PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
2023 Germination Suppression Flow Release Implementation Plan

INTRODUCTION

In 2007, the Platte River Recovery Implementation Program (Program or PRRIP) began its 13-year First Increment and implementation of an Adaptive Management Plan (AMP) to learn more about the physical processes of the central Platte River and the response of four target species to management actions: interior least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), whooping crane (*Grus americana*), and pallid sturgeon (*Scaphirhynchus albus*). In 2020 the Program began a 13-year Extension of the First Increment to provide additional time to complete and operate Program water projects and to conduct the monitoring and research necessary to determine the best use of Program water to benefit the target species (PRRIP 2021a).

The Program is committed to achieving the minimum water milestone of 130,000 acre-feet in annual reductions to target flow shortages. However:

- The Program recognizes there are fiscal constraints to achieving this milestone, and
- Scientific investigations need to be completed to confirm the need for 130,000 acre-feet in annual reductions to target flow shortages.

The Program will invest the resources available to achieve at least 120,000 acre-feet in annual reductions to target flow shortages as quickly as possible during the Extension and will also invest in the science necessary to determine if the additional 10,000 acre-feet is justified. The Program is committed to finding the additional resources necessary to achieve that additional 10,000 acre-feet if justified by the science. Extension Water Plan activities will proceed under the same principles that have guided water supply and management since Program initiation. Water acquisition will proceed under a willing buyer/willing seller approach and all water management activities will be conducted in accordance with the Program's Good Neighbor Policy (PRRIP 2021b).

The Program's original AMP was updated in 2022 as an Extension Science Plan (PRRIP 2022a) providing a concise and practical roadmap of Program science priorities during the Extension. The Extension Science Plan includes protocols for monitoring target species, habitat, and physical processes as well as plans for data analysis and synthesis to better understand interrelationships and provide information for evaluating habitat and species response to management actions. This document serves as the implementation plan for conducting germination suppression flow release for the Program.

Whooping crane roosting along the central Platte River is dependent upon wide, shallow river channels unobstructed by tall, dense vegetation. Flow releases to inundate the active channel early in the growing season have been designed to test the effectiveness of using Program water to suppress germination of problematic perennial species like cottonwoods (*Populus* spp.) and willows (*Salix* spp.), and to attempt to slow encroachment of *Phragmites australis* into the channel. Information collected during the implementation of germination suppression flow releases is used to evaluate the biological response of riparian vegetation to the inundation of the channel and the effectiveness of these releases in maintaining wide unobstructed channel widths for whooping crane roosting. Several critical scientific and technical uncertainties about physical processes and the response of the target species to management actions will be the focus of the application of rigorous adaptive management in the First Increment Extension through implementation of the Program's Extension Science Plan. These uncertainties are captured in statements of broad hypotheses in Table 1 on pages 8-9 of the Extension Science Plan and, as a means of better linking science learning to Program decision-making, those uncertainties comprise a set of "Extension Big Questions" that provide a template for linking specific hypotheses and performance measures to management objectives and overall Program goals (see PRRIP 2020).

Two Extension "Big Questions" (EBQs) relate directly to measuring vegetation response to germination suppression flow releases:

- ***EBQ #1*** **–** How effective is it to use Program water to maintain suitable whooping crane roosting habitat?
- ***EBQ #2*** **–** How effective is Program management of *Phragmites* for maintaining suitable whooping crane roosting habitat?

Implementation of germination suppression flow releases to address these questions provides valuable information on the quantity of Program water necessary for effective channel maintenance while providing information on the cost and benefits of a water alternative for maintaining suitable roosting and in-channel foraging habitat for whooping cranes.

To assess progress toward this objective and gather information to reduce remaining uncertainties during the Extension, several finer-scale priority management hypotheses were developed by Program participants to receive focused attention. For management of in-channel vegetation, those priority hypotheses are:

- ***EBQ #1*** Management Hypothesis: Releases to achieve a 30-day minimum flow target of 1,500 cfs between June 1 – July 15 will suppress germination, slow vegetation expansion into the channel, and increase the percent of AHR channel that remains highly suitable for whooping crane roosting (germination suppression release).
- ***EBQ #2*** Management Hypothesis: Releases to achieve a 30-day minimum flow target of 1,500 cfs between June 1 – July 15 in combination with continued herbicide spraying will slow *Phragmites* rhizome/stolon expansion into the channel and increase the percent of AHR channel that remains highly suitable for whooping crane roosting.

PURPOSE

This plan is intended to provide standard implementation guidance for planning, coordinating, and implementing germination suppression flow releases. The implementation plan describes the conceptual design, tools, and procedures that are used annually to plan for and implement a 30-day minimum flow target of 1,500 cfs at Grand Island between June 1 – July 15. The plan outlines information the Program's Executive Director's Office staff collect during implementation, as well as data collected and used by the United States Fish and Wildlife Service (USFWS), Central Nebraska Public Power and Irrigation District (CNPPID), and Nebraska Public Power District (NPPD) to make decisions during implementation and adjust the release accordingly.

DESIGN CONSIDERATIONS AND SPECIFICATIONS

Area of Interest

The germination suppression flow release encompasses a span of about 200 miles from its origin in the Lake McConaughy Environmental Account (EA) to a terminal flow measurement of the Platte River near Grand Island (06770500). This project area encompasses most of the Program's AHR between Lexington and Chapman, Nebraska. The Program's Environmental Account (EA) water can be routed through canal systems operated by NPPD and CNPPID for hydropower generation but must be returned to the river in its entirety, minus any appropriate transit losses.

If capacity is available, EA water is preferentially routed through the NPPD Sutherland Canal system. Water routed through NPPD system is returned to the South Platte River via the Sutherland Power Return at North Platte. If the Sutherland Canal is full (around 1,700 cfs) or the desired EA release exceeds acceptable ramping rates, additional EA water can be routed down the North Platte River channel. This water is subject to capacity constraints through the North Platte chokepoint reach which extends a few miles upstream and downstream of the North Platte River at North Platte (06693000) gage and the adjacent Highway 83 bridge. The current

rating curve employed by the Nebraska Department of Natural Resources (DNR) for the North Platte River at North Platte gage shows a discharge capacity of 1,930 cfs at the National Weather Service (NWS) 6.0 ft minor flood stage. However, from July 2020 to November 2022, the average shift-adjusted capacity at the North Platte gage was only 1,770 cfs (based on 29 flow measurements).

EA water routed through the NPPD system and the North Platte River channel is reunited at the confluence of the North Platte and South Platte rivers. Most of this EA water is then re-diverted into the CNPPID Tri-County Supply Canal system. Any flow in excess of the canal capacity (about 2,250 cfs) is routed down the parallel Platte River channel that passes by gages Maxwell, Brady, Cozad, and Darr. EA water routed through the CNPPID system is released back to the south channel of the Platte River at the J-2 Return between Lexington and Overton. The river channels come back together just upstream of the Overton bridge, and EA water continues to flow downstream in the Platte River past Kearney, Grand Island, and beyond.

Although the germination suppression flow release aims to achieve a 1,500 cfs flow at the Grand Island stream gage, the "work" of the flow release will be assessed based on the extent to which vegetation establishment and encroachment is minimized throughout the entire 90 miles of the AHR from Lexington to Chapman. **Figure 1** illustrates the locations of the Lake McConaughy EA, the North Platte chokepoint, and the AHR. United States Geological Survey (USGS) Platte River stream gages located in the upper (Overton) (USGS 2023a), middle (Kearney) (USGS 2023b) and lower (Grand Island) (USGS 2023c) portions of the AHR are used to monitor flow release implementation.

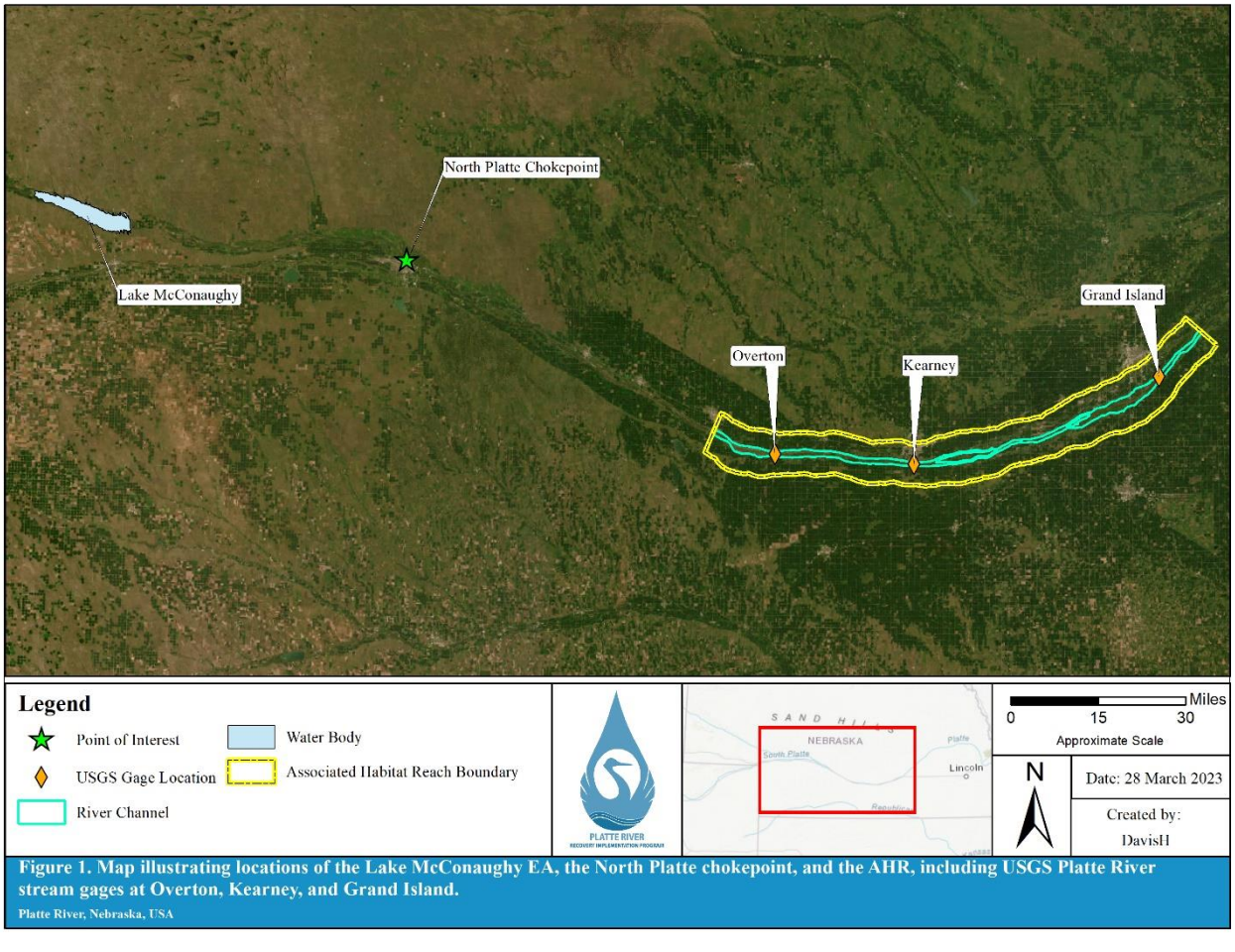

Figure 1. Map illustrating locations of the Lake McConaughy EA, the North Platte chokepoint, and the AHR, including USGS Platte River stream gages at Overton, Kearney, and Grand Island.
Platte River, Nebraska, USA

Project Design

The germination suppression flow release is not "designed" in a conventional sense. As described above, the release is intended to achieve a flow of 1,500 cfs at Grand Island for 30 days between June 1 and July 15[1]. Other than those defined objectives, project planning consists of real-time decision making in consideration of the variables described in the next section.

Variables Considered

Variables important to decision-making during the germination suppression flow release include measured flow at the Grand Island gage, flow deficit at Grand Island relative to the 1,500 cfs target, anticipated transit losses, available carriage capacity in the NPPD Sutherland Canal and CNPPID Tri-County Supply Canal systems, and available capacity through the North Platte chokepoint while remaining below the current shift-adjusted discharge at minor flood stage. Appropriate ramp up/ramp down rates must be employed to avoid damages to canal infrastructure.

Downstream irrigation demands must also be considered. As long as water released from the Lake McConaughy EA is present in the North Platte River, flows at the North Platte chokepoint cannot exceed the 6.0 minor flood stage established by the National Weather Service (NWS). This is a matter of both Program policy and the terms of CNPPID's 1998 FERC license for the operation of the Kingsley Dam Project. If an EA release is ongoing, and the NPPD Sutherland Canal and North Platte chokepoint are already at or near capacity, an increase in irrigation demand necessarily requires reduction of the EA release to allow for the additional irrigation water needed.

The timing of the germination suppression flow release coincides with the typical peak of convective thunderstorm activity in central Nebraska, so weather forecasts play an important role in the decision-making process. This is particularly important if thunderstorm activity is predicted to occur in the North Platte River drainage between Lake McConaughy and the City of North Platte, a situation which could potentially lead to flows at North Platte exceeding flood stage. Heavy precipitation can lead to rapid changes in both river flows and irrigation demands.

Timing

The germination suppression flow release is intended to occur such that water from the release is observed at Grand Island for 30 days between June 1 and July 15. Water released from the Lake McConaughy EA on day 1 reaches Grand Island on day 8. Irrigation demand has been ramping up significantly around the third weekend in June. Given that this can result in constraints on capacity available to deliver EA water to the AHR, it is preferred to start the EA release early as possible. In order for EA water to reach Grand Island on June 1, the EA release must begin no later than May 25. If the last of the germination suppression flow release is to pass through Grand Island on July 1, the release should be terminated on June 24. There may be some adjustment to the start end dates to maximize flow at Grand Island over 30 days while accomodating release ramp up and ramp down.

[1]Note that the 1,500 cfs flow target for germination suppression is independent of other U.S. Fish and Wildlife Service (USFWS) target flows that were defined for species and habitat benefits and may range from 800 cfs to 3,400 cfs from June 1-July 15 depending on whether the real-time hydrologic condition designation is wet, normal, or dry.

Coordination

Releases from the Lake McConaughy EA are overseen by the USFWS EA Manager and staff in coordination with CNPPID and Program EDO staff. Other parties involved in the release coordination include NPPD and the Nebraska DNR. Coordination conference calls are typically held twice weekly during the flow release, on Mondays and Thursdays. Flow release coordination involves planning for adjustments to compensate for weather, irrigation demand, river channel/canal carriage capacity, and other factors.

Data Collection

Streamflow and canal diversions are the primary parameters for which data is collected during the germination suppression flow release. The release is targeting a flow of 1,500 cfs at Grand Island, which is measured at the Grand Island gage. Nebraska DNR tracks EA water through the system using its Platte Water Accounting Program (PWAP). This tracking includes the amount of EA water and total flow at each gage along the North Platte River downstream of Lake McConaughy and the central Platte River, as well as diversions into and returns from both the NPPD Sutherland Canal and CNPPID Tri-County Supply Canal systems.

FLOW RELEASE SUMMARIES

Table 1 summarizes key information from germination suppression flow releases in 2020, 2021, and 2022. The flow target for the release was originally 2,000 cfs at Grand Island in 2020 and 2021, but that flow was rarely achieved. Given the revision of the flow target to 1,500 cfs for 2022 and subsequent years, those early years are evaluated in the context of achieving 1,500 cfs flows at Grand Island.

Table 1. Summary data for germination suppression flow releases implemented from 2020-2022.

Year	Lake McConaughy EA Release		Grand Island Flow		
	Volume (AF)	**Average Release (cfs)**	**Volume EA Water (AF)**	**Average Flow (cfs)**	**# Days > 1,500 cfs**
2020	29,036	457	18,538 (64%)	1,269	11*
2021	57,880	912	42,670 (74%)	1,602	26
2022	79,359	1,291	58,805 (74%)	1,474	16

*****The germination suppression flow release began June 11 and reached Grand Island on June 18. From June 18-28 there were 11 days with flow > 1,500 cfs (and none after), but if the period starting June 1 is included, there were 28 consecutive days with flow > 1,500 cfs in 2020.

2020

The USFWS made an EA release for channel maintenance and other purposes between April 29 and June 2, which put EA water at Grand Island from May 6 to June 9. Flow at Grand Island peaked at 9,310 cfs on May 26 and was on a downward trajectory into early June. On June 11, the USFWS initiated another EA release specifically for the purpose of germination suppression. This EA release continued into July, and on July 13 the purpose of the ongoing EA release was changed to support the North Platte chokepoint flow test.

If only the EA release from June 11-July 12 is considered, a total EA volume of 29,036 AF was released at an average rate of 457 cfs. EA water totaling 18,538 AF (64% of the release) reached Grand Island from June 18-July 19. The average Grand Island flow during this period was 1,269 cfs, with 11 days having flow above

1,500 cfs.

However, if the entire period starting June 1 is considered, including the early June days when the last of the channel maintenance EA release was passing through Grand Island, there were actually 28 consecutive days with flow above 1,500 cfs, from June 1-June 28. Average flow during this period was 2,061 cfs, although that is clearly skewed by the highest flows at the beginning of June. **Figure 2** illustrates the 2020 EA release for germination suppression and resulting Grand Island flows. The vertical black lines mark June 1 and July 15.

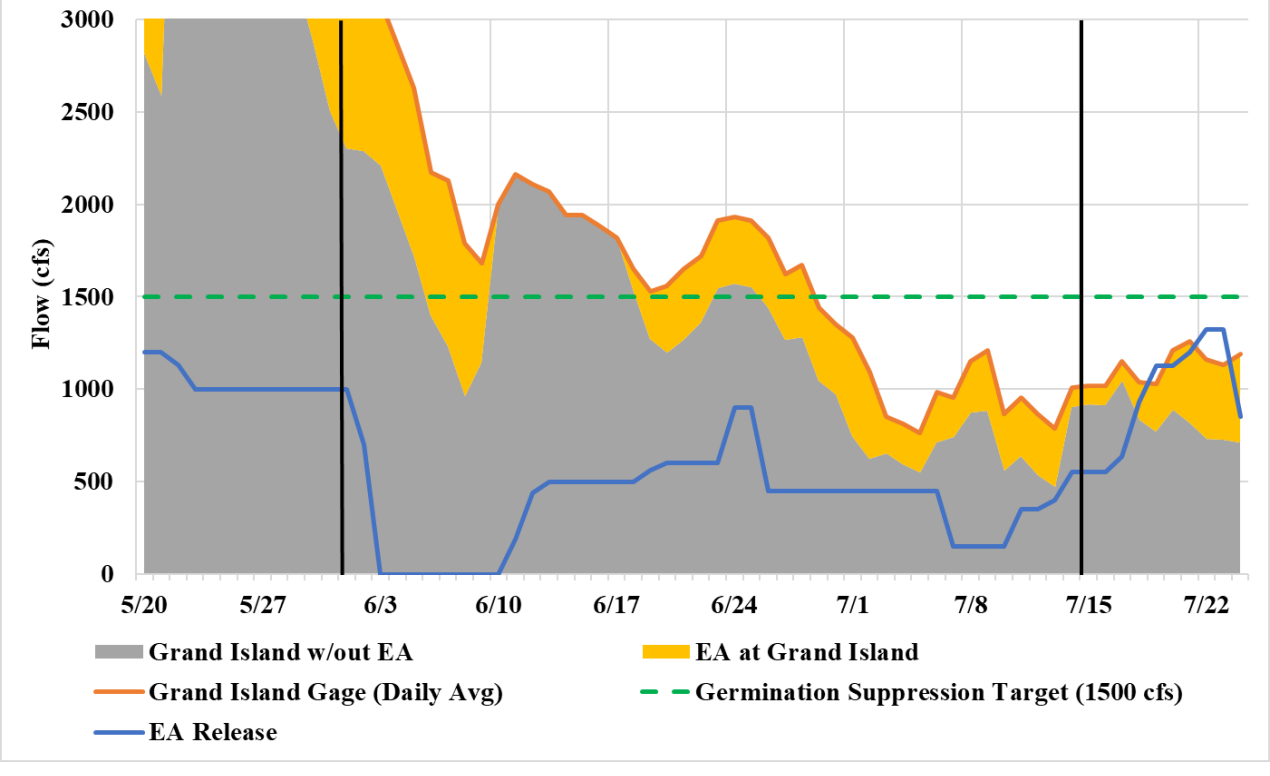

Figure 2. 2020 germination suppression flow release.

2021

The 2021 EA release for germination suppression began on May 24 but was quickly halted due to forecast precipitation over the Memorial Day weekend. The EA release resumed on June 2 and continued until July 2. A total volume of 57,880 AF was released from the Lake McConaughy EA at an average rate of 912 cfs. EA water reaching Grand Island totaled 42,670 AF (74% of total release) on May 31 and from June 9-July 9.

The average flow at Grand Island between the May 31 and July 9 (including 8 days from June 1-8 with no EA water) was 1,602 cfs, with 26 days (not all consecutive) having flows greater than 1,500 cfs. **Figure 3** illustrates the 2021 germination suppression flow release.

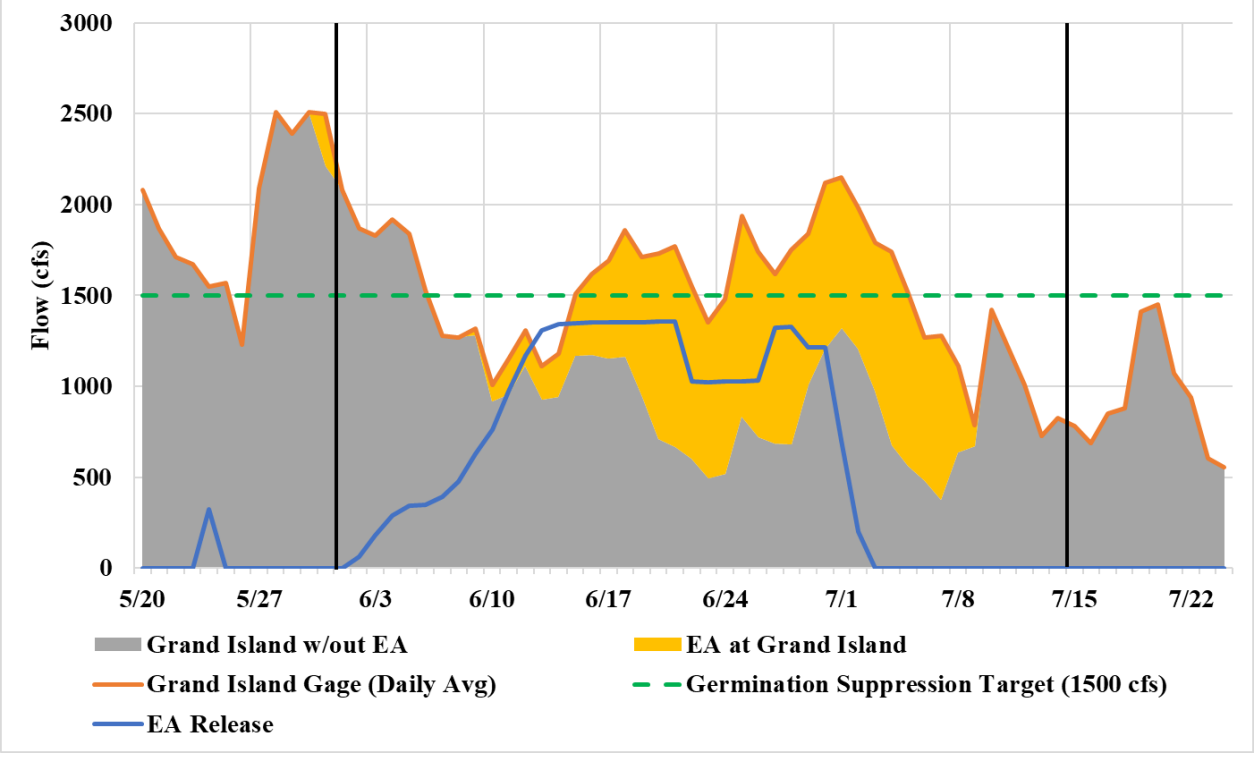

Figure 3. 2021 germination suppression flow release.

2022

The 2022 EA release for germination suppression began on May 25 and concluded on June 24. A total volume of 79,359 AF was released from the Lake McConaughy EA at an average rate of 1,291 cfs. EA water reaching Grand Island totaled 58,805 (74% of total release) from June 1-July 1. Average flow at Grand Island during this period was 1,474 cfs, with 16 days having flows greater than 1,500 cfs and a thunderstorm-aided peak daily average flow of 2,410 cfs on June 8. **Figure 4** illustrates the 2022 germination suppression flow release.

After initial ramp up, the NPPD Sutherland Canal operated at or near capacity for most of the germination suppression flow release. About 51% of the released EA water was routed through the NPPD system, and the other 49% was routed down the North Platte River. The shift-adjusted discharge capacity at the North Platte chokepoint was 1,660 cfs after Nebraska DNR made a flow measurement on May 19 and 1,710 cfs after a measurement on June 15. Additionally, USFWS requested to impose a 200 cfs flow buffer at the North Platte chokepoint. This effectively resulted in a 1,500 cfs flow limit through the chokepoint reach in mid- to late-June, but actual flow never exceeded 1,400 cfs during the germination suppression flow release.

Rapid intensification of irrigation demand around the 3rd weekend in June resulted in downward adjustments to the EA release back to June 14. EA release rates were reduced more quickly than planned because of high irrigation demand and capacity constraints below flood stage at the North Platte chokepoint.

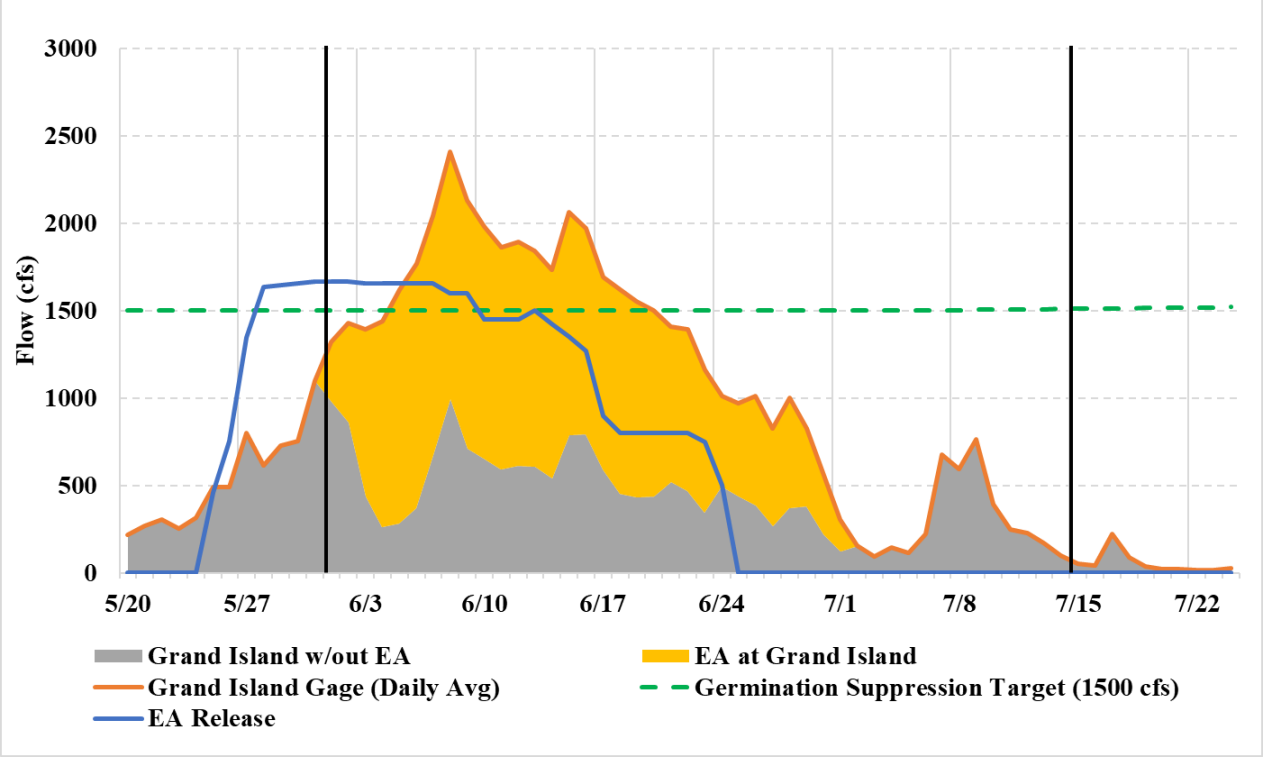

Figure 4. 2022 germination suppression flow release.

MONITORING

Information collected during and following the implementation of germination suppression flow releases is used to assess the amount of water coverage achieved by the release and the subsequent response of riparian vegetation.

Implementation Monitoring

Flow release implementation is monitored via a system of Platte River stream gages located in the upper (Overton) (USGS 2023a), middle (Kearney) (USGS 2023b) and lower (Grand Island) (USGS 2023c) portions of the AHR (**Figure 1**). All three gages are administered/maintained by the USGS and provide stage measurements (and associated discharges derived from rating curves) at a 15-minute interval. Data are accessible in real time with frequent physical measurements to calibrate rating curves.

Effectiveness Monitoring

Data collected during and following releases will be used to compile multiple lines of evidence for evaluating effectiveness and develop Structured Decision-Making (SDM) tools The system-scale geomorphology and vegetation monitoring protocol (PRRIP 2022b) will be the principal tool to monitor the effectiveness of germination suppression releases.

- Channel Inundation – Reach-wide 2-D hydrodynamic models have been developed and are updated annually using fall topo-bathymetric LiDAR. These models are grid-based and 1) distribute flow between channels in split-flow reaches and 2) estimate river stage/inundation depth as well as flow velocity, shear stress and other flow-dependent hydraulic metrics. This tool provides information on the timing and duration of water coverage resulting from flow releases across the AHR.
- Mechanical Management Actions – Activities like *Phragmites* spraying, disking, and in-channel tree clearing may confound assessments of effectiveness. The temporal and spatial extent of each of these activities is documented annually.

- In-Channel Vegetation – Fall color-infrared (CIR) imagery is used in tandem with concurrently collected LiDAR data (vegetation height raster) to conduct a supervised classification of in-channel land cover. This includes areas of bare sand and water as well as vegetation height classes ranging from short (<2.0 ft) up to mature forest. This tool is capable of classifying vegetation structure – not composition. First Increment monitoring focused heavily on composition and that data was generally found to be unhelpful in system-scale analyses.
- Unobstructed Channel Width – Supervised classification is processed into metrics found to be good predictors of whooping crane roost site selection – specifically channel width unobstructed by tall dense vegetation and unforested width.

Other Lines of Evidence

- Vegetation State-Change Evaluation – A grid-based analysis of the relationship between inundation (2-D model/June aerial imagery) and in-channel vegetation state (inundated, unvegetated, vegetated) will be conducted on an AHR scale. Discriminate analysis can be used to identify inundation timing, duration, and percentage channel inundated in relation to vegetation states, specifically conditions that lead to a state change. These analyses will also take any mechanical or chemical management into account.
- Timelapse Camera Analysis – Timelapse camera imagery captures channel inundation and vegetation response over the entire growing season at key locations across the AHR.
- Field measurements at *Phragmites* patches – Monthly field measurements at 150 Phragmites patches distributed across three representative reaches capture water surface elevations, patch inundation, and patch expansion rates in response to inundation.

Effectiveness Assessment

Formal assessments of effectiveness (using data above) are scheduled to occur in 2024 & 2028 if needed.

Machine Learning Model

A random forest machine learning model has been developed to utilize historical information gathered for the central Platte about how natural peak flows interact with channel geomorphology over time to affect unobstructed channel width. The model also accounts for mechanical management such as river channel disking and herbicide application to predict future channel conditions (annual changes in maximum unobstructed channel widths) under various flow and mechanical management scenarios. This model will be a primary line of evidence and is expected to be used as a predictive modeling tool during a SDM process for the Second Increment.

The combination of remote sensed and on the ground field measurements enables us to quantify the amount of spatial and temporal water coverage achieved during the flow release, quantify vegetation response to inundation, and estimate subsequent unobstructed channel widths to evaluate the effectiveness of using Program water to maintain wide, unvegetated channels for whooping crane roosting.

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