ASRP MEMORANDUM

Date: January 4, 2024
To: ASRP Steering Committee
From: ASRP Staff, with support provided by informal OSF Workgroup
cc: ASRP Technical Advisory Group (TAG), Technical Review Team (TRT), Regional Implementation Teams (RIT), and other interested parties
Re: ASRP Oregon Spotted Frog (OSF) Restoration Strategy

Oregon Spotted Frog (OSF) and ASRP Priorities: A Review

Background / Purpose & Need

The goal of this document is to provide a Restoration Strategy for the Oregon Spotted Frog (*Rana pretiosa*; OSF) that clearly summarizes to Aquatic Species Restoration Plan (ASRP) decision makers and restoration implementers the restoration and management options for the Chehalis Basin based on the science to-date. The OSF is the rarest amphibian and the only completely aquatic frog in the Pacific Northwest. It is a sensitive and federally threatened species, and the Chehalis Basin's Black River drainage represents the largest remaining of its rather limited populations in Washington State.

The prospects for enhancing Chehalis OSF population numbers and sizes are impacted by logistical constraints as well as biological and physical environmental challenges. Paramount among logistic challenges is that OSF restoration goals require intrinsically longer timelines and repeated actions that do not neatly align with the existing ASRP implementation structure that depends on biennial funding reevaluations. Further, many important gaps exist in our current OSF knowledge that hinder effective, sustainable restoration. One important gap is the historical distribution of OSF in the Chehalis Basin, including within the Black River drainage. A second important gap is around invasive species - particularly predators like American Bullfrogs (*Rana catesbeiana*) and warm water fish as well as tall-emergent plants like reed canary grass (*Phalaris arundinacea*; RCG) - and how to abate these threats over longer time frames beyond annual maintenance and without subsequent impacts to OSF and other co-occurring native species. A third important knowledge gap is how to maintain the appropriate hydrological conditions for OSF year-round and over the long-term. Superimposed on these data gaps is the specter of climate change, of which two important elements - seasonal warming and drying - are likely to exacerbate hydrological and invasive species problems for OSFs.

Currently, restoration actions for OSF are limited until existing approaches are refined or more effective tools are developed. Reducing vegetation height to a low-emergent stature is unambiguously essential to enhancing OSF breeding habitat, but aside from grazing, the only tool currently allowed for use in OSF-occupied habitat to achieve that goal is mowing or haying, which require annual maintenance.

Some herbicides may also reduce tall-stature vegetation with somewhat greater longevity, but these are disallowed for use in OSF habitat in the Chehalis Basin until these have been demonstrated to have no effect on OSF and co-occurring native species (namely, the state-sensitive Olympic mudminnow). Translocating OSF to nearby, presumably suitable but unoccupied habitats may also be an option should there be landowner willingness and appropriate federal permissions. Ongoing research under the ASRP is testing the impacts of herbicides and the potential for translocation.

Central to OSF restoration is monitoring, which is critical for 1) identifying loss (or gain) of individual OSF populations and any changes in population sizes, 2) determining restoration effectiveness, and 3) determining a need for or change in restoration choices. The OSF serves as a cautionary tale for restoration given that its federal status may severely restrict more intensive and potentially long-lived management options, especially once the US Fish and Wildlife Service (USFWS) Draft Recovery Plan has been finalized. Given this kind of challenging restoration landscape, certain knowledge gaps are particularly beneficial to address, including: 1) testing tools that allow for greater longevity in maintaining low-vegetation structure and minimal potential effects on non-target species, 2) modeling the likely historical distribution of OSF, and 3) modeling surface water and groundwater hydrology to understand the effects of drought versus wet years within a background of changes in human groundwater withdrawal and climate change.

ASRP and Process-Based Restoration (PBR)

Project proposals aimed at providing habitat uplift for OSF differ in important ways from other project proposals that come through ASRP for funding, which has posed challenges during review. The goal of this memo is to present a summary of available and relevant information and recommendations to the ASRP Steering Committee, Technical Advisory Group (TAG), Technical Review Team (TRT), and others, in time to inform 2023-25 biennium habitat protection and restoration efforts for OSF.

Some of the challenges to-date associated with evaluating OSF-focused project proposals for alignment with ASRP priorities stems from the programmatic emphasis on process-based restoration (PBR). Unfortunately, the implementation of PBR methods has its limitations, and these manifest upon an in-depth investigation of OSF habitats, threats, and tradeoffs associated with options for addressing existing needs. Most importantly, PBR methods rely on functioning processes to restore aquatic habitats. The ASRP and other existing Pacific Northwest habitat restoration programs are largely built around salmon as indicator and target species, so our understanding of the range of hydrogeological and geomorphological processes that shape aquatic systems is itself shaped by this taxonomic focus and lens. However, suitable OSF habitat differs from suitable salmonid habitat in important ways. Extant OSF populations in the Chehalis Basin largely utilize wetland prairie / headwater marsh habitat, not standard riverine habitats. The processes that historically naturally maintained this headwater marsh habitat and low emergent marsh vegetation in the Black River drainage are not only not functioning in this system, but they have been entirely and arguably permanently removed from the system via human influence.

Habitat restoration methods that rely on PBR concepts do not work in the long-term if operating in a habitat where the processes that naturally occurred in them are no longer present or are severely weakened. The Black River is, unfortunately, a prime example of such a habitat. Here, important historic processes have been removed: native grazers like elk have been displaced, Indigenous people who utilized fire to maintain open prairie habitat have also been displaced, the hydrology has been altered for agricultural use of the land (including channelization for draining and introduction of RCG for grazing and haying), ongoing human development in the area effects further habitat fragmentation and hydrological alteration, and climate change exacerbates all of these habitat issues. Now, all known OSF sites in the Chehalis Basin are dominated by RCG, and because RCG is tall and fast-growing, even more frequent "grazing" (anthropogenic mimicry of extirpated grazing processes) is needed at these sites to maintain suitable OSF breeding habitat.

For these reasons, what can currently be done to provide habitat protection and uplift for OSF largely involves elements that exist outside of PBR principles. For example, mowing, haying, and other maintenance of short stature emergent marsh vegetation. This is not to say that PBR methods are not feasible or appropriate in these and other headwater marsh habitats, rather that there are extra steps that need to be taken to develop these methods. These extra steps are the focus of this memo and, importantly, require investments, ASRP or otherwise.

Short-term vs. Long-term Needs

Applying the same lens across all at-risk species in the basin, a short-term versus long-term habitat needs paradigm becomes apparent. For example, as much as is known about what habitat conditions are needed for salmonid species and how to achieve those conditions, a concern that remains is that habitat restoration benefits may only be realized on long timescales, and that it is possible spring Chinook may not be able to hang on long enough to benefit from the long-term actions ASRP is focusing on. This lens can also be applied to OSF, where the primary areas of uncertainty are simply flipped – it is known what works in the short term, what the populations need to hang on, and there are ideas about what the populations need in the long-term, but there are not yet many robust or long-term data sets to support an all-in one-track approach. In fact, success of habitat approaches for OSF is likely highly site-specific, with no true one-size-fits-all approach recommended.

For this reason, and due to the nature of the specific threats OSF face (e.g., invasive species), monitoring is a key aspect of protection and restoration strategies. This includes monitoring of vegetation (species composition as well as stature/structure), monitoring for invasive predator presence, monitoring for OSF population losses/gains (on a two-to-four-year delay associated with the species' life history), and monitoring to assess the effectiveness of restoration treatments and inform both programmatic and project-level adaptive management.

Key OSF Biology & Ecology

Suitable habitat for OSF looks different depending on the season, in accordance with the needs of different life stages.

Figure 1
Salmon Creek OSF Breeding Habitat

Image credit: Michelle Tirhi, WDFW

Figure 2
West Rocky Prairie OSF Summer Pond (Non-breeding) Habitat

Image credit: Julie Tyson, WDFW

In addition to appropriate vegetation stature, the timing and availability of water is critical to the reproductive success of OSF. As plainly put in the USFWS draft Recovery Plan, "ensuring that the duration and spatial extent of water within aquatic habitats supports the species' life cycle is essential" (USFWS 2023b). Further, "Oregon Spotted Frogs select breeding sites in seasonally flooded wetland margins adjacent and connected to perennial wetlands. Full solar exposure also seems to be a significant factor in breeding habitat selection" (USFWS 2023b). Breeding occurs in the early spring, after which remnant connected pools that persist through the summer offer suitable habitat, in addition to perennial creeks, intermittent tributaries, and near-stream areas, with some individuals expressing high micro-site fidelity. In the winter, OSF require well-oxygenated waters and sheltering locations protected from predators and freezing conditions. Creeks and canals are also used during this time, as well as deeper ponded water. In total, heterogeneity and aquatic connectivity across these flooded marsh habitats are important factors for OSF habitat suitability.

ASRP Foundation: Prioritization & Sequencing (P&S)

As part of the ASRP's Prioritization and Sequencing scheme (P&S; ASRP SRT 2021), the three most at-risk species in the Chehalis Basin, spring Chinook, OSF, and Coastal Tailed Frog, were selected for focus in the near-term implementation period (2021-2031). OSF was also selected for focus because it is an "umbrella species for a suite of stillwater-breeding amphibians" (ASRP SRT 2021). While the whole of the Black River drainage represents important OSF habitat and/or opportunity, seven geospatial units (GSUs) in the Black River Ecological Region (ASRPSC 2019) were identified as particularly important for targeted protection and restoration actions in the near- and mid-term: Lower Black Mainstem, Upper Black Mainstem, Lower Black Tributaries, Upper Black Tributaries, Dempsey, Beaver, and Waddell.

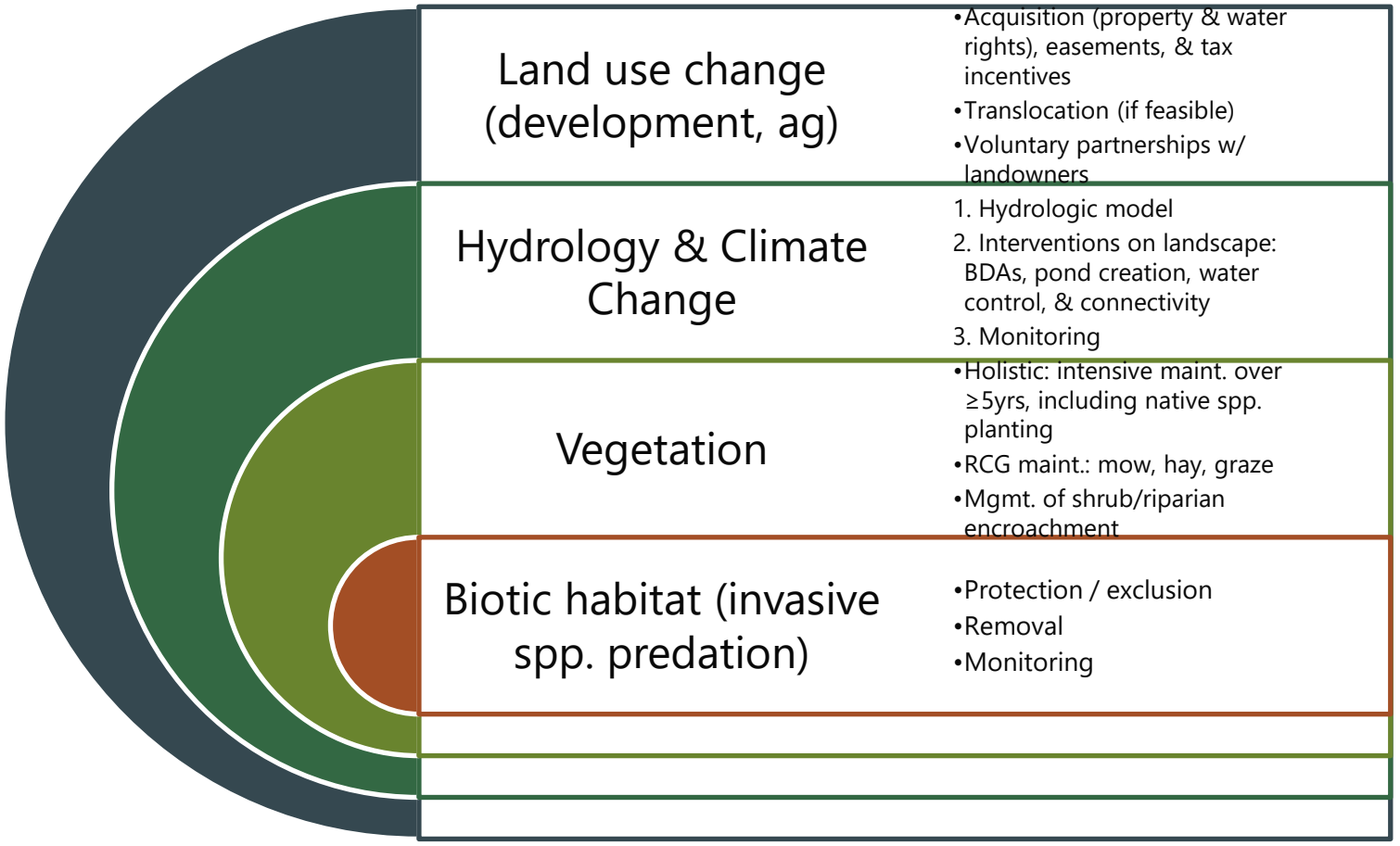
Protection activities recommended for near-term implementation in these GSUs include acquisition, protection from encroachment by invasive predators, and restoration to maintain low emergent marsh plant communities. Of these, it is important to recognize that restoration to maintain low emergent marsh plant communities is the only activity currently feasible from an implementation standpoint.

The P&S memo also sets a near-term recommended target of 56 acres of wetland restoration, also to occur in the same seven GSUs in the Black River Ecological Region. Actions include restoring existing habitat and adding off-channel ponds and wetlands, with the following objectives in mind: to maintain the hydrologic connectivity and adequate water supply to maintain habitats currently occupied by OSF, to limit incursion by invasive warm-water predators into these sites, and to restore low emergent breeding habitat that has been lost to succession. Again, it is important to recognize that restoration to maintain low emergent marsh breeding habitat is currently the only activity that is feasible from an implementation standpoint. The P&S memo, however, goes on to provide further guidance, recommending further expansion of OSF range, where possible, by restoring additional habitats via improving hydrologic connectivity and stability, resetting succession (i.e., reversing changes in the plant community back to low emergent marsh vegetation), and eliminating invasive predators.

OSF Threats and How to Address Them

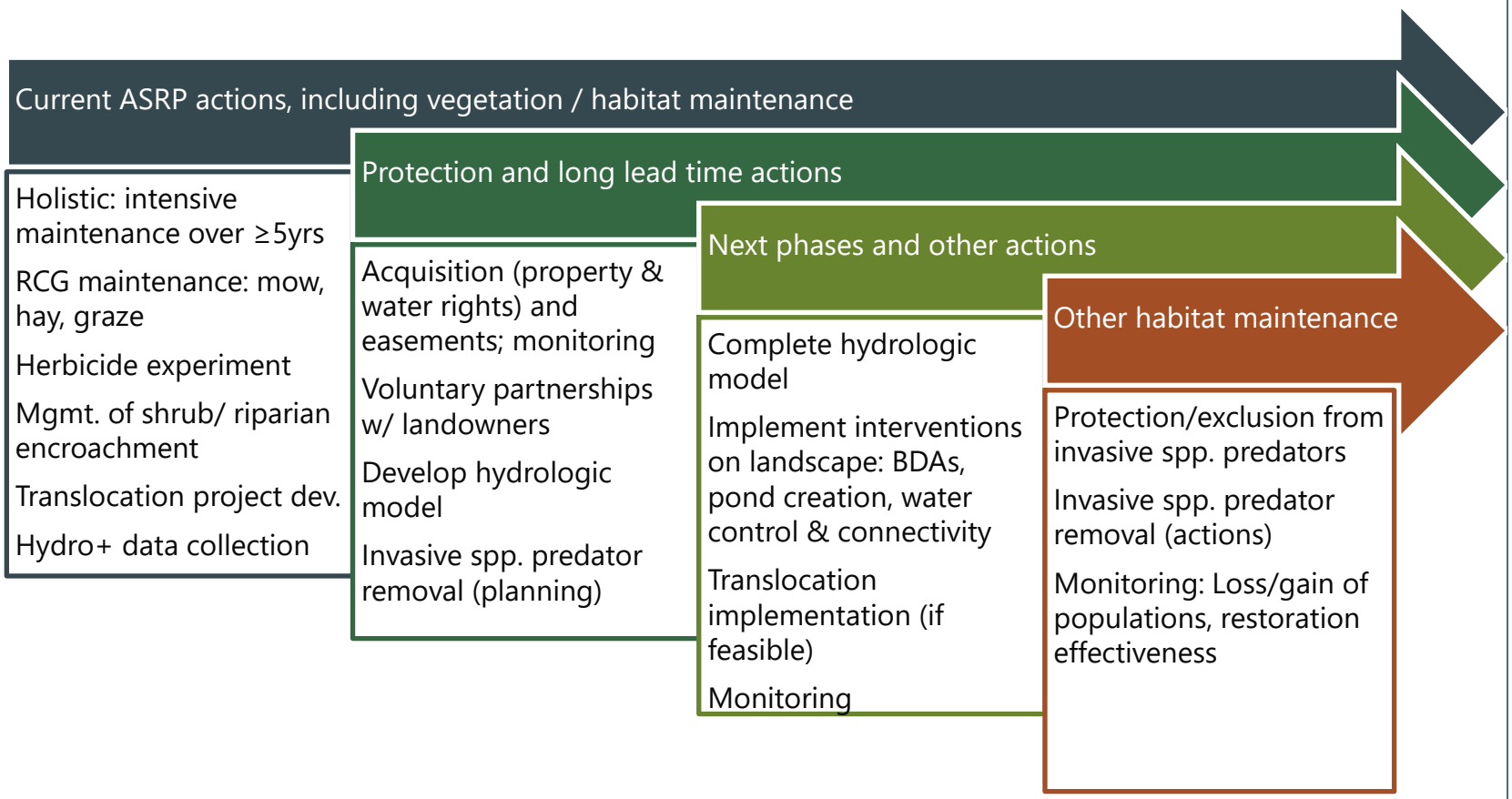
From the P&S memo, and from the more targeted investigation undertaken by ASRP staff to develop this OSF memo, just a few categories of threats/stressors to OSF related to habitat become apparent. These categories are depicted on the left in Figure 3 below.

Figure 3
OSF Threats Related to Habitat, and How to Address Them



Some action options for addressing the habitat-related threats OSF face can (or must) be sequenced, as in Figure 4 below.

Figure 4
OSF Threats Related to Habitat, and How to Address Them



Some action options require multiple planning phases prior to implementation. For example, social, legal, and biological feasibility scoping for translocation efforts is currently in early stages, a project development that has been funded through ASRP. Similarly, an experiment to test the potential impacts of the herbicide imazapyr on OSF is currently underway, also funded through ASRP.

Other Expected Benefits These Actions May Provide

Protecting and restoring flooded marsh habitat for OSF could be anticipated to provide uplift for co-occurring or potentially co-occurring species, including some that are ASRP indicator species – beaver (habitat engineer), Olympic mudminnow (state sensitive), Great blue heron (species of interest), and possibly Western pond turtle[1] (state endangered). Additionally, some downstream benefits for all aquatic and semi-aquatic species present in the Chehalis Basin may be realized, including those associated with water quantity and quality, as well as aquatic habitat connectivity.

Alignment with Federal Draft Recovery Plan

Recently, the federal draft Recovery Plan for OSF has been made available for review and public comment. The information included in this memo is in alignment with federally identified priorities for OSF in the Chehalis Basin Black River drainage, as shown in the table copied to Appendix A (Source: USFWS 2023a, pp. 35-38). Recovery action categories included in the federal draft Recovery Plan for all OSF populations that are in alignment with priorities identified in this memo are included in the following list (emphasis added; source: USFWS 2023b):

1. "restore and enhance wetland, riverine, and other aquatic habitats to support all life stages of the Oregon spotted frog
2. ameliorate threats from predation and disease to improve resiliency
3. increase population size and reduce isolation of Oregon spotted frog populations within sub-basins to improve resiliency and representation
4. promote awareness and increase conservation partnerships within the Oregon spotted frog range
5. utilize regulation and policy tools to protect wetland habitat and promote water availability to support species recovery

[1] Historic distribution of Western pond turtle is uncertain, but may include habitats that currently or historically supported OSF, like West Rocky Prairie. The Capitol Land Trust website states: "the quality habitat found in the West Rocky Prairie provides a unique opportunity for the reintroduction of many species of endangered species such as the Western pond turtle."

6. conduct inventory, monitoring, and scientific research to guide and support recovery" (USFWS 2023b)

Also, the Washington state draft Recovery Plan has been updated in coordination with the federal draft Recovery Plan, so a public release can be expected to occur once the federal draft plan is finalized.

Centering the Role of ASRP and Aligning with P&S Recommendations

While some non-habitat actions to support species recovery are funded through ASRP, the core work of the program is focused on habitat restoration. Therefore, in identifying and centering the role of ASRP within the ecosystem of OSF species recovery efforts, staff suggest the primary objective of actions funded through ASRP should be to improve wetland and flooded marsh habitat protections and conditions for OSF and other aquatic and semi-aquatic species that utilize this habitat, or to improve understanding of OSF habitat needs in order to provide more effective protections and/or improvements. This is in alignment with ASRP program goals and areas of emphasis expressed through the Prioritization & Sequencing effort, as well as via other ASRP program development and implementation efforts.

For example, while some currently occupied OSF sites fall within near-term priority GSUs, not all of them do. Still, the ASRP's implementation "roadmap" (i.e., P&S) identified 56 acres of wetland habitat restoration as a near-term priority for the program. Activities that contribute toward this programmatic target should therefore be prioritized for ASRP consideration as part of near-term implementation. Further, this target should continue to be seen as a goalpost, not a cap. Within these 56 acres, the following specific activities were recommended for ASRP implementation in the near-term (first ten years of implementation):

- Restore existing habitat and add off-channel ponds and wetlands
- "maintain the hydrologic connectivity and adequate water supply to maintain wetland habitats currently occupied by Oregon spotted frog"
- "limit incursion by invasive warm-water predators"
- "restore low emergent breeding habitat lost to succession"
- "further expand Oregon spotted frog range, where possible, by restoring additional habitats by improving hydrological connectivity and stability, resetting succession (i.e., reversing changes in the plant community back to low emergent vegetation), and eliminating invasive predators" (ASRP SRT 2021).

Protection activities recommended in P&S for near-term implementation in the seven priority GSUs identified include "acquisition, protection from encroachment by invasive predators, and restoration to maintain emergent marsh plant communities" (ASRP SRT 2021).

By way of fulfilling the primary objective of this memo, the barriers encountered thus far to implementation of OSF-focused projects through ASRP have been identified and described, and potential action steps to address these barriers, including those that have already been taken, are included in the list below.

- Sponsors and practitioners have been hesitant to propose long-term interventions until key and relevant data has been collected and synthesized. The source of this hesitation is two-fold and the magnitude is especially dependent on siting of proposed treatments. First, there is a moderate to high degree of uncertainty in population-level responses to restoration treatments, which represents an Endangered Species Act (ESA) concern; and second, the uncertainty associated with other habitat or co-occurring species' responses to restoration treatments.
  - Siting of hydrologic interventions that may provide long-term habitat protection and/or uplift, including beaver dam analogs (BDAs), pond creation, or other water control devices or techniques can and should be informed by hydrologic modeling of the area. A funding source for the hydrological modeling efforts needed to inform siting of restoration treatments to this end has not yet been identified although repeated attempts have been made (e.g., from ECY, NSF). One major location on Beaver Creek has sufficient existing data to perform the needed model. These data and the resultant model could inform long-term actions both at this site and likely others in the Basin.
  - Implementing herbicide application for RCG and/or other longer-term (beyond annual) vegetation management at OSF sites is contingent on demonstrating no significant impact on sensitive and threatened species in the area, including OSF and, potentially, Olympic mudminnow. An experiment to test imazapyr to this end is currently underway, funded through ASRP, to understand whether the herbicide imazapyr applied at rates that improves RCG control has any negative impacts on embryonic and larval OSF life stages and whether imazapyr residue persists on-site.
- Through technical review of a project proposed for ASRP consideration, the Technical Review Team (TRT) had removed a pond creation element, citing the uncertainties outlined above. The technical review process in ASRP no longer includes an option for the TRT to remove elements of a proposed project without the ASRP Steering Committee's awareness.
- On the policy / programmatic side, the ASRP Steering Committee's review of projects geared toward providing OSF uplift may benefit from review of this memo. The Steering Committee has expressed desire to better understand the long-range plans for OSF habitat, beyond annual management of vegetation. While some steps have already been taken to further develop long-range OSF habitat plans, this memo may serve as a useful reference into the future.

Remaining Gaps

There are several knowledge gaps that remain and may hinder implementation of recommended protection and restoration activities for OSF habitat, in addition to several potential implementation gaps.

While it is generally known where to implement site restoration and maintenance work in the Chehalis Basin for OSF (i.e., many active breeding sites are known and mapped, and all known OSF habitat in the Basin occurs in the Black River drainage), the exact location and type of intervention recommended on a per-site basis still needs to be determined. Three things are expected to help address this knowledge gap: 1) hydrologic modeling; 2) evaluation of herbicide impact on sensitive species; and 3) investigation into feasibility, techniques, and expected efficacy of invasive predator exclusion and removal.

On the implementation side, acquisition and some other protection pathways / mechanisms are still under development in ASRP. Staff should continue to support sponsors in communicating the value of their proposed actions relative to P&S and other ongoing OSF restoration strategies or recovery plans. Regional Implementation Teams (RIT) should continue to support sponsors' development of application materials, in alignment with near-term priorities expressed in P&S guidance. Staff should work with the TRT to ensure the team is well-equipped to continue to review OSF habitat projects as they come through the ASRP implementation pipeline. And ASRP Steering Committee members should review this memo and coordinate with staff to address any remaining programmatic needs to facilitate efficient review of projects that align with programmatic goals and priorities.

Next Steps

Table 1 (Appendix B) includes an analysis conducted by ASRP staff to support the Steering Committee's consideration of potential action items to address remaining programmatic gaps and/or otherwise facilitate future review of projects aiming to provide protection and/or uplift for OSF. It is important to note that Table 1 does not represent a comprehensive list of potential Steering Committee action options, only an initial draft list, and that some action options may be combined with others (options are not necessarily mutually exclusive) to effect multiple outcomes.

Appendix A - Recovery Actions to Improve Resiliency within the Upper Chehalis River sub-basin

Adapted from: USFWS Draft Recovery Implementation Strategy, pp. 35-38.

NOTE: The table below is a draft template and does not yet include a comprehensive review of relevant Chehalis basin knowledge.

Listing Factor A: Present or Threatened Destruction, Modification or Curtailment of its Habitat or Range	
Changes in Hydrology	The combination of severe drought in 2015 followed by on-going annual precipitation deficits has resulted in reports of some changes in wetland vegetation (*e.g.,* successional changes) at some of the sites. Reports suggestive of subsurface water deficits (*e.g.,* rapid draining of breeding pools and summer drying of rearing habitats) have also been made (USFWS 2022). And breaches in beaver dams and/or beaver dam removals have caused issues with long-term retention/recharge.
Changes in vegetation	Wetland margins and shallows have been dominated by reed canarygrass since OSF were documented the 1990s. Loss of grazing and haying in OSF habitat is a threat. Riparian and wetland planting with conifers for salmon habitat restoration (and the loss of habitat from areas that were already planted).
Removal or alteration of habitat for development and agriculture	Agricultural and residential development impact OSF habitat quality. Across the watershed there is a high threat of land conversion from agriculture into development as human populations and human needs for infrastructure, homes, and services grow. There is some level of uncertainty associated with the
Livestock grazing	Cattle grazing may pose a threat through trampling and reduced water quality in the few locations where it occurs; however, in all cases, grazing is also maintaining vegetation height that is necessary for suitable breeding habitat.
Recreation impacts to habitat (since ESA listing)	Off road vehicle traffic has been observed within the Refuge (USFWS) and on some Wildlife Areas (DFW).
Recovery Action 1.0 - Restore and enhance wetland, riverine, and other aquatic habitats to support all life stages of Oregon spotted frog	

1.1	*Restore and improve hydrological function of all aquatic habitats that support Oregon spotted frog life stages.*
The following sub-actions of Recovery Action 1.1 should be implemented to improve habitat conditions for Oregon spotted frog: (*Determine which sub-actions, below, best describe the actions needed for recovery in this sub-basin and bullet specific details that describe the sub-action)*	
1.1.2	Restore wetland and riverine function to re-establish hydrological patterns that support OSF habitats and connectivity.
1.1.3	Improve the size and quality of wetland complexes to ensure availability of water during all life stages of OSF.
1.1.4	Implement habitat restoration and enhancement to improve aquatic connectivity between seasonal habitats (breeding, summer, and overwintering) within sites. • Dempsey Creek- Nisqually National Wildlife Refuge (NWR) currently assessing connectivity between the Wilson Dairy (breeding) and Dempsey Creek (overwintering). • Culvert replacement and grading may be necessary to improve connectivity. NWR is partner with the county roads department.
1.1.5	Restore and manage wetland and aquatic habitats that have been altered by ditching and draining.
1.1.6	Work with State and Federal agencies to address beaver removal, management, and re-introduction in areas that support OSF. • Develop partnerships to promote beaver on private land. • Work with Beaver trappers to limit trapping on high priority public lands
1.2	*Manage encroachment, structure, and diversity of vegetation to improve quality of Oregon spotted frog habitat and support life stages.*
The following sub-actions of Recovery Action 1.2 should be implemented to improve habitat conditions for Oregon spotted frog: (*Determine which sub-actions, below, best describe the actions needed for recovery in this sub-basin and bullet specific details that describe the sub-action)*	
1.2.1	Implement reed canarygrass treatment in and adjacent to OSF habitat. • Determine where RCG is highest priority for treatment.

	• Dempsey Creek – Wilson Dairy is mowed and grazed to reduce height of RCG. • Black River at 123 population - 123 rd site is heavily infested with RCG but need to determine appropriate level of treatment as OSF are doing well here. Mowing occurs in mid-September in the breeding areas. • West Rocky Prairie and Salmon Creek Wildlife Units utilize mowing • Allen Creek and Mima Creek Wildlife Unites utilize mowing in wetter areas and haying in summer dry areas.
1.2.2	Utilize grazing to reduce reed canarygrass height in breeding and rearing (summer) habitat. • Dempsey Creek: Port Blakely Tract and Wilson Dairy – grazing is used as a management tool to enhance OSF habitat. Continue grazing these areas to support OSF.
1.2.3	Determine appropriate grazing management and implement to reduce encroachment of vegetation at OSF sites • Dempsey Creek: Port Blakely Tract – install fence to manage the timing and duration of cattle grazing to enhance OSF habitat. • Grazing studies by CNLM and USFWS
1.2.4	Utilize grazing to maintain early successional vegetation structure at breeding areas
1.2.5	Reduce lodgepole pine and other woody vegetation encroachment into OSF habitat.
1.2.6	Reduce cattail encroachment and other aquatic vegetation to improve open water condition. • Assess where dense vegetation is an issue for OSF. 123 Rd has dense vegetation that may been some openings.
1.3	*Manage development and recreational use in and near habitats that support Oregon spotted frog.* As human development continues to grow in this sub-basin, implement actions to prevent damage to OSF habitat such as the following: • Implement education and outreach on the sensitivity and importance of littoral vegetation around OSF sites. • Identify areas where water from impermeable surfaces may be conveyed away from OSF habitat to prevent flashiness of the hydroperiod that may result in stranding and the introduction of polluted water.

	• To prevent creosote from entering Dempsey Creek, consider removal of bridge with creosote-soaked pilings (Delphi Rd).
Factor C: Disease or predation	
Predatory, introduced fish – brook trout, brown trout, Brown bullhead	Warm water fish occur primarily in Black Lake and Black River proper, but also in other areas. Presence of warm water fish may be one reason why OSF do not occur in some areas like Millersylvania State Park. A sunfish was found in Dempsey Creek on September 8, 2022. More information is needed to understand the extent of overlap with OSF. Bass occur within the Black River.
Bullfrogs and green frogs	Bullfrogs were documented in the Black River watershed but were limited or absent in the areas occupied by Oregon spotted frogs (USFWS 2014). That situation, however, has changed since listing with bullfrogs now rapidly invading previously unoccupied areas. Currently, bullfrogs are known to occur throughout the Black River System, and in Dempsey Creek, in areas that are occupied by OSF. Bullfrogs occur within the Nisqually NWR and at Millersylvania State Park.
Recovery Action 2.0 - Ameliorate threats from predation and disease to improve resiliency	
2.1	Reduce or prevent introduction of American bullfrogs within and in proximity to Oregon spotted frog habitat. • Nisqually NWR are reducing bullfrogs at 123rd and Dempsey Creek OSF populations. • To prevent the spread of bullfrogs into OSF sites, the NWR is conducting bullfrog monitoring and rapid removal if detected. Bullfrog acoustic monitoring with USGS support is ongoing. • Salmon Creek OSF site has been actively managing bullfrog removals for several years.
2.2	Reduce or prevent introduction of non-native predatory fish within aquatic habitats that support Oregon spotted frog. • Determine where sunfish and other predaceous fish are resident within OSF habitat. • Develop actions to assess and address key areas that could be targeted for removal.
2.3	Monitor, assess, and prevent the spread of disease that has the potential to impact Oregon spotted frog viability. • NWR- If observations of mortality are observed, collect samples for analysis. • Decontamination between sites in the basin is done by DFW and USFWS
Factor E: Other Natural or Manmade Factors	
Small populations	Abundance levels based on a median of egg mass counts from 2017 to 2021 are high in two populations; moderate in five populations and low in five populations (USFWS 2022).

Isolated populations	Connectivity in terms of genetic exchange has been identified between a few of the populations (Goldberg and Brinkmeyer 2015).
Water quality and contamination	Poor water quality and contaminants were considered a threat to OSF in the Listing Rule (USFWS 2014, p. 51690).
Hybridization	Listing Rule did not consider hybridization to be a threat to OSF in 2014 (USFWS 2014, p. 51690).
Climate Change	
3.0 Increase population size and reduce isolation of Oregon spotted frog populations within sub-basins to improve resiliency and representation	
3.1	Improve reproductive success within sub-basin populations
3.2	Augment small populations • To be informed by pending genomics study.
3.3	Improve aquatic connectivity between OSF sites and populations to reduce isolation • There is potential for enhancing connectivity between populations in this sub-basin. Using genomics and other methods, identity where it is feasible to conduct restoration actions to improve connectivity.
4.0 Promote awareness and conservation partnerships within the Oregon spotted frog range	
4.1	Coordinate and collaborate with partners to recover Oregon spotted frog.
4.2	Promote Oregon spotted frog conservation through outreach and education.
4.3	Develop voluntary agreements and conservation easements to protect and manage Oregon spotted frog populations and habitat. Many of the Oregon spotted frog populations within the Upper Chehalis sub-basin are on conservation lands or easements, managed by a variety of owners, including Fish and Wildlife Service Partners Program and Nisqually NWR-Black River Unit, WDFW, land conservancy groups, private companies and private individuals. However, there is a lack of long-term management commitments to implement conservation actions that will sustain populations into the future.
5.0 Utilize regulation and policy tools to support species recovery	
5.1	Address water rights and management to improve hydrology of OSF habitat
5.2	Address development of wetland habitats that support OSF
6.0 Conduct inventory, monitoring, and research to guide and support Oregon spotted frog recovery	
6.1	Conduct inventory and demographic monitoring. Oregon spotted frog breeding occurs on approximately 37 parcels with ownership in a mix of federal, state, private and NGO-owned lands. Resources are insufficient to survey all these parcels annually while also conducting inventory to find new breeding areas. • NNWRC conducts annual surveys. • WDFW has a survey strategy and rotation for surveying populations. • Inventory of new areas is a priority but is only feasible where land access is granted.

6.2	Research species demographics, genetics, habitat, demography, movement, and dispersal. • Need to better understand habitat overlap and interaction between bullfrog and spotted frog. • Genomics for the basin were collected in 2022 from all geographic populations in the basin, results expected in 2023.

Appendix B – Next Steps

Table 1

ASRP Steering Committee Action Options

ACTION(S)	POSSIBLE OR EXPECTED OUTCOME(S) POSITIVE (BLUE) & NEGATIVE (RED)	CERTAINTY (OF OUTCOME)	REMAINING UNCERTAINTY
No action	• Information received regardless! • Not mutually exclusive from other action options (e.g., RIT or TRT actions) • Opportunity cost – time	High (all)	Prompt: what does selecting a "no-action" option mean in the context of Steering Committee roles and responsibilities?
Develop / refine an ASRP-specific OSF Restoration Strategy document	• Guide ongoing & future OSF project development and implementation – Protection and restoration actions for OSF more clearly articulated (than P&S), with feasibility and long-term strategy timeline – More OSF projects to support near-term targets are approved • Opportunity cost: staff time	High Low High	How would a document be utilized, and by whom? What additional information should be included?
Remove Project Development (PD) funding cap and allow modeling/ engineering for PD funding	• Opportunity for ASRP to fund hydrologic model (needed to inform future project implementation) – Allows implementation of larger, long term OSF restoration interventions, e.g., pond and BDA siting • Would lower available PD funds for landowner outreach, site assessments, and concept design – Fewer **non-OSF** project opportunities ready to fund • Would allow sponsors to utilize PD funds for modeling and engineering for non-OSF projects – Implementation project applications have more detailed design reports when submitted to TRT	High Medium High	Impact of expected outcomes: • How much would these actions cost? • How many sponsors would be interested in this? • Would there still be sufficient PD funds for outreach efforts?
Increase M&AM Budget (25-27BN)	• Option for funding hydrological model to inform more long-term / PBR methods for OSF and other wetland species important for ASRP • Better future projects and better species and habitat outcomes from projects!	Medium Medium	What other demands on M&AM budget will arise? Where would the dollars come from? If from projects, will this

	• Opportunity cost – dollars must come from other ASRP activities (e.g., project implementation)	High	impede our ability to achieve ASRP goals?
Update technical review criteria and/or process to facilitate scoring that reflects OSF habitat value	• Easier for TRT to consistently and transparently score OSF projects, and OSF projects spend less time in review stage – OSF projects are implemented faster – More OSF projects are implemented • Lose the ability to make apples-to-apples comparisons between project categories – Lose existing leverage that encourages ASRP holistic project design (all habitat goals)	Faster imp. – High More projects – Low High	How would future OSF projects score use existing criteria? To what extent do scoring criteria influence project design?
Update or refine guidance provided to sponsors re: OSF suitable habitat and needs and application materials	• Sponsors have greater understanding of OSF projects – Greater number of OSF projects – Non-OSF project contain benefits to OSF • Opportunity cost - time could be spent on other trainings	Low/Medium Low	Do current non-WDFW sponsors even have interest in OSF projects? Typically extra time in RIT meetings
RIT provide more support for sponsors developing OSF project application materials	• Sponsors submit higher quality application materials (OSF and non-OSF) – More projects come through TRT for SC review, and with fewer iterations (lower admin cost) • Opportunity cost – time could be spent on other trainings	High Low/Medium Low	How many more OSF projects are we expecting? Typically extra time in RIT meeting

Note: Table 1 does not represent a comprehensive list of potential Steering Committee action options, only a draft list provided by ASRP staff for consideration. Some action options may be combined with others (options are not necessarily mutually exclusive) to effect multiple outcomes.

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