 13 $^{1}/_{8}$" – 17 $^{5}/_{8}$"
- Oregon Shore upstream = 13 $^{1}/_{2}$" – 17 $^{1}/_{8}$"

iii. When not counting, open crowder to full count slot width and remove picketed leads.

iv. During counting, open crowder as far as possible to allow accurate counting, no less than 18" to the extent possible. This will usually occur during high turbidity conditions to achieve count accuracy criteria.

2.4.2.12. Facility Inspections.

i. Powerhouse operators shall inspect facilities once per day shift and check computer monitor information at least once during each back shift.

ii. Project biologists shall inspect facilities three times per week according to the fish facilities monitoring program.

iii. Inspect picketed leads during all inspections to ensure they are clean and in the correct position (all the way down).

iv. Check calibration of fishway control system twice per month. This may be done as part of routine fishway inspections.

v. Inspect fishways daily for foreign substances (particularly oil). If substances are found, corrective actions should be undertaken immediately.

vi. Record all inspections.

2.4.2.13. Fishway Temperature Monitoring. From June 1 through September 30, measure water temperature at adult fishway entrances and exits and submit data to the Fish Passage Center (FPC) weekly for posting online.[7] Ensure the location of the monitors meets the following criteria:

i. Within 10 meters of all shore-oriented entrances and exits.

[7] FPC ladder temperature data: www.fpc.org/smolt/smolt_queries/Q_ladderwatertempgraphv2.php

ii. Entrance monitor within 1 meter above the ladder floor and at least 10 meters downstream of ladder diffusers, if possible, to allow for sufficient mixing with surface water.

iii. Exit monitor within 1 meter above the ladder floor and above all diffusers to allow for sufficient mixing with surface water.

iv. If an existing temperature monitoring location is proposed to be used for either the exit or entrance, verify that the site accurately reflects water temperature within 10 meters of the entrance or exit.

2.5. Fish Facilities Monitoring & Reporting

2.5.1. Monitoring.

2.5.1.1. Project biologists shall inspect fish passage facilities at the frequencies described above in the juvenile and adult fish facilities operating criteria, **sections 2.3 and 2.4**.

2.5.1.2. Project biologists will inspect project facilities for the presence of zebra and Quagga mussels once per month and during dewaterings, and will provide a monthly inspection report to CENWW-OD-T.

2.5.2. Reporting.

2.5.2.1. Weekly Reports. Project Biologists shall prepare weekly reports March 1–December 31 summarizing project and fish facility operations for each week (Friday through Thursday), along with an evaluation of resulting fish passage conditions. The reports will be e-mailed CENWW-OD-T by noon the following Monday. The weekly reports will include:

i. Out-of-criteria situations and subsequent corrective actions taken.

ii. Equipment malfunctions, breakdowns, or damage, with a summary of resulting repairs.

iii. Adult fishway control calibrations.

iv. ESBS and VBS inspections.

v. Unusual activities that at the project that may have affected fish passage.

2.5.2.2. In-Season. Any adverse or negative impact to fish or fishways shall be reported in a *Memorandum for the Record* (MFR) prepared by Project biologists and sent to FPOM by the next working day, pursuant to the coordination process and template in **FPP Chapter 1 – Overview** (section 2.3.2).

2.5.2.3. Annual Reports. Project biologists shall prepare a draft annual report by February 10 and a final report by March 15 summarizing fish facility operations for the previous year. The annual report shall also include a description of all actions taken to discourage avian predation at the project, with an overview of the effectiveness of the actions.

3. FISH FACILITIES MAINTENANCE

3.1. Dewatering & Fish Handling

3.1.1. Project biologists should be present to provide technical guidance at all project activities that may involve fish handling. All dewaterings shall be accomplished in accordance with approved *Dewatering Guidelines and Fish Salvage Plans* (**Appendix F**). When river temperatures exceed 68°F at the Juvenile Fish Facility (JFF) sample tank, all adult fish handling will be coordinated through CENWW-OD-T. Project *Dewatering Plans*[8] were reviewed and revised in 2011 to ensure they comply with **Appendix F**.

3.2. Maintenance - Juvenile Fish Facilities

3.2.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modifications of facilities that require them to be out of service for extended periods of time are conducted during the winter maintenance period from December 16 – March 31*. *[*NOTE: in 2022, bypass operations will start March 1, as described in **sections 2.3.1 and 2.3.2**]*. During the fish passage season parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance is the correction of any situation that prevents facilities from operating according to criteria or that will impact fish passage or survival.

3.2.2.1. Notification/Reporting. Maintenance of facilities such as ESBSs that sometimes break down during fish passage season will be carried out as described below. In these cases, repairs will be made as prescribed, and CENWW-OD-T will be notified as soon as possible after it becomes apparent that repairs are required. The Operations Manager may determine that work must be initiated prior to notifying CENWW-OD-T if a delay will result in an unsafe situation for people, property, or fish. Unscheduled maintenance that will have a significant impact on fish passage shall be coordinated with NOAA Fisheries and FPOM on a case-by-case basis by CENWW-OD-T. Information required by CENWW-OD-T includes (see also **FPP Chapter 1 - Overview**):

- **i.** Description of outage.
- **ii.** Type of outage required.
- **iii.** Impact on facility operation.
- **iv.** Length of time for repairs.
- **v.** Potential fish impacts and proposed mitigation measures.

3.2.2.2. ESBSs. The ESBSs deflect fish and water up the gatewell slots as part of the fish bypass system and are inspected periodically throughout the juvenile passage season with a video monitoring system. If an ESBS is found to be damaged, it will be removed and either replaced with a spare or repaired and returned to service. A turbine unit shall not be operated with a known damaged or nonfunctioning screen or without a full complement of ESBSs, flow vanes and VBSs. If a screen fails on a weekend or at night when maintenance crews are

[8] Project Dewatering Plans: pweb.crohms.org/tmt/documents/FPOM/2010/

not available, the respective turbine unit will be shut down and generation switched to a fully screened unit. If all screened turbine units are in service, water may be spilled until the affected screen can be removed and repaired or replaced.

3.2.2.3. VBSs. Each gatewell has a VBS located vertically between the bulkhead slot and the operating gate slot to guide fish away from the turbine intake. The VBSs are designed to distribute flow evenly through the screens to minimize fish impingement and/or descaling. The gatewell water surface elevations are routinely measured to determine head differential across the VBSs caused by debris. VBSs are to be pulled and cleaned when head differentials reach 1.5'. Prior to pulling a VBS for cleaning, the turbine unit loading will be lowered to the lower end of the 1% efficiency range, gatewell orifices closed, and the gatewell dipped with a gatewell basket to remove all fish present in the gatewell unless doing so results in increased mortality (e.g., high numbers of adult or juvenile shad in gatewells). Immediately after dipping, the VBS shall be raised and debris hosed off. The turbine unit shall remain operating at the lower end of 1% while the VBS is being cleaned so gatewell flow will carry the debris into the operating gatewell where it will pass through the turbine unit. Immediately after cleaning the VBS, the VBS shall be lowered to the normal operating position to prevent fish passing from the bulkhead slot into the operating gate slot and orifices reopened. The VBSs shall not be raised longer than 30 minutes with the turbine unit running. If VBSs cannot be cleaned within 1 workday of the head differential reaching 1.5', the turbine unit loading will be lowered to the lower end of the 1% range until the VBS can be cleaned. If the cleaning frequency of VBSs exceeds Project personnel's cleaning capability of approximately 10 VBSs per day, 7 days per week, Project personnel will notify CENWW-OD-T. Then CENWW-OD-T will coordinate with NOAA Fisheries and other FPOM participants regarding an exemption to dipping gatewells prior to cleaning VBSs. An exemption to dipping gatewells prior to cleaning VBSs will be based on fish numbers and TDG levels. If a VBS is found to be damaged during an inspection or cleaning, the VBS panel will be repaired or replaced with a spare panel. The turbine unit will not be operated with a knowingly damaged VBS.

3.2.2.4. Gatewell Orifices. Each gatewell has two orifices with air operated valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell (normally the south orifice) is operated. If an air-valve that operates the orifice fails or the orifice becomes blocked with debris or is damaged, it will be closed and the alternate orifice for that gatewell operated until repairs can be made. If both air-valves that operate the orifices fail and the orifice cannot be fully operated, or must be kept closed, the turbine unit will normally be taken out of service until repairs can be made. At the discretion of the Project Biologist, both orifices in a gatewell may be closed for up to 5 hours in an operating turbine unit with ESBSs in place, but orifice closure times may need to be less depending on fish numbers and condition. Reduce turbine unit loading to the lower end of the 1% efficiency range if deemed necessary by the Project Biologist. If both orifices remain closed after 5 hours, the turbine unit will be taken out of service. During any orifice closure, gatewells shall be monitored hourly (unit is operating) or at least every 2 hours (unit is not operating) by project personnel for signs of fish problems or mortality. If repairs are to take longer than 48 hours and both orifices in a gatewell need to remain closed, juvenile fish will be dipped from the gatewell with a gatewell dip basket in accordance with the project dewatering and fish-handling plan. During times of high fish passage or if there is evidence of any difficulty in holding fish in

gatewells, fish are to be dipped from the gatewells prior to the 48 hours in accordance with the project dewatering and fish-handling plan.

3.2.2.5. Dewatering Structure. The dewatering structure acts as a transition from the collection channel to the bypass pipe/flume. An inclined screen and a side dewatering screen allow excess water to be bled off, with all fish and remaining water transitioning into the bypass pipe. Some of the excess water is discharged into the adult fish facility auxiliary water supply system and some is used as the water supply for the sampling facilities. The dewatering structure contains trash sweeps and an air-burst system for cleaning the dewatering screens of impinged debris. If a trash sweep breaks and interferes with juvenile fish passage through the structure or if a screen is damaged, an emergency bypass system in the collection channel may be used to bypass juveniles while repairs are made. Operation of the emergency bypass system requires the juvenile bypass system to be dewatered and stoplogs inserted at the upstream end of the dewatering structure. The emergency bypass is then opened and the bypass system operated with one orifice per gatewell open. Spill may also be required to bypass juvenile fish while in emergency bypass operations. Prior to any emergency dewatering of the collection channel, the project will notify CENWW-OD-T. Then CENWW-OD-T will be responsible for notifying NOAA Fisheries and other FPOM participants of the action and coordinating changes in spill or other project operations. The emergency bypass system is not equipped with PIT-tag detectors.

3.2.2.6. Bypass Outfall Flume. The corrugated metal bypass flume routes juveniles to either the sampling facilities or to the river below the project through the primary bypass pipe. If a problem interferes with the flume's operation, the project can open the emergency bypass system in the collection system and all fish in the bypass system will be diverted into the ice and trash sluiceway and passed to the river through the north powerhouse ice and trash sluiceway exit.

3.2.2.7. Sampling Facilities. The sampling facilities can be operated to collect and hold juvenile fish for research and sampling purposes, enumerate fish through the sampling system, or bypass some or all of the fish back to the river (secondary bypass). If part of the facility malfunctions or is damaged, the switch gate in the bypass flume will be used to bypass fish directly to the river (primary bypass) until repairs can be made.

3.3. Maintenance - Adult Fish Facilities

3.3.1. Scheduled Maintenance. Scheduled maintenance of a facility that must be dewatered to work on or whose maintenance will have a significant effect on fish passage will be done during the January and February winter maintenance period. Maintenance of facilities that will have no effect on fish passage may be conducted at any time. Maintenance is normally conducted on one fish ladder at a time during the winter to always provide some fish passage at the project. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal criteria unless otherwise coordinated with NOAA Fisheries and other FPOM participants.

3.3.2. Unscheduled Maintenance.

3.3.2.1. Notification/Reporting. Unscheduled maintenance that will significantly affect facility operation will be coordinated with NOAA Fisheries and other FPOM participants. Coordination procedures for unscheduled maintenance of adult facilities are the same as for juvenile facilities (**section 3.2.2**). If part of a facility malfunctions or is damaged during fish passage season and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

3.3.2.2. Fish Ladders & Counting Stations. Fish ladders contain tilting weirs, fixed weirs, counting stations with picket leads, and fish exits with trashracks. If any part of the fish ladder fails or is blocked with debris during fish passage season, efforts will first be made to correct the problem without dewatering the ladder. Trashracks, picket leads, tilting weir mechanisms, and counting stations can sometimes be repaired or maintained without dewatering the ladder. The decision to dewater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after coordination with the fish agencies and tribes.

3.3.2.2.a. Hazardous Materials Spill. In the event of a hazardous materials spill, the Project Biologist has the authority to make fishway adjustments outside of operating criteria as necessary to prevent contamination of the ladder until unified command is formed and consultation is established with FPOM. NOAA Fisheries will be notified within 24 hours of a ladder closure.

3.3.2.3. North Shore Auxiliary Water Supply System. The auxiliary water for the north shore fish ladder is provided by gravity-flow from the forebay. The water passes either through a turbine unit or through a bypass system. The turbine/bypass system is operated by North Wasco County PUD. During normal operations, when the turbine unit is operating, water passes through conduits 3 and 4 to the turbine unit. From the turbine unit, the water discharges into an open pool where it feeds into ladder diffusers. If there are problems with the turbine unit, automatic valves close and the auxiliary water is diverted through conduits 1 and 3A to the baffled bypass system within the old fish lock, where the hydraulic head is dissipated and the water discharged into the diffuser pool.

3.3.2.4. South Shore Auxiliary Water Supply System. The south shore auxiliary water is made up of a combination of gravity flow from the forebay, pumped water from the tailrace and 450 cfs of water from the juvenile collection channel. The gravity flow supplies the diffusers above weir 253 (diffusers 7 through 14) and the pumps supply diffusers below weir 253 (diffusers 1 through 7 and main unit diffusers). Diffuser 7 is where both systems meet and is supplied by either gravity flow or pumped flow. Gravity flow diffusers are regulated by rotovalves and pumped flow diffusers by sluice gates. Water from the juvenile collection channel enters the south fishway near the north powerhouse entrances.

i. If a rotovalve fails, the nearest closed rotovalve will be opened to supply flow. If more rotovalves fail than there are closed valves, the sluice gates in diffusers 3 through 7 will be opened more to provide required flows.

ii. If any sluice gates fail, the nearest sluice gates will be opened further to make up the flow.

iii. If one pump fails, the other two pumps will be operated to maintain facilities within criteria.

iv. If two pumps are expected to be out of service short-term (up to five days), NFE3 will be closed and SFE1, SFE2, NFE2 will be operated as deep as possible while maintaining head differential at 1–2’ at both north and south PH entrances.

v. If two pumps are expected to be out of service six days or longer, then the middle eight of twelve open floating orifices (4, 8, 14, 21, 26, 32, 37, 41) should be closed and monitored before closing main entrances. If extra water is still needed, NFE3 will be closed and SFE1, SFE2, NFE2 will be operated as deep as possible to maintain head differential at 1–2' at both north and south PH entrances.

vi. If all three pumps fail and the outage is expected to last five days or less, CENWW-OD-T will be notified and in turn will coordinate with NOAA Fisheries and other FPOM participants.

vii. If all three pumps fail and the outage is expected to last six days or longer, NFE3 and the middle eight of twelve open floating orifices (4, 8, 14, 21, 26, 32, 37, 41) will be closed, and SFE1 and SFE2 operated as deep as possible while maintaining head differential at 1–2’ at the south PH entrances. If a depth of 6’ on both gates cannot be maintained, SFE1 will be closed as long as the lamprey passage structure is in place at SFE2; if the lamprey structure is not in place, then SFE2 will be closed.

viii. If both pumped auxiliary water supply systems and juvenile collection channel are closed or in emergency bypass (eliminating the 450 cfs contribution from the juvenile system), close north powerhouse entrances and eight of twelve open floating orifices starting at the north end of collection channel, and operate SFE1, SFE2 as deep as possible while maintaining head differential at 1–2’ at the south PH entrances. If both gates cannot be maintained at a depth of 6’, SFE1 will be closed as long as the lamprey passage structure is in place at SFE2. If the lamprey structure is not in place, close SFE2.

3.3.2.5. Fishway Entrances. Fishway entrances consist of main entrance weirs with hoists and automatic controls, and floating orifices that self-regulate with tailwater fluctuations. If any automatic controls malfunction, the weirs can be operated manually by Project personnel and kept within criteria. If there is a further failure that prevents the entrance from being operated manually, the entrance may be lowered down and left in an operating position or an alternate entrance opened until repairs can be made. If a floating orifice fails, it will be pulled out of the water and replaced with a spare floating orifice.

3.3.2.6. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser

gratings are normally checked during winter maintenance to ensure they are in place. These inspections are done by both dewatering and physically inspecting the diffuser gratings, or by using underwater video cameras, divers, or other methods. Diffuser gratings may come loose during the fish passage season due to a variety of reasons. Daily inspections of fish ladders and collection systems should include looking for any flow changes that may indicate problems with diffuser gratings. If a diffuser grating is known or suspected to have moved, creating an opening into a diffuser chamber, efforts must immediately be taken to correct the situation and minimize impacts on adult fish in the fishway. Coordination of the problems should begin immediately through the established coordination procedure in **section 3.2.2**. If possible, a video inspection should be made as soon as possible to determine extent of the problem. If diffuser gratings are found to be missing or displaced, creating openings into the diffuser chambers, a method of repair shall be developed and coordinated with the fish agencies and tribes through the established coordination procedure. Repairs shall be made as quickly as possible unless otherwise coordinated.

4. TURBINE UNIT OPERATIONS & MAINTENANCE

4.1. Turbine Unit Priority Order

4.1.1. Turbine units will be operated in the order of priority defined in **Table MCN-5** to optimize adult and juvenile fish passage. If a unit is out of service, the next unit in the priority order will be operated. Unit priority order may be coordinated differently for fish research, construction, or project maintenance. Unit operations during warm water events are described in **section 4.2.**

Table MCN-5. McNary Dam Turbine Unit Priority Order.

Dates/Operation	Unit Priority Order
March 1 – November 30 Fish Passage/Bypass Season	1, then 14–2 in descending order [a]
Warm Water Operations [b] (see **section 4.2**)	U1 available: STOP every other unit starting w/ 2 and move north. = 2, 4, 6, 8, 10, 12, 14, 3, 5, 7, 9, 11, 13, 1 Unit 1 OOS: STOP every other unit starting w/ 3 and move north. = 3, 5, 7, 9, 11, 13, 2, 4, 6, 8, 10, 12, 14
December 1 – End February Winter Maintenance Period	Any Order (if OR ladder is in service, request to operate Unit 1 or 2 if possible)

a. Provides positive downstream flows at the outfall, based on unit availability.

b. Warm Water Operations priority order may be adjusted if needed, as coordinated by the Project Biologist.

4.2. Warm Water Turbine Operations

4.2.1. To minimize thermal stress on juvenile salmonids during warm water conditions, the turbine operations described below will be implemented at the request of the Project Biologist when *any* of the following conditions occur:

i. Water temperature in the McNary JFF sample tank > 68°F.

ii. Water temperature elsewhere at the Project (e.g., gatewells) that is likely to induce thermal stress in juvenile salmonids.

iii. Temperature gradients > 5°F.

iv. Sample mortality > 3%.

v. System mortality > 6%.

4.2.2. Operation in Secondary Bypass or Sample Mode. When any of the conditions listed above occur, the Project will begin to shut down units in a staggered order (**Table MCN-5**, stopping every other unit starting at Unit 2, then ascending as necessary to avoid temperature shocks in the juvenile channel (i.e., shutting down units 2, 4, 6, 8, 10, 12 and 14). If possible, Unit 1 shall be left in operation to provide attraction flow to the two entrances of the Oregon shore fish ladder. Project Fisheries will coordinate with CENWW to modify the sequence as necessary to provide equal or better levels of fish protection. Starting and stopping of two or more units at a time should be avoided during warm water conditions, if possible, especially during the hours of 1000–2400. The Project and CENWW will coordinate these protocols with

fish agencies and tribes through FPOM and other entities as necessary. The purpose of these protocols is to provide precautionary measures to avoid or minimize any direct or delayed mortality resulting from additional thermal stress when handling juvenile salmonid fishes.

4.2.3. Continued Mortality. If juvenile salmonid populations continue to experience high mortality after implementing the above turbine operations, collection for fish condition sampling by smolt monitoring staff should continue for up to 8 hours a day. Except for daily monitoring, the Project shall switch to primary bypass, routing fish past the JFF and through the bypass outfall for the duration of the event.

4.3. Turbine Unit Operating Range

4.3.1. Turbine unit flow and power output at the lower and upper limits of the ±1% peak efficiency range, and at the operating limit, are defined in **Table MCN-6**, except Unit 6 with locked blades is in **Table MCN-6-A**. Turbine units will be operated within these ranges according to *BPA's Load Shaping Guidelines* (**Appendix C**), as summarized below.

4.3.2. In-Season: April 10–August 31 (Spring/Summer Spill for Juvenile Fish Passage). Turbine units will be operated within ±1% of peak turbine efficiency (1% range), except under limited conditions and durations when turbines may be operated above the 1% range for the use of reserves or for TDG management during high flows (refer to **Appendix C** for more information). All required fish passage spill operations will be met prior to operating turbines above the 1% range. If in-season operation outside the 1% range is necessary, Project personnel shall record the information and provide to BPA on a weekly basis according to the *Guidelines*. Operation outside the 1% range may be necessary to:

i. Meet BPA load requests made pursuant to BPA's policy, statutory requirements, and *Load Shaping Guidelines* (**Appendix C**).

ii. If the draft tube is to be dewatered (**section 4.4.7**), the unit will be operated at full load >1% (or at speed no load <1% if not possible to load) for a minimum of 15 minutes prior to installing tail logs to flush fish from the unit.

iii. Operate a turbine unit solely to provide station service.

iv. Comply with other coordinated fish measures.

4.3.3. Off-Season: September 1–April 9. While not required to do so in the off-season, turbines will normally run within the 1% range since it is the optimum point for maximizing energy output of a given unit of water over time. Operation outside the 1% range is allowed if needed for power generation or other needs.

4.4. Turbine Unit Maintenance

4.4.1. Turbine unit maintenance schedules will be reviewed annually by Project and District Operations biologists for fish impacts. If maintenance requires operating outside of FPP criteria, the work will be coordinated with FPOM per the procedures defined in **FPP Chapter 1–Overview** (section 2.3).

4.4.2. Priority unit maintenance will be scheduled for the winter maintenance period or when there are few fish passing the project, to the extent possible. Impacts to migrating adults should be minimized. When possible, units used for temperature operations should remain available.

4.4.3. Each turbine unit requires annual maintenance that may take from several days to two weeks and is normally scheduled from mid-July through late December. Annual maintenance of priority units for adult passage is normally conducted in November-December but can be completed in mid-August.

4.4.4. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish.

4.4.5. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the 1% peak efficiency range. This work will be scheduled in compliance with the *BPA Load Shaping Guidelines* (**Appendix C**) to minimize impacts on juvenile fish.

4.4.6. Operational Testing. Operational testing of a unit under maintenance is in addition to a unit in run status required for power plant reliability. Operational testing may deviate from FPP priority order and may require water that would otherwise be used for spill if the project is operating at minimum generation requirements. Water for operational testing will be used from powerhouse allocation when possible and diverted from spill only to the extent necessary to maintain generation system reliability.

4.4.6.1. Pre-Maintenance: Units may be operationally tested for up to 30 minutes prior to going into maintenance status by running at speed-no-load and various loads within the 1% range for measurements and testing and to allow all fish to move through the unit.

4.4.6.2. Post-Maintenance: Units may be operationally tested while remaining in maintenance or forced outage status by running the unit for up to a cumulative time of 30 minutes (within 1% range) before returning to operational status.

4.4.7. Dewatering. Dewatering turbine units should be accomplished in accordance with project dewatering plans. If the turbine unit draft tube is to be dewatered, operate unit with full load for a minimum of 15 minutes prior to installing tail logs. If not possible to load, run unit at speed-no-load for minimum of 15 minutes. This is to reduce the number of fish in the scrollcase prior to installing stop logs. If a turbine unit is out of service for maintenance for an extended period without tailrace stoplogs in place, efforts should be made to not open the wicket gates if the scroll case must be dewatered at a later date without the unit being spun beforehand.

4.4.8. Head Gates (also referred to as Operating Gates). Head gates will normally remain in standard operating position except as required for maintenance.

Table MCN-6. McNary Dam Turbine Unit Power (MW) and Flow (cfs) at ±1% of Peak Turbine Efficiency (Lower and Upper Limits of 1% Range) and Operating Limits. [9] [10]

Project	MCN Units 1–14 With ESBS [b]						MCN Units 1–14 No ESBS [b]					
Head	1% Lower Limit		1% Upper Limit		Operating Limit		1% Lower Limit		1% Upper Limit		Operating Limit	
(feet)	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs
62	34.5	7,951	49.7	11,454	68.0	16,311	34.7	7754	50.8	11,346	68.0	15,710
63	35.2	7,963	51.0	11,552	69.6	16,399	35.4	7765	52.1	11,444	69.6	15,793
64	35.8	7,974	52.3	11,646	71.2	16,486	36.0	7776	53.5	11,537	71.2	15,875
65	36.5	7,984	53.7	11,736	72.8	16,571	36.7	7,786	54.8	11,627	72.8	15,955
66	37.0	7,959	55.2	11,869	74.1	16,574	37.2	7,762	56.3	11,759	74.1	15,945
67	37.5	7,934	56.7	11,997	75.3	16,574	37.7	7,739	57.9	11,887	75.3	15,933
68	38.0	7,911	58.2	12,121	76.6	16,572	38.2	7,716	59.4	12,009	76.6	15,919
69	38.5	7,887	59.7	12,240	77.8	16,567	38.7	7,694	60.9	12,128	77.8	15,903
70	39.0	7,864	61.2	12,355	79.0	16,560	39.2	7,671	62.5	12,243	79.0	15,884
71	39.6	7,874	62.1	12,355	79.7	16,433	39.8	7,681	63.4	12,243	79.7	15,782
72	40.2	7,883	63.1	12,354	80.4	16,303	40.4	7,691	64.4	12,242	80.4	15,676
73	40.9	7,892	64.0	12,353	81.0	16,169	41.1	7,699	65.3	12,241	81.0	15,567
74	41.5	7,901	64.9	12,351	81.6	16,033	41.7	7,708	66.3	12,240	81.3	15,455
75	42.2	7,909	65.8	12,350	82.2	15,893	42.4	7,716	67.2	12,239	81.3	15,340
76	42.8	7,907	66.4	12,282	82.5	15,705	43.0	7,714	67.9	12,172	81.3	15,161
77	43.4	7,905	67.1	12,216	82.8	15,513	43.6	7,713	68.5	12,107	81.3	14,979
78	44.0	7,903	67.7	12,151	83.1	15,319	44.2	7,711	69.1	12,044	81.3	14,795
79	44.6	7,900	68.3	12,088	83.3	15,122	44.8	7,709	69.7	11,981	81.3	14,608
80	45.2	7,897	68.9	12,026	83.4	14,922	45.5	7,706	70.3	11,920	81.3	14,418
81	45.9	7,911	70.0	12,067	83.7	14,747	46.1	7,720	71.5	11,961	81.3	14,256
82	46.5	7,925	71.1	12,106	83.8	14,569	46.8	7,734	72.6	12,000	81.3	14,091
83	47.2	7,939	72.2	12,145	84.0	14,389	47.4	7,747	73.7	12,038	81.3	13,924
84	47.9	7,952	73.3	12,182	84.1	14,206	48.1	7,759	74.9	12,076	81.3	13,754
85	48.5	7,964	74.4	12,219	84.2	14,020	48.8	7,772	76.0	12,112	81.3	13,582
86	49.2	7,987	75.1	12,179	84.0	13,806	49.5	7,794	76.7	12,073	81.3	13,373
87	50.0	8,008	75.7	12,140	83.8	13,588	50.2	7,815	77.3	12,034	81.3	13,161

[9] Values provided by HDC (Mar 1999; updated Jan 2005). Flow (cfs) calculated based on turbine efficiency, project head, and power output (MW). "Operating Limit" is the maximum safe operating point based on cavitation or generator limit (added Feb 2018).

[10] Units 5 and 6 have hydraulically locked blades and restricted operating ranges defined below in **Table MCN-6-A**.

Table MCN-6-A. Temporary Operating Ranges for McNary Dam Units 5 and 6 with Locked Blades. [11]

Project	MCN Unit 5 (Blades Locked at 22.0°) – With ESBS						MCN Unit 5 (Blades Locked at 22.0°) – No ESBS					
Head	Lower Limit		Peak Efficiency		Upper Limit		Lower Limit		Peak Efficiency		Upper Limit	
(feet)	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs
62	44.9	10,245	46.7	10,585	48.6	11,084	45.8	10,236	47.6	10,570	49.5	11,059
63	45.7	10,239	47.6	10,610	49.7	11,143	46.6	10,230	48.5	10,595	50.6	11,117
64	46.4	10,232	48.5	10,633	50.8	11,198	47.3	10,224	49.4	10,618	51.7	11,173
65	47.2	10,226	49.4	10,656	51.9	11,252	48.1	10,217	50.3	10,641	52.8	11,227
66	48.0	10,228	50.3	10,654	52.8	11,247	48.9	10,220	51.2	10,640	53.7	11,222
67	48.8	10,229	51.1	10,652	53.6	11,240	49.7	10,222	52.1	10,638	54.6	11,216
68	49.6	10,230	52.0	10,650	54.5	11,234	50.6	10,223	52.9	10,636	55.5	11,210
69	50.5	10,230	52.8	10,647	55.4	11,227	51.4	10,224	53.8	10,633	56.4	11,204
70	51.3	10,230	53.7	10,643	56.2	11,220	52.3	10,224	54.7	10,630	57.2	11,197
71	52.3	10,275	54.7	10,673	57.2	11,233	53.3	10,269	55.7	10,660	58.2	11,210
72	53.4	10,319	55.7	10,701	58.2	11,245	54.4	10,313	56.7	10,689	59.2	11,223
73	54.4	10,360	56.7	10,728	59.1	11,256	55.5	10,355	57.7	10,716	60.2	11,234
74	55.5	10,400	57.7	10,754	60.1	11,266	56.5	10,395	58.8	10,742	61.2	11,245
75	56.5	10,438	58.7	10,778	61.0	11,276	57.6	10,433	59.8	10,767	62.1	11,255
76	57.4	10,459	59.7	10,810	62.1	11,320	58.5	10,454	60.8	10,799	63.2	11,299
77	58.3	10,479	60.7	10,841	63.2	11,363	59.4	10,475	61.8	10,830	64.4	11,342
78	59.2	10,499	61.6	10,871	64.3	11,405	60.3	10,494	62.8	10,860	65.5	11,384
79	60.1	10,518	62.6	10,900	65.4	11,446	61.3	10,513	63.8	10,889	66.6	11,425
80	61.0	10,536	63.6	10,928	66.5	11,485	62.2	10,531	64.8	10,917	67.7	11,464
81	61.9	10,558	64.5	10,944	67.4	11,495	63.1	10,553	65.7	10,933	68.6	11,474
82	62.8	10,579	65.4	10,960	68.3	11,504	64.0	10,575	66.6	10,949	69.5	11,483
83	63.7	10,600	66.3	10,975	69.2	11,513	64.9	10,596	67.6	10,964	70.4	11,492
84	64.6	10,620	67.2	10,990	70.1	11,522	65.9	10,616	68.5	10,979	71.3	11,501
85	65.5	10,640	68.1	11,004	71.0	11,531	66.8	10,635	69.4	10,993	72.3	11,510
86	66.5	10,679	69.1	11,027	71.9	11,537	67.8	10,675	70.4	11,028	73.3	11,541
87	67.5	10,718	70.0	11,050	72.7	11,543	68.8	10,714	71.5	11,063	74.3	11,571

[11] Units 5 and 6 have hydraulically locked (non-adjustable) runner blades to prevent oil leaks and are restricted to a smaller operating range until the blade seals are repaired. Values provided by HDC based on the abbreviated index test of Unit 5 (Aug 2021) and Unit 6 (Jan 2019).

Project	MCN Unit 6 (Blades Locked at 22.5°) – With ESBS						MCN Unit 6 (Blades Locked at 22.5°) – No ESBS					
Head	Lower Limit		Peak Efficiency		Upper Limit		Lower Limit		Peak Efficiency		Upper Limit	
(feet)	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs	MW	cfs
62	46.8	10,665	49.1	11,130	49.8	11,345	47.6	10,648	49.9	11,078	50.5	11,289
63	47.5	10,659	50.1	11,175	50.9	11,405	48.4	10,641	50.9	11,122	51.6	11,348
64	48.3	10,652	51.2	11,218	52.0	11,462	49.2	10,635	52.0	11,165	52.8	11,405
65	49.1	10,645	52.2	11,259	53.1	11,517	50.0	10,628	53.0	11,205	53.9	11,460
66	49.9	10,647	53.1	11,255	54.0	11,511	50.9	10,631	53.9	11,202	54.8	11,455
67	50.8	10,649	54.0	11,251	54.9	11,505	51.7	10,633	54.8	11,198	55.7	11,449
68	51.7	10,650	54.9	11,246	55.8	11,498	52.6	10,634	55.7	11,194	56.6	11,443
69	52.5	10,650	55.8	11,241	56.7	11,491	53.5	10,635	56.6	11,189	57.5	11,436
70	53.4	10,650	56.6	11,235	57.6	11,484	54.4	10,635	57.5	11,184	58.4	11,429
71	54.5	10,697	57.6	11,256	58.5	11,497	55.5	10,682	58.5	11,205	59.4	11,443
72	55.6	10,742	58.7	11,275	59.5	11,509	56.6	10,728	59.6	11,225	60.4	11,455
73	56.6	10,785	59.7	11,294	60.5	11,521	57.7	10,771	60.6	11,244	61.4	11,467
74	57.7	10,827	60.7	11,311	61.5	11,531	58.8	10,813	61.6	11,262	62.4	11,478
75	58.8	10,866	61.7	11,328	62.5	11,541	59.9	10,853	62.6	11,279	63.4	11,488
76	59.8	10,888	62.8	11,368	63.6	11,587	60.9	10,875	63.7	11,319	64.6	11,534
77	60.7	10,909	63.8	11,407	64.7	11,631	61.8	10,896	64.8	11,357	65.7	11,578
78	61.6	10,929	64.9	11,444	65.8	11,674	62.8	10,916	65.9	11,395	66.8	11,620
79	62.6	10,949	66.0	11,481	66.9	11,715	63.7	10,936	67.0	11,431	67.9	11,662
80	63.5	10,968	67.0	11,516	68.0	11,755	64.7	10,955	68.1	11,466	69.1	11,702
81	64.4	10,991	68.0	11,529	69.0	11,765	65.6	10,978	69.0	11,479	70.0	11,712
82	65.4	11,013	68.9	11,541	69.9	11,775	66.6	11,000	70.0	11,492	71.0	11,721
83	66.3	11,035	69.8	11,553	70.8	11,784	67.5	11,022	70.9	11,504	71.9	11,731
84	67.3	11,056	70.8	11,565	71.7	11,793	68.5	11,043	71.8	11,515	72.8	11,740
85	68.2	11,076	71.7	11,576	72.7	11,802	69.5	11,063	72.8	11,527	73.8	11,749
86	69.2	11,117	72.6	11,590	73.5	11,808	70.5	11,104	73.7	11,541	74.7	11,755
87	70.3	11,158	73.5	11,604	74.4	11,815	71.6	11,145	74.7	11,555	75.6	11,761

5. FOREBAY DEBRIS REMOVAL

5.1.1. Debris at projects can adversely impact fish passage conditions by plugging or blocking trashracks, VBSs, gatewell orifices, dewatering screens, separators, and facility piping resulting in impingement, injuries, and descaling of fish. Removing debris at its source in the forebay is sometimes necessary to maintain safe and efficient fish passage conditions, navigation, and other project activities. The preferred option is to remove debris at each project, when possible, to avoid passing debris on to the next project downstream. Debris can be removed from the forebay by:

i. Using a boat to encircle debris with a log boom and pull it to the spillway where operators can spill it or to the shore to be removed by crane.

ii. Removing the debris from the top of the dam using a crane and scoop.

iii. Passing debris via the spillway with special turbine and/or spill operations.

iv. Using a boom, spreader bar or other device, suspended from a crane, to move the debris to the spillway, in coordination with special powerhouse and spill operations (if needed).

5.1.2. Debris Spill. If the Project does not have forebay debris removal capability, the only viable alternative is to pass the debris via spill. Except in an emergency, the Project shall contact CENWW-OD-T and the John Day Dam Control Room and Fishery Biologist at least one workday in advance of debris spill operations. CENWW-OD-T will notify FPOM and the special operation will be detailed in a teletype issued by RCC. In an emergency operation, notification may be provided as described below**.**

5.1.3. Special Spills. All special spills (other than normal spill patterns for ongoing spill operations) and project operations for passing debris will be coordinated prior to the operations taking place. Each project shall contact CENWW-OD-T at least two workdays prior to the day they want the special project operation for spilling to pass debris. Then CENWW-OD-T shall coordinate the special operation with RCC, NOAA Fisheries, and other FPOM participants. Project personnel shall provide CENWW-OD-T the reason for the debris spill request, including an explanation of Project facilities being impacted by debris, the date and time of the requested spill, and any special powerhouse or other operations required to move debris to the spillway. When a debris spill is coordinated and approved, RCC shall issue a teletype detailing the specifics of the special operations.

5.1.4. Emergency Spills. Implement as necessary to pass woody debris that is accumulating in the forebay and compromising the safe, unobstructed passage of fish**.** The operating project will immediately spill the woody debris to remove obstructions to fish passage. The operating project will notify CENWW-OD-T of the emergency spill as soon as possible to notify RCC, NOAA Fisheries, and other FPOM participants.

Table MCN-7. McNary Dam Spill Patterns for Fish Passage with TSWs in Bays 19-20 and Bays 2, 6, 16 Locked at 4 or 6 Stops.

Table MCN-7 Spill Patterns with TSWs (# Gate Stops per Spillbay) - Bay 2, 6, and 16 locked at 4 or 6 stops																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
																		TSW	TSW	1		1	21.2
																	1	TSW	TSW	1		2	23.2
																	1	TSW	TSW	1	1	3	25.2
																	1	TSW	TSW	2	1	4	27.1
																	2	TSW	TSW	2	1	5	29.0
																1	2	TSW	TSW	2	1	6	31.0
																2	2	TSW	TSW	2	1	7	32.9
														1		2	2	TSW	TSW	2	1	8	34.9
														1		2	2	TSW	TSW	2	2	9	36.8
														2		2	2	TSW	TSW	2	2	10	38.7
												1		2		2	2	TSW	TSW	2	2	11	40.7
												2		2		2	2	TSW	TSW	2	2	12	42.6
										1		2		2		2	2	TSW	TSW	2	2	13	44.6
										2		2		2		2	2	TSW	TSW	2	2	14	46.5
										0		1		2	4	2	2	TSW	TSW	2	2	15	47.9
												2		2	4	2	2	TSW	TSW	2	2	16	49.8
										1		2		2	4	2	2	TSW	TSW	2	2	17	51.8
										2		2		2	4	2	2	TSW	TSW	2	2	18	53.7
								1		2		2		2	4	2	2	TSW	TSW	2	2	19	55.7
								2		2		2		2	4	2	2	TSW	TSW	2	2	20	57.6
		1						2		2		2		2	4	2	2	TSW	TSW	2	2	21	59.6
		2						2		2		2		2	4	2	2	TSW	TSW	2	2	22	61.5
		2		1				2		2		2		2	4	2	2	TSW	TSW	2	2	23	63.5
		2		2				2		2		2		2	4	2	2	TSW	TSW	2	2	24	65.4
		2		2		1		2		2		2		2	4	2	2	TSW	TSW	2	2	25	67.4
	4	0		2		0		2		2		2		2	4	2	2	TSW	TSW	2	2	26	68.7
	4			2		1		2		2		2		2	4	2	2	TSW	TSW	2	2	27	70.7
	4			2		2		2		2		2		2	4	2	2	TSW	TSW	2	2	28	72.6
	4	1		2		2		2		2		2		2	4	2	2	TSW	TSW	2	2	29	74.6
	4	2		2		2		2		2		2		2	4	2	2	TSW	TSW	2	2	30	76.5
1	4	2		2		2		2		2		2		2	4	2	2	TSW	TSW	2	2	31	78.5
2	4	2		2		2		2		2		2		2	4	2	2	TSW	TSW	2	2	32	80.4
2	4	2	1	2		2		2		2		2		2	4	2	2	TSW	TSW	2	2	33	82.4

Table MCN-7 Spill Patterns with TSWs (# Gate Stops per Spillbay) - Bay 2, 6, and 16 locked at 4 or 6 stops																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
2	4	2	2	2		2		2		2		2		2	4	2	2	TSW	TSW	2	2	**34**	**84.3**
2	4	2	2	2		2	1	2		2		2		2	4	2	2	TSW	TSW	2	2	**35**	**86.3**
2	4	2	2	2		2	2	2		2		2		2	4	2	2	TSW	TSW	2	2	**36**	**88.2**
2	4	2	2	2		2	2	2		2	1	2		2	4	2	2	TSW	TSW	2	2	**37**	**90.2**
2	4	2	2	2		2	2	2		2	2	2		2	4	2	2	TSW	TSW	2	2	**38**	**92.1**
2	4	2	2	2		2	2	2	1	2	2	2		2	4	2	2	TSW	TSW	2	2	**39**	**94.1**
2	4	2	2	2		2	2	2	2	2	2	2		2	4	2	2	TSW	TSW	2	2	**40**	**96.0**
2	4	2	2	2		2	2	2	2	2	2	2	1	2	4	2	2	TSW	TSW	2	2	**41**	**98.0**
2	4	2	2	2		2	2	2	2	2	2	2	2	2	4	2	2	TSW	TSW	2	2	**42**	**99.9**
2	4	2	2	3		2	2	2	2	2	2	2	2	2	4	2	2	TSW	TSW	2	2	**43**	**101.6**
2	4	2	2	0	6	0	2	2	2	2	2	2	2	2	4	2	2	TSW	TSW	2	2	**44**	**102.5**
2	4	2	2		6	1	2	2	2	2	2	2	2	2	4	2	2	TSW	TSW	2	2	**45**	**104.5**
2	4	2	2		6	2	2	2	2	2	2	2	2	2	4	2	2	TSW	TSW	2	2	**46**	**106.4**
2	4	2	2	1	6	2	2	2	2	2	2	2	2	2	4	2	2	TSW	TSW	2	2	**47**	**108.4**
2	4	2	2	2	6	2	2	2	2	2	2	2	2	2	4	2	2	TSW	TSW	2	2	**48**	**110.3**
2	4	2	2	2	6	2	2	2	2	2	2	2	2	2	4	2	2	TSW	TSW	3	2	**49**	**112.0**
2	4	2	2	2	6	2	2	2	2	2	2	2	2	2	4	2	3	TSW	TSW	3	2	**50**	**113.7**
2	4	3	2	2	6	2	2	2	2	2	2	2	2	2	4	2	3	TSW	TSW	3	2	**51**	**115.4**
2	4	3	2	3	6	2	2	2	2	2	2	2	2	2	4	2	3	TSW	TSW	3	2	**52**	**117.1**
2	4	3	2	3	6	2	2	2	2	2	2	2	3	2	4	2	3	TSW	TSW	3	2	**53**	**118.8**
2	4	3	2	3	6	3	2	2	2	2	2	2	3	2	4	2	3	TSW	TSW	3	2	**54**	**120.5**
2	4	3	2	3	6	3	2	2	2	2	3	2	3	2	4	2	3	TSW	TSW	3	2	**55**	**122.2**
2	4	3	2	3	6	3	2	3	2	2	3	2	3	2	4	2	3	TSW	TSW	3	2	**56**	**123.9**
2	4	3	2	3	6	3	2	3	3	2	3	2	3	2	4	2	3	TSW	TSW	3	2	**57**	**125.6**
2	4	3	2	3	6	3	2	3	3	2	3	2	3	2	4	2	3	TSW	TSW	3	3	**58**	**127.3**
3	4	3	2	3	6	3	2	3	3	2	3	2	3	2	4	2	3	TSW	TSW	3	3	**59**	**129.0**
3	4	3	2	3	6	3	2	3	3	2	3	2	3	2	4	3	3	TSW	TSW	3	3	**60**	**130.7**
3	4	3	3	3	6	3	2	3	3	2	3	2	3	2	4	3	3	TSW	TSW	3	3	**61**	**132.4**
3	4	3	3	3	6	3	2	3	3	2	3	2	3	3	4	3	3	TSW	TSW	3	3	**62**	**134.1**
3	4	3	3	3	6	3	3	3	3	2	3	2	3	3	4	3	3	TSW	TSW	3	3	**63**	**135.8**
3	4	3	3	3	6	3	3	3	3	2	3	3	3	3	4	3	3	TSW	TSW	3	3	**64**	**137.5**
3	4	3	3	3	6	3	3	3	3	3	3	3	3	3	4	3	3	TSW	TSW	3	3	**65**	**139.2**
3	4	3	3	3	6	3	3	3	3	3	3	3	3	3	4	3	3	TSW	TSW	4	3	**66**	**140.8**
3	4	3	3	3	6	3	3	3	3	3	3	3	3	3	4	3	4	TSW	TSW	4	3	**67**	**142.4**
3	4	4	3	3	6	3	3	3	3	3	3	3	3	3	4	3	4	TSW	TSW	4	3	**68**	**144.0**

Table MCN-7 Spill Patterns with TSWs (# Gate Stops per Spillbay) - Bay 2, 6, and 16 locked at 4 or 6 stops																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
3	4	4	3	4	6	3	3	3	3	3	3	3	3	3	4	3	4	TSW	TSW	4	3	**69**	**145.6**
3	4	4	3	4	6	3	3	3	3	3	3	3	4	3	4	3	4	TSW	TSW	4	3	**70**	**147.2**
3	4	4	3	4	6	4	3	3	3	3	3	3	4	3	4	3	4	TSW	TSW	4	3	**71**	**148.8**
3	4	4	3	4	6	4	3	3	3	3	4	3	4	3	4	3	4	TSW	TSW	4	3	**72**	**150.4**
3	4	4	3	4	6	4	3	4	3	3	4	3	4	3	4	3	4	TSW	TSW	4	3	**73**	**152.0**
3	4	4	3	4	6	4	3	4	4	3	4	3	4	3	4	3	4	TSW	TSW	4	3	**74**	**153.6**
3	4	4	3	4	6	4	3	4	4	3	4	3	4	3	4	3	4	TSW	TSW	4	4	**75**	**155.2**
4	4	4	3	4	6	4	3	4	4	3	4	3	4	3	4	3	4	TSW	TSW	4	4	**76**	**156.8**
4	4	4	3	4	6	4	3	4	4	3	4	3	4	3	4	4	4	TSW	TSW	4	4	**77**	**158.4**
4	4	4	4	4	6	4	3	4	4	3	4	3	4	3	4	4	4	TSW	TSW	4	4	**78**	**160.0**
4	4	4	4	4	6	4	3	4	4	3	4	3	4	4	4	4	4	TSW	TSW	4	4	**79**	**161.6**
4	4	4	4	4	6	4	4	4	4	3	4	3	4	4	4	4	4	TSW	TSW	4	4	**80**	**163.2**
4	4	4	4	4	6	4	4	4	4	3	4	4	4	4	4	4	4	TSW	TSW	4	4	**81**	**164.8**
4	4	4	4	4	6	4	4	4	4	4	4	4	4	4	4	4	4	TSW	TSW	4	4	**82**	**166.4**
4	4	4	4	4	6	4	4	4	4	4	4	4	4	4	4	4	4	TSW	TSW	5	4	**83**	**168.0**
4	4	4	4	4	6	4	4	4	4	4	4	4	4	4	4	4	5	TSW	TSW	5	4	**84**	**169.6**
4	4	5	4	4	6	4	4	4	4	4	4	4	4	4	4	4	5	TSW	TSW	5	4	**85**	**171.2**
4	4	5	4	5	6	4	4	4	4	4	4	4	4	4	4	4	5	TSW	TSW	5	4	**86**	**172.8**
4	4	5	4	5	6	4	4	4	4	4	4	4	5	4	4	4	5	TSW	TSW	5	4	**87**	**174.4**
4	4	5	4	5	6	5	4	4	4	4	4	4	5	4	4	4	5	TSW	TSW	5	4	**88**	**176.0**
4	4	5	4	5	6	5	4	4	4	4	5	4	5	4	4	4	5	TSW	TSW	5	4	**89**	**177.6**
4	4	5	4	5	6	5	4	5	4	4	5	4	5	4	4	4	5	TSW	TSW	5	4	**90**	**179.2**
4	4	5	4	5	6	5	4	5	5	4	5	4	5	4	4	4	5	TSW	TSW	5	4	**91**	**180.8**
4	4	5	4	5	6	5	4	5	5	4	5	4	5	4	4	4	5	TSW	TSW	5	5	**92**	**182.4**
5	4	5	4	5	6	5	4	5	5	4	5	4	5	4	4	4	5	TSW	TSW	5	5	**93**	**184.0**
5	4	5	4	5	6	5	4	5	5	4	5	4	5	4	4	5	5	TSW	TSW	5	5	**94**	**185.6**
5	4	5	5	5	6	5	4	5	5	4	5	4	5	4	4	5	5	TSW	TSW	5	5	**95**	**187.2**
5	4	5	5	5	6	5	4	5	5	4	5	4	5	5	4	5	5	TSW	TSW	5	5	**96**	**188.8**
5	4	5	5	5	6	5	5	5	5	4	5	4	5	5	4	5	5	TSW	TSW	5	5	**97**	**190.4**
5	4	5	5	5	6	5	5	5	5	4	5	5	5	5	4	5	5	TSW	TSW	5	5	**98**	**192.0**
5	4	5	5	5	6	5	5	5	5	5	5	5	5	5	4	5	5	TSW	TSW	5	5	**99**	**193.6**
5	4	5	5	5	6	5	5	5	5	5	5	5	5	5	4	5	5	TSW	TSW	6	5	**100**	**195.2**
5	4	5	5	5	6	5	5	5	5	5	5	5	5	5	4	5	6	TSW	TSW	6	5	**101**	**196.8**
5	4	6	5	5	6	5	5	5	5	5	5	5	5	5	4	5	6	TSW	TSW	6	5	**102**	**198.4**
5	4	5	5	5	6	5	5	5	5	5	5	5	5	5	6	5	6	TSW	TSW	6	5	**103**	**200.0**

Table MCN-7 Spill Patterns with TSWs (# Gate Stops per Spillbay) - Bay 2, 6, and 16 locked at 4 or 6 stops																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
5	4	6	5	5	6	5	5	5	5	5	5	5	5	5	6	5	6	TSW	TSW	6	5	**104**	**201.6**
5	4	6	5	6	6	5	5	5	5	5	5	5	5	5	6	5	6	TSW	TSW	6	5	**105**	**203.2**
5	4	6	5	6	6	5	5	5	5	5	5	5	6	5	6	5	6	TSW	TSW	6	5	**106**	**204.8**
5	4	6	5	6	6	6	5	5	5	5	5	5	6	5	6	5	6	TSW	TSW	6	5	**107**	**206.4**
5	4	6	5	6	6	6	5	5	5	5	6	5	6	5	6	5	6	TSW	TSW	6	5	**108**	**208.0**
5	4	6	5	6	6	6	5	6	5	5	6	5	6	5	6	5	6	TSW	TSW	6	5	**109**	**209.6**
5	4	6	5	6	6	6	5	6	6	5	6	5	6	5	6	5	6	TSW	TSW	6	5	**110**	**211.2**
5	4	6	5	6	6	6	5	6	6	5	6	5	6	5	6	5	6	TSW	TSW	6	6	**111**	**212.8**
6	4	6	5	6	6	6	5	6	6	5	6	5	6	5	6	5	6	TSW	TSW	6	6	**112**	**214.4**
6	4	6	5	6	6	6	5	6	6	5	6	5	6	5	6	6	6	TSW	TSW	6	6	**113**	**216.0**
6	4	6	6	6	6	6	5	6	6	5	6	5	6	5	6	6	6	TSW	TSW	6	6	**114**	**217.6**
6	4	6	6	6	6	6	5	6	6	5	6	5	6	6	6	6	6	TSW	TSW	6	6	**115**	**219.2**
6	4	6	6	6	6	6	6	6	6	5	6	5	6	6	6	6	6	TSW	TSW	6	6	**116**	**220.8**
6	4	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6	6	TSW	TSW	6	6	**117**	**222.4**
6	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	TSW	TSW	6	6	**118**	**224.0**
6	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	TSW	TSW	7	6	**119**	**225.6**
6	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	TSW	TSW	7	6	**120**	**227.2**
6	4	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	TSW	TSW	7	6	**121**	**228.8**
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	TSW	TSW	7	6	**122**	**230.4**
6	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	TSW	TSW	7	6	**123**	**232.0**
6	6	7	7	6	6	6	6	6	6	6	6	6	6	6	6	7	7	TSW	TSW	7	6	**125**	**235.2**
6	6	7	7	7	6	6	6	6	6	6	6	6	6	6	6	7	7	TSW	TSW	7	6	**126**	**236.8**
6	6	7	7	7	6	7	6	6	6	6	6	6	6	7	6	7	7	TSW	TSW	7	6	**128**	**240.0**
6	6	7	7	7	6	7	7	6	6	6	6	6	7	7	6	7	7	TSW	TSW	7	6	**130**	**243.2**
6	6	7	7	7	6	7	7	7	6	6	6	7	7	7	6	7	7	TSW	TSW	7	6	**132**	**246.4**
6	6	7	7	7	6	7	7	7	7	6	7	7	7	7	6	7	7	TSW	TSW	7	6	**134**	**249.6**
7	6	7	7	7	6	7	7	7	7	7	7	7	7	7	6	7	7	TSW	TSW	7	6	**136**	**252.8**
7	6	7	7	7	6	7	7	7	7	7	7	7	7	7	6	7	8	TSW	TSW	7	7	**138**	**256.1**
7	6	8	7	7	6	7	7	7	7	7	7	7	7	7	6	7	8	TSW	TSW	8	7	**140**	**259.5**
7	6	8	8	7	6	7	7	7	7	7	7	7	7	7	6	8	8	TSW	TSW	8	7	**142**	**262.9**
7	6	8	8	8	6	7	7	7	7	7	7	7	7	7	6	8	8	TSW	TSW	8	7	**143**	**264.6**
7	6	8	8	8	6	8	7	7	7	7	7	7	7	8	6	8	8	TSW	TSW	8	7	**145**	**268.0**
7	6	8	8	8	6	8	8	7	7	7	7	7	8	8	6	8	8	TSW	TSW	8	7	**147**	**271.4**
7	6	8	8	8	6	8	8	8	7	7	7	8	8	8	6	8	8	TSW	TSW	8	7	**149**	**274.8**
7	6	8	8	8	6	8	8	8	8	7	8	8	8	8	6	8	8	TSW	TSW	8	7	**151**	**278.2**

Table MCN-7 Spill Patterns with TSWs (# Gate Stops per Spillbay) - Bay 2, 6, and 16 locked at 4 or 6 stops																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
8	6	8	8	8	6	8	8	8	8	8	8	8	8	8	6	8	8	TSW	TSW	8	7	**153**	**281.6**
8	6	8	8	8	6	8	8	8	8	8	8	8	8	8	6	8	9	TSW	TSW	8	8	**155**	**284.9**
8	6	9	8	8	6	8	8	8	8	8	8	8	8	8	6	8	9	TSW	TSW	9	8	**157**	**288.1**
8	6	9	9	8	6	8	8	8	8	8	8	8	8	8	6	9	9	TSW	TSW	9	8	**159**	**291.3**
8	6	9	9	9	6	8	8	8	8	8	8	8	8	8	6	9	9	TSW	TSW	9	8	**160**	**292.9**
8	6	9	9	9	6	9	8	8	8	8	8	8	8	9	6	9	9	TSW	TSW	9	8	**162**	**296.1**
8	6	9	9	9	6	9	9	8	8	8	8	8	9	9	6	9	9	TSW	TSW	9	8	**164**	**299.3**
8	6	9	9	9	6	9	9	9	8	8	8	9	9	9	6	9	9	TSW	TSW	9	8	**166**	**302.5**
8	6	9	9	9	6	9	9	9	9	8	9	9	9	9	6	9	9	TSW	TSW	9	8	**168**	**305.7**
9	6	9	9	9	6	9	9	9	9	9	9	9	9	9	6	9	9	TSW	TSW	9	8	**170**	**308.9**
9	6	9	9	9	6	9	9	9	9	9	9	9	9	9	6	9	10	TSW	TSW	9	9	**172**	**312.1**
9	6	10	9	9	6	9	9	9	9	9	9	9	9	9	6	9	10	TSW	TSW	10	9	**174**	**315.3**
9	6	10	10	9	6	9	9	9	9	9	9	9	9	9	6	10	10	TSW	TSW	10	9	**176**	**318.5**
9	6	10	10	10	6	9	9	9	9	9	9	9	9	9	6	10	10	TSW	TSW	10	9	**177**	**320.1**
9	6	10	10	10	6	10	9	9	9	9	9	9	9	10	6	10	10	TSW	TSW	10	9	**179**	**323.3**
9	6	10	10	10	6	10	10	9	9	9	9	9	10	10	6	10	10	TSW	TSW	10	9	**181**	**326.5**
9	6	10	10	10	6	10	10	10	9	9	9	10	10	10	6	10	10	TSW	TSW	10	9	**183**	**329.7**
9	6	10	10	10	6	10	10	10	10	9	10	10	10	10	6	10	10	TSW	TSW	10	9	**185**	**332.9**
10	6	10	10	10	6	10	10	10	10	10	10	10	10	10	6	10	10	TSW	TSW	10	9	**187**	**336.1**
10	6	10	10	10	6	10	10	10	10	10	10	10	10	10	6	10	11	TSW	TSW	10	10	**189**	**339.2**
10	6	11	10	10	6	10	10	10	10	10	10	10	10	10	6	10	11	TSW	TSW	11	10	**191**	**342.2**
10	6	11	11	10	6	10	10	10	10	10	10	10	10	10	6	11	11	TSW	TSW	11	10	**193**	**345.2**
10	6	11	11	11	6	10	10	10	10	10	10	10	10	10	6	11	11	TSW	TSW	11	10	**194**	**346.7**
10	6	11	11	11	6	11	10	10	10	10	10	10	10	11	6	11	11	TSW	TSW	11	10	**196**	**349.7**
10	6	11	11	11	6	11	11	10	10	10	10	10	11	11	6	11	11	TSW	TSW	11	10	**198**	**352.7**
10	6	11	11	11	6	11	11	11	10	10	10	11	11	11	6	11	11	TSW	TSW	11	10	**200**	**355.7**
10	6	11	11	11	6	11	11	11	11	10	11	11	11	11	6	11	11	TSW	TSW	11	10	**202**	**358.7**
11	6	11	11	11	6	11	11	11	11	11	11	11	11	11	6	11	11	TSW	TSW	11	10	**204**	**361.7**
11	6	11	11	11	6	11	11	11	11	11	11	11	11	11	6	11	12	TSW	TSW	11	11	**206**	**364.8**
11	6	12	11	11	6	11	11	11	11	11	11	11	11	11	6	11	12	TSW	TSW	12	11	**208**	**368.0**
11	6	12	12	11	6	11	11	11	11	11	11	11	11	11	6	12	12	TSW	TSW	12	11	**210**	**371.2**
11	6	12	12	12	6	11	11	11	11	11	11	11	11	11	6	12	12	TSW	TSW	12	11	**211**	**372.8**
11	6	12	12	12	6	12	11	11	11	11	11	11	11	12	6	12	12	TSW	TSW	12	11	**213**	**376.0**
11	6	12	12	12	6	12	12	11	11	11	11	11	12	12	6	12	12	TSW	TSW	12	11	**215**	**379.2**
11	6	12	12	12	6	12	12	12	11	11	11	12	12	12	6	12	12	TSW	TSW	12	11	**217**	**382.4**

Table MCN-7 Spill Patterns with TSWs (# Gate Stops per Spillbay) - Bay 2, 6, and 16 locked at 4 or 6 stops																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
11	6	12	12	12	6	12	12	12	12	11	12	12	12	12	6	12	12	TSW	TSW	12	11	**219**	**385.6**
12	6	12	12	12	6	12	12	12	12	12	12	12	12	12	6	12	12	TSW	TSW	12	11	**221**	**388.8**
12	6	12	12	12	6	12	12	12	12	12	12	12	12	12	6	12	13	TSW	TSW	12	12	**223**	**392.0**
12	6	13	12	12	6	12	12	12	12	12	12	12	12	12	6	12	13	TSW	TSW	13	12	**225**	**395.2**
12	6	13	13	12	6	12	12	12	12	12	12	12	12	12	6	13	13	TSW	TSW	13	12	**227**	**398.4**
12	6	13	13	13	6	12	12	12	12	12	12	12	12	12	6	13	13	TSW	TSW	13	12	**228**	**400.0**
12	6	13	13	13	6	13	12	12	12	12	12	12	12	13	6	13	13	TSW	TSW	13	12	**230**	**403.2**
12	6	13	13	13	6	13	13	12	12	12	12	12	13	13	6	13	13	TSW	TSW	13	12	**232**	**406.4**
12	6	13	13	13	6	13	13	13	12	12	12	13	13	13	6	13	13	TSW	TSW	13	12	**234**	**409.6**
12	6	13	13	13	6	13	13	13	13	12	13	13	13	13	6	13	13	TSW	TSW	13	12	**236**	**412.8**
12	6	13	13	13	6	13	13	13	13	13	13	13	13	13	6	13	13	TSW	TSW	13	12	**237**	**414.4**
13	6	13	13	13	6	13	13	13	13	13	13	13	13	13	6	13	13	TSW	TSW	13	13	**239**	**417.6**

a. Spill (kcfs) is calculated as a function of total stops + TSW spill at forebay elevation 339 ft.

b. Bays 1, 22 MAY require special open/close sequence (pending field test verification). Open Bays 2–21 for ≥10 minutes, then open Bays 1, 22. Close Bays 1, 22 first.

c. Bays 19-20 with TSWs = fixed spill of ~19.2 kcfs (~9.6 kcfs/bay) at fb el 339'. Raise tainter gates ~3-5 ft above water surface to ensure free flow through TSWs.

Table MCN-8. McNary Dam Spill Patterns with TSWs for Navigation.

MCN Spill Patterns with TSWs for Navigation (# Gate Stops per Spillbay)																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
																		TSW	TSW	1		**1**	**21.2**
																	1	TSW	TSW	1		**2**	**23.2**
	1																1	TSW	TSW	1		**3**	**25.2**
	2																1	TSW	TSW	1		**4**	**27.1**
	3																1	TSW	TSW	1		**5**	**28.8**
	3																1	TSW	TSW	1	1	**6**	**30.8**
	4																1	TSW	TSW	1	1	**7**	**32.4**
	3	2															1	TSW	TSW	1	1	**8**	**34.7**
	4	2															1	TSW	TSW	1	1	**9**	**36.3**
	4	3															1	TSW	TSW	1	1	**10**	**38.0**
	4	3													1		1	TSW	TSW	1	1	**11**	**40.0**
	4	4													1		1	TSW	TSW	1	1	**12**	**41.6**
	4	4												1	1		1	TSW	TSW	1	1	**13**	**43.6**
	4	4										1		1	1		1	TSW	TSW	1	1	**14**	**45.6**
	4	4										2		1	1		1	TSW	TSW	1	1	**15**	**47.5**
	4	4								1		2		1	1		1	TSW	TSW	1	1	**16**	**49.5**
	4	4						1		1		2		1	1		1	TSW	TSW	1	1	**17**	**51.5**
	4	4						1		2		2		1	1		1	TSW	TSW	1	1	**18**	**53.4**
	4	4						1		2		2		1	1		1	TSW	TSW	2	1	**19**	**55.3**
	4	4						1		2		2		1	1		2	TSW	TSW	2	1	**20**	**57.2**
	4	4						2		2		2		1	1		2	TSW	TSW	2	1	**21**	**59.1**
	4	4						2		2		2		1	2		2	TSW	TSW	2	1	**22**	**61.0**
	4	4						2		2		2		2	2		2	TSW	TSW	2	1	**23**	**62.9**
	5	4						2		2		2		2	2		2	TSW	TSW	2	1	**24**	**64.5**
	5	4						2		2		2		2	2		2	TSW	TSW	2	2	**25**	**66.4**

Table MCN-9. McNary Dam Spill Patterns with NO TSWs and Bays 2, 6, 16 Locked at 4 or 6 Stops.

Table MCN-9 Spill Patterns with NO TSWs (# Gate Stops per Spillbay) - Bays 2, 6, 16 locked at 4 or 6 stops.																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
																		3				3	5.6
																		4				4	7.2
																	2	3				5	9.5
																	2	4				6	11.1
																	2	3	2			7	13.4
																	2	4	2			8	15.0
														1			2	4	2			9	17.0
														2			2	4	2			10	18.9
													1	2			2	4	2			11	20.9
													2	2			2	4	2			12	22.8
											1		2	2			2	4	2			13	24.8
											2		2	2			2	4	2			14	26.7
									1		2		2	2			2	4	2			15	28.7
									2		2		2	2			2	4	2			16	30.6
							1		2		2		2	2			2	4	2			17	32.6
							2		2		2		2	2			2	4	2			18	34.5
				1			2		2		2		2	2			2	4	2			19	36.5
				2			2		2		2		2	2			2	4	2			20	38.4
		1		2			2		2		2		2	2			2	4	2			21	40.4
		2		2			2		2		2		2	2			2	4	2			22	42.3
		2		2			2		2		2		2	2			2	4	2	1		23	44.3
		2		2			2		2		2		2	2			2	4	2	2		24	46.2
		2		2			2		2		2		2	2			2	4	3	2		25	47.9
		2		2			2		2		2		2	2			2	4	4	2		26	49.5
1		2		2			2		2		2		2	2			2	4	4	2		27	51.5
2		2		2			2		2		2		2	2			2	4	4	2		28	53.4
3		2		2			2		2		2		2	2			2	4	4	2		29	55.1
0	4	2		2			2		2		2		2	2			2	4	4	2		30	56.7
	4	3		2			2		2		2		2	2			2	4	4	2		31	58.4
	4	4		2			2		2		2		2	2			2	4	4	2		32	60.0
	4	4		2		1	2		2		2		2	2			2	4	4	2		33	62.0
	4	4		2		2	2		2		2		2	2			2	4	4	2		34	63.9
	4	4		2		3	2		2		2		2	2			2	4	4	2		35	65.6

Table MCN-9 Spill Patterns with NO TSWs (# Gate Stops per Spillbay) - Bays 2, 6, 16 locked at 4 or 6 stops.																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
	4	4		2	4	0	2		2		2		2	2			2	4	4	2		36	67.2
	4	4		2	4		2		2		2		2	2		1	2	4	4	2		37	69.2
	4	4		2	4		2		2		2		2	2		2	2	4	4	2		38	71.1
	4	4		2	4		2		2		2		2	2		3	2	4	4	2		39	72.8
	4	4		2	4		2		2		2		2	2	4	0	2	4	4	2		40	74.4
	4	4		2	4		2		2		2		2	2	4	1	2	4	4	2		41	76.4
	4	4		2	4		2		2		2		2	2	4	2	2	4	4	2		42	78.3
1	4	4		2	4		2		2		2		2	2	4	2	2	4	4	2		43	80.3
2	4	4		2	4		2		2		2		2	2	4	2	2	4	4	2		44	82.2
2	4	4	1	2	4		2		2		2		2	2	4	2	2	4	4	2		45	84.2
2	4	4	2	2	4		2		2		2		2	2	4	2	2	4	4	2		46	86.1
2	4	4	2	2	4	1	2		2		2		2	2	4	2	2	4	4	2		47	88.1
2	4	4	2	2	4	2	2		2		2		2	2	4	2	2	4	4	2		48	90.0
2	4	4	2	2	4	2	2	1	2		2		2	2	4	2	2	4	4	2		49	92.0
2	4	4	2	2	4	2	2	2	2		2		2	2	4	2	2	4	4	2		50	93.9
2	4	4	2	2	4	2	2	2	2	1	2		2	2	4	2	2	4	4	2		51	95.9
2	4	4	2	2	4	2	2	2	2	2	2		2	2	4	2	2	4	4	2		52	97.8
2	4	4	2	2	4	2	2	2	2	2	2	1	2	2	4	2	2	4	4	2		53	99.8
2	4	4	2	2	4	2	2	2	2	2	2	2	2	2	4	2	2	4	4	2		54	101.7
2	4	4	2	2	4	2	2	2	2	2	2	2	2	2	4	2	2	4	4	2	1	55	103.7
2	4	4	2	2	4	2	2	2	2	2	2	2	2	2	4	2	2	4	4	2	2	56	105.6
2	4	4	2	2	4	2	2	2	2	2	2	2	2	2	4	2	2	5	4	2	2	57	107.2
2	4	4	2	2	4	2	2	2	2	2	2	2	2	2	4	2	2	5	5	2	2	58	108.8
2	4	4	2	2	4	2	2	2	2	2	2	2	2	2	4	2	3	5	5	2	2	59	110.5
2	4	4	2	2	4	2	2	2	2	2	2	2	2	2	4	2	3	5	5	3	2	60	112.2
2	4	4	3	2	4	2	2	2	2	2	2	2	2	2	4	2	3	5	5	3	2	61	113.9
2	4	4	3	2	4	2	2	2	2	2	2	2	2	2	4	3	3	5	5	3	2	62	115.6
2	4	4	3	3	4	2	2	2	2	2	2	2	2	2	4	3	3	5	5	3	2	63	117.3
2	4	4	3	3	4	2	2	2	2	2	2	2	2	3	4	3	3	5	5	3	2	64	119.0
2	4	4	3	3	4	3	2	2	2	2	2	2	2	3	4	3	3	5	5	3	2	65	120.7
2	4	4	3	3	4	3	2	2	2	2	2	2	3	3	4	3	3	5	5	3	2	66	122.4
2	4	4	3	3	4	3	3	2	2	2	2	2	3	3	4	3	3	5	5	3	2	67	124.1
2	4	4	3	3	4	3	3	2	2	2	2	3	3	3	4	3	3	5	5	3	2	68	125.8
2	4	4	3	3	4	3	3	3	2	2	2	3	3	3	4	3	3	5	5	3	2	69	127.5

Table MCN-9 Spill Patterns with NO TSWs (# Gate Stops per Spillbay) - Bays 2, 6, 16 locked at 4 or 6 stops.																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
2	4	4	3	3	4	3	3	3	2	2	3	3	3	3	4	3	3	5	5	3	2	**70**	**129.2**
2	4	4	3	3	4	3	3	3	3	2	3	3	3	3	4	3	3	5	5	3	2	**71**	**130.9**
2	4	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3	3	5	5	3	2	**72**	**132.6**
3	4	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3	3	5	5	3	2	**73**	**134.3**
3	4	4	3	3	4	3	3	3	3	3	3	3	3	3	4	3	3	5	5	3	3	**74**	**136.0**
3	4	5	3	3	4	3	3	3	3	3	3	3	3	3	4	3	3	5	5	3	3	**75**	**137.6**
3	4	5	3	3	4	3	3	3	3	3	3	3	3	3	4	3	3	6	5	3	3	**76**	**139.2**
3	4	5	3	3	4	3	3	3	3	3	3	3	3	3	4	3	3	6	6	3	3	**77**	**140.8**
3	4	5	3	3	4	3	3	3	3	3	3	3	3	3	4	3	4	6	6	3	3	**78**	**142.4**
3	4	5	3	3	4	3	3	3	3	3	3	3	3	3	4	3	4	6	6	4	3	**79**	**144.0**
3	4	5	4	3	4	3	3	3	3	3	3	3	3	3	4	3	4	6	6	4	3	**80**	**145.6**
3	4	5	4	3	4	3	3	3	3	3	3	3	3	3	4	4	4	6	6	4	3	**81**	**147.2**
3	4	5	4	4	4	3	3	3	3	3	3	3	3	3	4	4	4	6	6	4	3	**82**	**148.8**
3	4	5	4	4	4	3	3	3	3	3	3	3	3	4	4	4	4	6	6	4	3	**83**	**150.4**
3	4	5	4	4	4	4	3	3	3	3	3	3	3	4	4	4	4	6	6	4	3	**84**	**152.0**
3	4	5	4	4	4	4	3	3	3	3	3	3	4	4	4	4	4	6	6	4	3	**85**	**153.6**
3	4	5	4	4	4	4	4	3	3	3	3	3	4	4	4	4	4	6	6	4	3	**86**	**155.2**
3	4	5	4	4	4	4	4	3	3	3	3	4	4	4	4	4	4	6	6	4	3	**87**	**156.8**
3	4	5	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4	6	6	4	3	**88**	**158.4**
3	4	5	4	4	4	4	4	4	3	3	4	4	4	4	4	4	4	6	6	4	3	**89**	**160.0**
3	4	5	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	6	6	4	3	**90**	**161.6**
3	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	4	3	**91**	**163.2**
4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	4	3	**92**	**164.8**
4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	4	4	**93**	**166.4**
4	4	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	6	4	4	**94**	**168.0**
4	4	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	7	6	4	4	**95**	**169.6**
4	4	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	7	7	4	4	**96**	**171.2**
4	4	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	7	7	4	4	**97**	**172.8**
4	4	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	7	7	5	4	**98**	**174.4**
4	4	6	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	7	7	5	4	**99**	**176.0**
4	4	6	5	4	4	4	4	4	4	4	4	4	4	4	4	5	5	7	7	5	4	**100**	**177.6**
4	4	6	5	5	4	4	4	4	4	4	4	4	4	4	4	5	5	7	7	5	4	**101**	**179.2**
4	4	6	5	5	4	4	4	4	4	4	4	4	4	5	4	5	5	7	7	5	4	**102**	**180.8**
4	4	6	5	5	4	5	4	4	4	4	4	4	4	5	4	5	5	7	7	5	4	**103**	**182.4**

Table MCN-9 Spill Patterns with NO TSWs (# Gate Stops per Spillbay) - Bays 2, 6, 16 locked at 4 or 6 stops.																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
4	4	6	5	5	4	5	4	4	4	4	4	4	5	5	4	5	5	7	7	5	4	**104**	**184.0**
4	4	6	5	5	4	5	5	4	4	4	4	4	5	5	4	5	5	7	7	5	4	**105**	**185.6**
4	4	6	5	5	4	5	5	4	4	4	4	5	5	5	4	5	5	7	7	5	4	**106**	**187.2**
4	4	6	5	5	4	5	5	5	4	4	4	5	5	5	4	5	5	7	7	5	4	**107**	**188.8**
4	4	6	5	5	4	5	5	5	4	4	5	5	5	5	4	5	5	7	7	5	4	**108**	**190.4**
4	4	6	5	5	4	5	5	5	5	4	5	5	5	5	4	5	5	7	7	5	4	**109**	**192.0**
4	4	6	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	7	7	5	4	**110**	**193.6**
5	4	6	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	7	7	5	4	**111**	**195.2**
5	4	6	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	7	7	5	5	**112**	**196.8**
5	4	7	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	7	7	5	5	**113**	**198.4**
5	4	7	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	8	7	5	5	**114**	**200.1**
5	4	7	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	8	8	5	5	**115**	**201.8**
5	4	7	5	5	4	5	5	5	5	5	5	5	5	5	4	5	6	8	8	5	5	**116**	**203.4**
5	4	7	5	5	4	5	5	5	5	5	5	5	5	5	4	5	6	8	8	6	5	**117**	**205.0**
5	4	7	6	5	4	5	5	5	5	5	5	5	5	5	4	5	6	8	8	6	5	**118**	**206.6**
5	4	7	6	5	4	5	5	5	5	5	5	5	5	5	4	6	6	8	8	6	5	**119**	**208.2**
5	4	7	6	6	4	5	5	5	5	5	5	5	5	5	4	6	6	8	8	6	5	**120**	**209.8**
5	4	7	6	6	4	5	5	5	5	5	5	5	5	6	4	6	6	8	8	6	5	**121**	**211.4**
5	4	7	6	6	4	6	5	5	5	5	5	5	5	6	4	6	6	8	8	6	5	**122**	**213.0**
5	4	7	6	6	4	6	5	5	5	5	5	5	6	6	4	6	6	8	8	6	5	**123**	**214.6**
5	4	7	6	6	4	6	6	5	5	5	5	5	6	6	4	6	6	8	8	6	5	**124**	**216.2**
5	4	7	6	6	4	6	6	5	5	5	5	6	6	6	4	6	6	8	8	6	5	**125**	**217.8**
5	4	7	6	6	4	6	6	6	5	5	5	6	6	6	4	6	6	8	8	6	5	**126**	**219.4**
5	4	7	6	6	4	6	6	6	5	5	6	6	6	6	4	6	6	8	8	6	5	**127**	**221.0**
5	4	7	6	6	4	6	6	6	6	5	6	6	6	6	4	6	6	8	8	6	5	**128**	**222.6**
5	4	7	6	6	4	6	6	6	6	6	6	6	6	6	4	6	6	8	8	6	5	**129**	**224.2**
6	4	7	6	6	4	6	6	6	6	6	6	6	6	6	4	6	6	8	8	6	5	**130**	**225.8**
6	4	7	6	6	4	6	6	6	6	6	6	6	6	6	4	6	6	8	8	6	6	**131**	**227.4**
6	4	8	6	6	4	6	6	6	6	6	6	6	6	6	4	6	6	8	8	6	6	**132**	**229.1**
5	6	8	6	6	4	6	6	6	6	6	6	6	6	6	4	6	6	8	8	6	6	**133**	**230.7**
6	6	8	6	6	4	6	6	6	6	6	6	6	6	6	4	6	6	8	8	6	6	**134**	**232.3**
5	6	8	6	6	6	6	6	6	6	6	6	6	6	6	4	6	6	8	8	6	6	**135**	**233.9**
6	6	8	6	6	6	6	6	6	6	6	6	6	6	6	4	6	6	8	8	6	6	**136**	**235.5**
5	6	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	8	6	6	**137**	**237.1**

Table MCN-9 Spill Patterns with NO TSWs (# Gate Stops per Spillbay) - Bays 2, 6, 16 locked at 4 or 6 stops.																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
6	6	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	8	6	6	**138**	**238.7**
6	6	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	9	8	6	6	**139**	**240.3**
6	6	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	9	9	6	6	**140**	**241.9**
6	6	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	9	9	6	6	**141**	**243.5**
6	6	8	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	9	9	7	6	**142**	**245.1**
6	6	8	7	6	6	6	6	6	6	6	6	6	6	6	6	6	7	9	9	7	6	**143**	**246.7**
6	6	8	7	6	6	6	6	6	6	6	6	6	6	6	6	7	7	9	9	7	6	**144**	**248.3**
6	6	8	7	7	6	6	6	6	6	6	6	6	6	6	6	7	7	9	9	7	6	**145**	**249.9**
6	6	8	7	7	6	6	6	6	6	6	6	6	6	7	6	7	7	9	9	7	6	**146**	**251.5**
6	6	8	7	7	6	7	6	6	6	6	6	6	6	7	6	7	7	9	9	7	6	**147**	**253.1**
6	6	8	7	7	6	7	6	6	6	6	6	6	7	7	6	7	7	9	9	7	6	**148**	**254.7**
6	6	8	7	7	6	7	7	6	6	6	6	6	7	7	6	7	7	9	9	7	6	**149**	**256.3**
6	6	8	7	7	6	7	7	6	6	6	6	7	7	7	6	7	7	9	9	7	6	**150**	**257.9**
6	6	8	7	7	6	7	7	7	6	6	6	7	7	7	6	7	7	9	9	7	6	**151**	**259.5**
6	6	8	7	7	6	7	7	7	6	6	7	7	7	7	6	7	7	9	9	7	6	**152**	**261.1**
6	6	8	7	7	6	7	7	7	7	6	7	7	7	7	6	7	7	9	9	7	6	**153**	**262.7**
6	6	8	7	7	6	7	7	7	7	7	7	7	7	7	6	7	7	9	9	7	6	**154**	**264.3**
7	6	8	7	7	6	7	7	7	7	7	7	7	7	7	6	7	7	9	9	7	6	**155**	**265.9**
7	6	8	7	7	6	7	7	7	7	7	7	7	7	7	6	7	7	9	9	7	7	**156**	**267.5**
7	6	9	7	7	6	7	7	7	7	7	7	7	7	7	6	7	7	9	9	7	7	**157**	**269.1**
7	6	9	7	7	6	7	7	7	7	7	7	7	7	7	6	7	7	10	9	7	7	**158**	**270.7**
7	6	9	7	7	6	7	7	7	7	7	7	7	7	7	6	7	7	10	10	7	7	**159**	**272.3**
7	6	9	7	7	6	7	7	7	7	7	7	7	7	7	6	7	8	10	10	7	7	**160**	**274.0**
7	6	9	7	7	6	7	7	7	7	7	7	7	7	7	6	7	8	10	10	8	7	**161**	**275.7**
7	6	9	8	7	6	7	7	7	7	7	7	7	7	7	6	7	8	10	10	8	7	**162**	**277.4**
7	6	9	8	7	6	7	7	7	7	7	7	7	7	7	6	8	8	10	10	8	7	**163**	**279.1**
7	6	9	8	8	6	7	7	7	7	7	7	7	7	7	6	8	8	10	10	8	7	**164**	**280.8**
7	6	9	8	8	6	7	7	7	7	7	7	7	7	8	6	8	8	10	10	8	7	**165**	**282.5**
7	6	9	8	8	6	8	7	7	7	7	7	7	7	8	6	8	8	10	10	8	7	**166**	**284.2**
7	6	9	8	8	6	8	7	7	7	7	7	7	8	8	6	8	8	10	10	8	7	**167**	**285.9**
7	6	9	8	8	6	8	8	7	7	7	7	7	8	8	6	8	8	10	10	8	7	**168**	**287.6**
7	6	9	8	8	6	8	8	7	7	7	7	8	8	8	6	8	8	10	10	8	7	**169**	**289.3**
7	6	9	8	8	6	8	8	8	7	7	7	8	8	8	6	8	8	10	10	8	7	**170**	**291.0**
7	6	9	8	8	6	8	8	8	7	7	8	8	8	8	6	8	8	10	10	8	7	**171**	**292.7**

Table MCN-9 Spill Patterns with NO TSWs (# Gate Stops per Spillbay) - Bays 2, 6, 16 locked at 4 or 6 stops.																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
7	6	9	8	8	6	8	8	8	8	7	8	8	8	8	6	8	8	10	10	8	7	**172**	**294.4**
7	6	9	8	8	6	8	8	8	8	8	8	8	8	8	6	8	8	10	10	8	7	**173**	**296.1**
8	6	9	8	8	6	8	8	8	8	8	8	8	8	8	6	8	8	10	10	8	7	**174**	**297.8**
8	6	9	8	8	6	8	8	8	8	8	8	8	8	8	6	8	8	10	10	8	8	**175**	**299.5**
8	6	10	8	8	6	8	8	8	8	8	8	8	8	8	6	8	8	10	10	8	8	**176**	**301.1**

a. Spill (kcfs) is calculated as a function of total stops + TSW spill at forebay elevation 339 ft.

b. Bays 1, 22 MAY require special open/close sequence (pending field test verification). Open Bays 2–21 for ≥10 minutes, then open Bays 1, 22. Close Bays 1, 22 first.

Table MCN-10. [*page 1 of 5*]. McNary Dam Spill Patterns during TSW Removal in Bays 19-20.

NOTE: The process to remove the TSWs and re-install standard spill gate sections in Bays 19-20 may take up to 5 days, depending on weather conditions and crane status. During this time, Bays 19-20 will be closed all hours until standard spill gate sections are installed and the bays can be operated as conventional (deep) spillbays. For worker safety, all bays being worked in and adjacent bays must be closed, which includes bays where the gate sections are stored. Therefore, during the workday (approx. 0630-1700), bays 14-21 will be closed and FOP spill will be distributed across the remaining bays 1-13 and 22. See section 2.3.2.6 for more information.

Table MCN-10 Spill Patterns During TSW Removal (# Gate Stops per Spillbay)																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
								2		2		2		2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**12**	**23.4**
								2	1	2		2		2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**13**	**25.4**
								2	2	2		2		2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**14**	**27.3**
								2	2	2		2	1	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**15**	**29.3**
								2	2	2		2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**16**	**31.2**
								2	2	2	1	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**17**	**33.2**
								2	2	2	2	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**18**	**35.1**
						1		2	2	2	2	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**19**	**37.1**
						2		2	2	2	2	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**20**	**39.0**
				1		2		2	2	2	2	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**21**	**41.0**
				2		2		2	2	2	2	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**22**	**42.9**
2.5	2	3.5		2		2		2		2		2	1	2		2	CLOSE	CLOSE	CLOSE	CLOSE		**23**	**44.4**
2.5	2	3.5		2		2		2		2		2	1	2	1	2	CLOSE	CLOSE	CLOSE	CLOSE		**24**	**46.4**
2.5	2	3.5		2	1	2		2		2		2	1	2	1	2	CLOSE	CLOSE	CLOSE	CLOSE		**25**	**48.4**
2.5	2	3.5		2	1	2		2	1	2		2	1	2	1	2	CLOSE	CLOSE	CLOSE	CLOSE		**26**	**50.4**
2.5	2	3.5		2	1	2		2	1	2	1	2	1	2	1	2	CLOSE	CLOSE	CLOSE	CLOSE		**27**	**52.4**
2.5	2	3.5		2	1	2	1	2	1	2	1	2	1	2	1	2	CLOSE	CLOSE	CLOSE	CLOSE		**28**	**54.4**
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	1	2	1	2	CLOSE	CLOSE	CLOSE	CLOSE		**29**	**56.4**
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	2	2	1	2	CLOSE	CLOSE	CLOSE	CLOSE		**30**	**58.3**
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**31**	**60.2**
2.5	2	3.5	1	2	2	2	1	2	1	2	1	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**32**	**62.1**
2.5	2	3.5	1	2	2	2	1	2	2	2	1	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**33**	**64.0**
2.5	2	3.5	1	2	2	2	1	2	2	2	2	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**34**	**65.9**
2.5	2	3.5	1	2	2	2	2	2	2	2	2	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**35**	**67.8**
2.5	2	3.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**36**	**69.7**
2.5	2.5	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	CLOSE	CLOSE	CLOSE	CLOSE		**37**	**71.3**
2.5	2.5	4	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5	CLOSE	CLOSE	CLOSE	CLOSE		**38**	**73.0**
2.5	2.5	4	2	2	2	2.5	2	2	2	2.5	2	2	2	2	2.5	2.5	CLOSE	CLOSE	CLOSE	CLOSE		**39**	**74.7**
2.5	2.5	4	2	2.5	2	2.5	2	2	2	2.5	2	2	2	2.5	2.5	2.5	CLOSE	CLOSE	CLOSE	CLOSE		**40**	**76.4**

Table MCN-10 Spill Patterns During TSW Removal (# Gate Stops per Spillbay)																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
2.5	2.5	4	2	2.5	2	2.5	2	2.5	2	2.5	2	2.5	2	2.5	2.5	2.5	CLOSE	CLOSE	CLOSE	CLOSE		**41**	**78.1**
2.5	2.5	4	2	2.5	2.5	2.5	2	2.5	2.5	2.5	2	2.5	2	2.5	2.5	2.5	CLOSE	CLOSE	CLOSE	CLOSE		**42**	**79.8**
2.5	2.5	4	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2.5	2.5	CLOSE	CLOSE	CLOSE	CLOSE		**43**	**81.5**
2.5	2.5	4	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2.5	2.5	CLOSE	CLOSE	CLOSE	CLOSE		**44**	**83.2**
2.5	2.5	4	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	CLOSE	CLOSE	CLOSE	CLOSE		**45**	**84.1**
2.5	2.5	4	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3	CLOSE	CLOSE	CLOSE	CLOSE		**46**	**85.8**
2.5	2.5	4.5	3	2.5	2.5	2.5	2.5	2.5	2.5	3	2.5	2.5	2.5	2.5	3	3	CLOSE	CLOSE	CLOSE	CLOSE		**47**	**87.4**
2.5	2.5	4.5	3	2.5	2.5	3	2.5	2.5	2.5	3	2.5	3	2.5	2.5	3	3	CLOSE	CLOSE	CLOSE	CLOSE		**48**	**89.1**
2.5	2.5	4.5	3	3	2.5	3	2.5	3	2.5	3	2.5	3	2.5	2.5	3	3	CLOSE	CLOSE	CLOSE	CLOSE		**49**	**90.8**
2.5	2.5	4.5	3	3	3	3	2.5	3	2.5	3	2.5	3	2.5	3	3	3	CLOSE	CLOSE	CLOSE	CLOSE		**50**	**92.5**
2.5	2.5	5	3	3	3	3	2.5	3	3	3	2.5	3	2.5	3	3	3	CLOSE	CLOSE	CLOSE	CLOSE		**51**	**94.2**
2.5	2.5	5	3	3	3	3	3	3	3	3	3	3	2.5	3	3	3	CLOSE	CLOSE	CLOSE	CLOSE		**52**	**95.9**
3	3	5	3	3	3	3	3	3	3	3	3	3	2.5	3	3	3	CLOSE	CLOSE	CLOSE	CLOSE		**53**	**97.6**
3	3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	CLOSE	CLOSE	CLOSE	CLOSE		**53**	**98.4**
3	3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**54**	**100.0**
3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**55**	**101.6**
4	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**56**	**103.2**
4	4	5	3	3	3	4	3	3	3	3	3	3	3	3	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**57**	**104.8**
4	4	5	3	3	3	4	3	3	3	4	3	3	3	3	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**58**	**106.4**
4	4	5	3	4	3	4	3	3	3	4	3	3	3	3	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**59**	**108.0**
4	4	5	3	4	3	4	3	3	3	4	3	3	3	4	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**60**	**109.6**
4	4	5	3	4	3	4	3	4	3	4	3	3	3	4	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**61**	**111.2**
4	4	5	3	4	3	4	3	4	3	4	3	4	3	4	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**62**	**112.8**
4	4	5	3	4	4	4	3	4	3	4	3	4	3	4	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**63**	**114.4**
4	4	5	3	4	4	4	3	4	4	4	3	4	3	4	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**64**	**116.0**
4	4	5	3	4	4	4	3	4	4	4	4	4	3	4	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**65**	**117.6**
4	4	5	3	4	4	4	4	4	4	4	4	4	3	4	3	4	CLOSE	CLOSE	CLOSE	CLOSE		**66**	**119.2**
4	4	5	3	4	4	4	4	4	4	4	4	4	3	4	4	4	CLOSE	CLOSE	CLOSE	CLOSE		**67**	**120.8**
4	4	5	4	4	4	4	4	4	4	4	4	4	3	4	4	4	CLOSE	CLOSE	CLOSE	CLOSE		**68**	**122.4**
4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	CLOSE	CLOSE	CLOSE	CLOSE		**69**	**124.0**
4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**70**	**125.6**
4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**71**	**127.2**
5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**72**	**128.8**
5	5	5	4	4	4	5	4	4	4	4	4	4	4	4	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**73**	**130.4**
5	5	5	4	4	4	5	4	4	4	5	4	4	4	4	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**74**	**132.0**
5	5	5	4	5	4	5	4	4	4	5	4	4	4	4	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**75**	**133.6**

Table MCN-10 Spill Patterns During TSW Removal (# Gate Stops per Spillbay)																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
5	5	5	4	5	4	5	4	4	4	5	4	4	4	5	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**76**	**135.2**
5	5	5	4	5	4	5	4	5	4	5	4	4	4	5	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**77**	**136.8**
5	5	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**78**	**138.4**
5	5	5	4	5	5	5	4	5	4	5	4	5	4	5	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**79**	**140.0**
5	5	5	4	5	5	5	4	5	5	5	4	5	4	5	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**80**	**141.6**
5	5	5	4	5	5	5	4	5	5	5	5	5	4	5	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**81**	**143.2**
5	5	5	4	5	5	5	5	5	5	5	5	5	4	5	4	5	CLOSE	CLOSE	CLOSE	CLOSE		**82**	**144.8**
5	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	5	CLOSE	CLOSE	CLOSE	CLOSE		**83**	**146.4**
5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	CLOSE	CLOSE	CLOSE	CLOSE		**84**	**148.0**
5	5	6	5	5	5	5	5	5	5	5	5	5	4	5	5	5	CLOSE	CLOSE	CLOSE	CLOSE		**85**	**149.6**
5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	CLOSE	CLOSE	CLOSE	CLOSE		**86**	**151.2**
5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**87**	**152.8**
5	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**88**	**154.4**
6	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**89**	**156.0**
6	6	6	5	5	5	6	5	5	5	5	5	5	5	5	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**90**	**157.6**
6	6	6	5	5	5	6	5	5	5	6	5	5	5	5	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**91**	**159.2**
6	6	6	5	6	5	6	5	5	5	6	5	5	5	5	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**92**	**160.8**
6	6	6	5	6	5	6	5	5	5	6	5	5	5	6	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**93**	**162.4**
6	6	6	5	6	5	6	5	6	5	6	5	5	5	6	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**94**	**164.0**
6	6	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**95**	**165.6**
6	6	6	5	6	6	6	5	6	5	6	5	6	5	6	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**96**	**167.2**
6	6	6	5	6	6	6	5	6	6	6	5	6	5	6	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**97**	**168.8**
6	6	6	5	6	6	6	5	6	6	6	6	6	5	6	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**98**	**170.4**
6	6	6	5	6	6	6	6	6	6	6	6	6	5	6	5	6	CLOSE	CLOSE	CLOSE	CLOSE		**99**	**172.0**
6	6	6	5	6	6	6	6	6	6	6	6	6	5	6	6	6	CLOSE	CLOSE	CLOSE	CLOSE		**100**	**173.6**
6	6	6	6	6	6	6	6	6	6	6	6	6	5	6	6	6	CLOSE	CLOSE	CLOSE	CLOSE		**101**	**175.2**
6	6	7	6	6	6	6	6	6	6	6	6	6	5	6	6	6	CLOSE	CLOSE	CLOSE	CLOSE		**102**	**176.8**
6	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	CLOSE	CLOSE	CLOSE	CLOSE		**103**	**178.4**
6	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**104**	**180.0**
6	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**105**	**181.6**
7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**106**	**183.2**
7	7	7	6	6	6	7	6	6	6	6	6	6	6	6	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**107**	**184.8**
7	7	7	6	6	6	7	6	6	6	7	6	6	6	6	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**108**	**186.4**
7	7	7	6	7	6	7	6	6	6	7	6	6	6	6	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**109**	**188.0**
7	7	7	6	7	6	7	6	6	6	7	6	6	6	7	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**110**	**189.6**
7	7	7	6	7	6	7	6	7	6	7	6	6	6	7	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**111**	**191.2**

Table MCN-10 Spill Patterns During TSW Removal (# Gate Stops per Spillbay)																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
7	7	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**112**	**192.8**
7	7	7	6	7	7	7	6	7	6	7	6	7	6	7	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**113**	**194.4**
7	7	7	6	7	7	7	6	7	7	7	6	7	6	7	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**114**	**196.0**
7	7	7	6	7	7	7	6	7	7	7	7	7	6	7	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**115**	**197.6**
7	7	7	6	7	7	7	7	7	7	7	7	7	6	7	6	7	CLOSE	CLOSE	CLOSE	CLOSE		**116**	**199.2**
7	7	7	6	7	7	7	7	7	7	7	7	7	6	7	7	7	CLOSE	CLOSE	CLOSE	CLOSE		**117**	**200.8**
7	7	7	7	7	7	7	7	7	7	7	7	7	6	7	7	7	CLOSE	CLOSE	CLOSE	CLOSE		**118**	**202.4**
7	7	8	7	7	7	7	7	7	7	7	7	7	6	7	7	7	CLOSE	CLOSE	CLOSE	CLOSE		**119**	**204.1**
7	7	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	CLOSE	CLOSE	CLOSE	CLOSE		**120**	**205.7**
7	7	8	7	7	7	7	7	7	7	7	7	7	7	7	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**121**	**207.4**
7	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**122**	**209.1**
8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**123**	**210.8**
8	8	8	7	7	7	8	7	7	7	7	7	7	7	7	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**124**	**212.5**
8	8	8	7	7	7	8	7	7	7	8	7	7	7	7	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**125**	**214.2**
8	8	8	7	8	7	8	7	7	7	8	7	7	7	7	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**126**	**215.9**
8	8	8	7	8	7	8	7	7	7	8	7	7	7	8	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**127**	**217.6**
8	8	8	7	8	7	8	7	8	7	8	7	7	7	8	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**128**	**219.3**
8	8	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**129**	**221.0**
8	8	8	7	8	8	8	7	8	7	8	7	8	7	8	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**130**	**222.7**
8	8	8	7	8	8	8	7	8	8	8	7	8	7	8	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**131**	**224.4**
8	8	8	7	8	8	8	7	8	8	8	8	8	7	8	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**132**	**226.1**
8	8	8	7	8	8	8	8	8	8	8	8	8	7	8	7	8	CLOSE	CLOSE	CLOSE	CLOSE		**133**	**227.8**
8	8	8	7	8	8	8	8	8	8	8	8	8	7	8	8	8	CLOSE	CLOSE	CLOSE	CLOSE		**134**	**229.5**
8	8	8	8	8	8	8	8	8	8	8	8	8	7	8	8	8	CLOSE	CLOSE	CLOSE	CLOSE		**135**	**231.2**
8	8	9	8	8	8	8	8	8	8	8	8	8	7	8	8	8	CLOSE	CLOSE	CLOSE	CLOSE		**136**	**232.8**
8	8	9	8	8	8	8	8	8	8	8	8	8	8	8	8	8	CLOSE	CLOSE	CLOSE	CLOSE		**137**	**234.5**
8	8	9	8	8	8	8	8	8	8	8	8	8	8	8	8	9	CLOSE	CLOSE	CLOSE	CLOSE		**138**	**236.1**
8	9	9	8	8	8	8	8	8	8	8	8	8	8	8	8	9	CLOSE	CLOSE	CLOSE	CLOSE		**139**	**237.7**
9	9	9	8	8	8	8	8	8	8	8	8	8	8	8	8	9	CLOSE	CLOSE	CLOSE	CLOSE		**140**	**239.3**
9	9	9	8	8	8	8	8	8	8	8	8	8	8	8	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**141**	**240.9**
9	9	9	8	8	8	8	8	8	8	8	8	8	8	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**142**	**242.5**
9	9	9	8	8	8	8	8	8	8	8	8	8	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**143**	**244.1**
9	9	9	9	8	8	8	8	8	8	8	8	8	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**144**	**245.7**
9	9	9	9	8	8	8	8	8	8	8	8	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**145**	**247.3**
9	9	9	9	9	8	8	8	8	8	8	8	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**146**	**248.9**
9	9	9	9	9	8	8	8	8	8	8	9	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**147**	**250.5**

Table MCN-10 Spill Patterns During TSW Removal (# Gate Stops per Spillbay)																						Total Stops	Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22 [b]	(#)	(kcfs)
9	9	9	9	9	9	8	8	8	8	8	9	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**148**	**252.1**
9	9	9	9	9	9	9	8	8	8	8	9	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**149**	**253.7**
9	9	9	9	9	9	9	8	8	8	9	9	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**150**	**255.3**
9	9	9	9	9	9	9	9	8	8	9	9	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**151**	**256.9**
9	9	9	9	9	9	9	9	8	9	9	9	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**152**	**258.5**
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**153**	**260.1**
10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	CLOSE	CLOSE	CLOSE	CLOSE		**154**	**261.7**
10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	10	CLOSE	CLOSE	CLOSE	CLOSE		**155**	**263.3**
10	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	10	CLOSE	CLOSE	CLOSE	CLOSE		**156**	**264.9**
10	10	9	9	9	9	9	9	9	9	9	9	9	9	9	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**157**	**266.5**
10	10	10	9	9	9	9	9	9	9	9	9	9	9	9	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**158**	**268.1**
10	10	10	9	9	9	9	9	9	9	9	9	9	9	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**159**	**269.7**
10	10	10	10	9	9	9	9	9	9	9	9	9	9	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**160**	**271.3**
10	10	10	10	9	9	9	9	9	9	9	9	9	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**161**	**272.9**
10	10	10	10	10	9	9	9	9	9	9	9	9	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**162**	**274.5**
10	10	10	10	10	9	9	9	9	9	9	9	10	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**163**	**276.1**
10	10	10	10	10	10	9	9	9	9	9	9	10	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**164**	**277.7**
10	10	10	10	10	10	9	9	9	9	9	10	10	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**165**	**279.3**
10	10	10	10	10	10	10	9	9	9	9	10	10	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**166**	**280.9**
10	10	10	10	10	10	10	9	9	9	10	10	10	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**167**	**282.5**
10	10	10	10	10	10	10	10	9	9	10	10	10	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**168**	**284.1**
10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**169**	**285.7**
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**170**	**287.3**
11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	CLOSE	CLOSE	CLOSE	CLOSE		**171**	**288.8**
11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	11	CLOSE	CLOSE	CLOSE	CLOSE		**172**	**290.3**
11	11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	11	CLOSE	CLOSE	CLOSE	CLOSE		**173**	**291.8**
11	11	10	10	10	10	10	10	10	10	10	10	10	10	10	11	11	CLOSE	CLOSE	CLOSE	CLOSE		**174**	**293.3**
11	11	11	10	10	10	10	10	10	10	10	10	10	10	10	11	11	CLOSE	CLOSE	CLOSE	CLOSE		**175**	**294.8**
11	11	11	10	10	10	10	10	10	10	10	10	10	10	11	11	11	CLOSE	CLOSE	CLOSE	CLOSE		**176**	**296.3**
11	11	11	11	10	10	10	10	10	10	10	10	10	10	11	11	11	CLOSE	CLOSE	CLOSE	CLOSE		**177**	**297.8**
11	11	11	11	10	10	10	10	10	10	10	10	10	11	11	11	11	CLOSE	CLOSE	CLOSE	CLOSE		**178**	**299.3**
11	11	11	11	11	10	10	10	10	10	10	10	10	11	11	11	11	CLOSE	CLOSE	CLOSE	CLOSE		**179**	**300.8**

Table MCN-11. McNary Dam MICRO/MACRO Spill Patterns with Bays 2, 6, and 16 Locked at 4 or 6 Stops - see section 2.2.1.1 for more information (added July 2022). [a] [b]

APRIL Micro/Macro Spill Patterns w/ TSWs:

APRIL Micro/Macro Spill Patterns with TSWs (# Gate Stops per Spillbay). Bays 2, 6, and 16 locked at 4 or 6 stops (manually adjusted)																						Total Stops	Total Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
2	4		2	2			2	1	2		2	2		2	4	2	2	TSW	TSW	2		**31**	**78.5**
2	4	3	2	2		3	2	1	2	3	2	2		2	4	2	2	TSW	TSW	2	3	**43**	**100.9**
2	4	6	2	2		6	2	1	2	6	2	2		2	4	2	2	TSW	TSW	2	6	**55**	**120.1**
3	4	0	3	3	6	0	3	3	3	0	3	3	3	3	4	3	4	TSW	TSW	4	0	**55**	**120.0**
3	4	3	3	3	6	3	3	3	3	3	3	3	3	3	4	3	4	TSW	TSW	4	3	**67**	**142.4**
3	4	6	3	3	6	6	3	3	3	6	3	3	3	3	4	3	4	TSW	TSW	4	6	**79**	**161.6**
4	4	2	4	5	6	2	4	5	5	1	5	4	5	4	4	4	5	TSW	TSW	5	2	**80**	**162.5**
4	4	5	4	5	6	5	4	5	5	4	5	4	5	4	4	4	5	TSW	TSW	5	5	**92**	**182.4**
4	4	8	4	5	6	8	4	5	5	7	5	4	5	4	4	4	5	TSW	TSW	5	8	**104**	**201.9**
6	4	3	6	6	6	3	6	6	6	2	6	6	6	6	6	6	6	TSW	TSW	6	3	**105**	**203.1**
6	4	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6	6	TSW	TSW	6	6	**117**	**222.4**
6	4	9	6	6	6	9	6	6	6	8	6	6	6	6	6	6	6	TSW	TSW	6	9	**129**	**242.0**
7	6	5	8	7	6	4	7	7	7	4	7	7	7	7	6	8	8	TSW	TSW	8	4	**130**	**243.6**
7	6	8	8	7	6	7	7	7	7	7	7	7	7	7	6	8	8	TSW	TSW	8	7	**142**	**262.9**
7	6	11	8	7	6	10	7	7	7	10	7	7	7	7	6	8	8	TSW	TSW	8	10	**154**	**282.3**

[a] Spill (kcfs) is calculated as a function of total stops + TSW spill at forebay elevation 339 ft.
[b] Bays 19-20 with TSWs = ~19.2 kcfs spill (~9.6 kcfs/bay) at forebay 339'. Raise tainter gates ~3-5 ft above water surface to ensure free flow through the TSWs.

MAY Micro/Macro Spill Patterns w/ TSWs:

MAY Micro/Macro Spill Patterns with TSWs (# Gate Stops per Spillbay). Bays 2, 6, and 16 locked at 4 or 6 stops (manually adjusted)																						Total Stops	Total Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
2	4	2		2		3	2	1		2	2	1		2	4		2	TSW	TSW	2		**31**	**78.5**
2	4	2	3	2		3	2	1	3	2	2	1	3	2	4	3	2	TSW	TSW	2		**43**	**100.7**
2	4	2	6	2		3	2	1	6	2	2	1	6	2	4	6	2	TSW	TSW	2		**55**	**120.1**
3	4	3	0	3	6	3	3	3	0	3	3	3	0	3	4	0	4	TSW	TSW	4	3	**55**	**120.0**
3	4	3	3	3	6	3	3	3	3	3	3	3	3	3	4	3	4	TSW	TSW	4	3	**67**	**142.4**
3	4	3	6	3	6	3	3	3	6	3	3	3	6	3	4	6	4	TSW	TSW	4	3	**79**	**161.6**
4	4	5	1	5	6	5	4	5	2	4	5	4	2	4	4	1	5	TSW	TSW	5	5	**80**	**162.5**
4	4	5	4	5	6	5	4	5	5	4	5	4	5	4	4	4	5	TSW	TSW	5	5	**92**	**182.4**
4	4	5	7	5	6	5	4	5	8	4	5	4	8	4	4	7	5	TSW	TSW	5	5	**104**	**201.9**
6	4	6	3	6	6	6	6	6	3	5	6	6	3	6	6	3	6	TSW	TSW	6	6	**105**	**203.1**
6	4	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6	6	TSW	TSW	6	6	**117**	**222.4**
6	4	6	9	6	6	6	6	6	9	5	6	6	9	6	6	9	6	TSW	TSW	6	6	**129**	**242.0**
7	6	8	5	7	6	7	7	7	4	7	7	7	4	7	6	5	8	TSW	TSW	8	7	**130**	**243.6**
7	6	8	8	7	6	7	7	7	7	7	7	7	7	7	6	8	8	TSW	TSW	8	7	**142**	**262.9**
7	6	8	11	7	6	7	7	7	10	7	7	7	10	7	6	11	8	TSW	TSW	8	7	**154**	**282.3**

JUNE Micro/Macro Spill Patterns w/ TSWs:

JUNE Micro/Macro Spill Patterns with TSWs (# Gate Stops per Spillbay). Bays 2, 6, and 16 locked at 4 or 6 stops (manually adjusted)																						Total Stops	Total Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
2	4	2	2			2	2		2	1		2		2	4	2		TSW	TSW	2	2	**31**	**78.5**
2	4	2	2	3		2	2	3	2	1	3	2		2	4	2	3	TSW	TSW	2	2	**43**	**100.7**
2	4	2	2	6		2	2	6	2	1	6	2		2	4	2	6	TSW	TSW	2	2	**55**	**120.1**
3	4	3	3	0	6	3	3	0	3	3	0	3	3	3	4	3	1	TSW	TSW	4	3	**55**	**120.0**
3	4	3	3	3	6	3	3	3	3	3	3	3	3	3	4	3	4	TSW	TSW	4	3	**67**	**142.4**
3	4	3	3	6	6	3	3	6	3	3	6	3	3	3	4	3	7	TSW	TSW	4	3	**79**	**161.6**
4	4	5	4	2	6	5	4	2	5	4	2	4	5	4	4	4	2	TSW	TSW	5	5	**80**	**162.5**
4	4	5	4	5	6	5	4	5	5	4	5	4	5	4	4	4	5	TSW	TSW	5	5	**92**	**182.4**
4	4	5	4	8	6	5	4	8	5	4	8	4	5	4	4	4	8	TSW	TSW	5	5	**104**	**201.9**
6	4	6	6	3	6	6	6	3	6	5	3	6	6	6	6	6	3	TSW	TSW	6	6	**105**	**203.1**
6	4	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6	6	TSW	TSW	6	6	**117**	**222.4**
6	4	6	6	9	6	6	6	9	6	5	9	6	6	6	6	6	9	TSW	TSW	6	6	**129**	**242.0**
7	6	8	8	4	6	7	7	4	7	7	4	7	7	7	6	8	5	TSW	TSW	8	7	**130**	**243.6**
7	6	8	8	7	6	7	7	7	7	7	7	7	7	7	6	8	8	TSW	TSW	8	7	**142**	**262.9**
7	6	8	8	10	6	7	7	10	7	7	10	7	7	7	6	8	11	TSW	TSW	8	7	**154**	**282.3**

Micro/Macro Spill Patterns w/ NO TSWs (after TSW removal):

Micro/Macro Spill Patterns with NO TSWs (# Gate Stops per Spillbay). Bays 2, 6, and 16 locked at 3 or 5 stops																						Total Stops	Total Spill [a]
1 [b]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 [c]	20 [c]	21	22 [b]	(#)	(kcfs)
3	5		2		3	2		2		2	2		3	2	3	2		3		2		**36**	**68.0**
3	5	1	2		3	2	1	2		2	2	1	3	2	3	2		3	1	2		**40**	**76.0**
3	5	2	2		3	2	2	2		2	2	2	3	2	3	2		3	2	2		**44**	**83.6**
3	5	3	2		3	2	3	2		2	2	3	3	2	3	2		3	3	2		**48**	**90.4**
3	5	4	2		3	2	4	2		2	2	4	3	2	3	2		3	4	2		**52**	**96.8**
4	5	2	2	3	3	3	0	3	2	2	3	0	3	3	3	3	2	3	0	3	2	**54**	**101.0**
4	5	3	2	3	3	3	1	3	2	2	3	1	3	3	3	3	2	3	1	3	2	**58**	**108.7**
4	5	4	2	3	3	3	2	3	2	2	3	2	3	3	3	3	2	3	2	3	2	**62**	**116.0**
4	5	5	2	3	3	3	3	3	2	2	3	3	3	3	3	3	2	3	3	3	2	**66**	**122.7**
4	5	6	2	3	3	3	4	3	2	2	3	4	3	3	3	3	2	3	4	3	2	**70**	**129.1**
4	5	3	4	3	3	4	2	4	3	3	4	2	3	3	3	4	3	4	2	3	3	**72**	**132.5**
4	5	4	4	3	3	4	3	4	3	3	4	3	3	3	3	4	3	4	3	3	3	**76**	**139.2**
4	5	5	4	3	3	4	4	4	3	3	4	4	3	3	3	4	3	4	4	3	3	**80**	**145.6**
4	5	6	4	3	3	4	5	4	3	3	4	5	3	3	3	4	3	4	5	3	3	**84**	**152.0**
4	5	7	4	3	3	4	6	4	3	3	4	6	3	3	3	4	3	4	6	3	3	**88**	**158.4**