CHEHALIS BASIN STRATEGY

MEMORANDUM

Date: December 2, 2022
To: Nat Kale, Andrea McNamara-Doyle, Office of Chehalis Basin
From: Merri Martz, Anchor QEA; Shelby Thomas, Ross Strategic
cc: Heather Page, Anchor QEA
Re: Erosion Management Program Summary Memorandum

Executive Summary

The Chehalis Basin Board funded the development of an erosion management program as a result of work in 2021 to develop local actions to reduce flood and erosion damages throughout the Chehalis Basin.

The purpose of this proposed erosion management program is to reduce the use of hard bank stabilization practices within the Chehalis Basin that degrade habitats and instead to promote the use of bioengineering techniques that can provide effective erosion management while also improving aquatic habitat conditions. The program will work with willing landowners with both urgent and longer-term erosion concerns. The program will also provide funding and technical assistance to jurisdictions and Tribes within the Chehalis Basin to reduce future development of structures and infrastructure in erosion hazard areas.

The program is proposed to be housed within the Office of the Chehalis Basin (OCB) for program management. Project sponsors (local jurisdictions, Tribes, or conservation districts) would be funded to manage individual projects with private landowners. Public landowners could also sponsor projects. Projects that meet program criteria would be funded using allocated funds in each biennium. The Recreation and Conservation Office (RCO) will provide fiscal and contracting support.

Program funding would be allocated to three funding tracks: 1) urgent and imminent projects; 2) proactive reach-scale projects; and 3) program technical advancement studies. Urgent and imminent projects are proposed to be funded on a rolling basis as project proposals come in during a biennium. This allows for rapid response to high-risk situations where structures and infrastructure are threatened. Proactive reach-scale projects are proposed to be funded through a biennial grant round for larger-scale projects that require more extensive design and analysis and involve multiple landowners or parcels. Technical advancement studies will support basin jurisdictions with funding and technical resources to support land use regulations, monitor and track projects to support management of the program, and develop materials and educational presentations for landowners and other interested parties.

The erosion management program is part of the Chehalis Basin Strategy integrated funding, which means that it must provide both flood/erosion damage reduction and aquatic species benefits. As such, it can potentially collaborate with other Strategy programs such as the Community Flood Assistance and Resilience (CFAR) program, the Aquatic Species Restoration Plan (ASRP), and the Flood Authority. If the Local Actions Non-Dam (LAND) program that is under development is implemented in the future, it could also partner on erosion management projects. There are also existing Washington Department of Ecology (Ecology) programs and staff that provide technical assistance for floodplain management, channel migration zone delineations, and other topics related to erosion management and can participate and collaborate with this program.

OCB has identified a budget for the 2023–2025 biennium that ranges from $800,000 to $3.7 million and that could fund two or more urgent/imminent projects, one to three reach-scale projects, and several technical advancement studies, depending on the level of funding provided. As learned from the pilot projects, there are many landowners interested in participating in this program that could rapidly allocate this level of funding.

Introduction

In July 2020, Governor Inslee requested that the Chehalis Basin Board (Board) develop a basin-wide non-dam alternative to reducing flood damage in the Chehalis Basin. The Board began the process of developing a Local Actions Program (LAP) as part of its approach to determine the potential for flood damage reduction with a comprehensive, basin-wide approach (which also includes the Community Flood Assistance and Resilience program, and local flood damage reduction projects).[1] The Board worked with two advisory groups, a Technical Advisory Group and an Implementation Advisory Group, to identify key issues that the LAP could address.

The Board agreed upon several outcome measures for a LAP, with the following being the most directly relevant to erosion and channel migration hazards:

- The number of locations where migrating river channels and bank erosion pose a high risk of near-term damage to valuable structures or loss of economically productive land uses would be reduced…while protecting ecological processes (Outcome 4A "Farmland and Rural Structures Protected).
- No new structures would be developed that are vulnerable to channel erosion or mainstem or tributary flooding from 2080 predicted 100-year flood levels, because all basin local governments have adopted model floodplain management ordinances that exceed the State and National Flood Insurance Programs' minimum requirements; all local government construction and building code standards support flood damage risk reduction through measures such as subdivision set-asides, filling restrictions, freeboard height of new buildings, critical facility placement and protection, and non-conversion

[1] As reflected in the September 2020 – March 2021 Board Objectives.

agreements; and incentives direct future development out of harm's way (Outcome 8: Prevent New At-Risk Development).

Addressing accelerated bank erosion was part of the local flood damage reduction issue the advisory groups ultimately identified in early 2021 for the Board to consider as part of the LAP and a technical assistance program for erosion management was proposed to the Board as part of the advisory groups' outcomes (Anchor QEA 2021a). The Board funded the development of an erosion management program in late 2021.

This memorandum summarizes the outcomes from the program development process undertaken in 2022 with an erosion management workgroup (see Appendix A).

Purpose of Erosion Management Program

Riverbank erosion and channel migration are natural processes and are highly valuable as a river migrates through its floodplain and creates new habitats, stores and recruits large wood and coarse sediment, and creates bare alluvial surfaces that are readily colonized by cottonwoods and other native riparian species. However, past and ongoing land uses can increase bank erosion and channel migration above natural rates and can adversely affect property and infrastructure adjacent to rivers and streams. The extent of potential channel migration in the basin is also not well understood. Structures and infrastructure have unknowingly been placed in high-risk locations because channel migration zones have not been delineated.

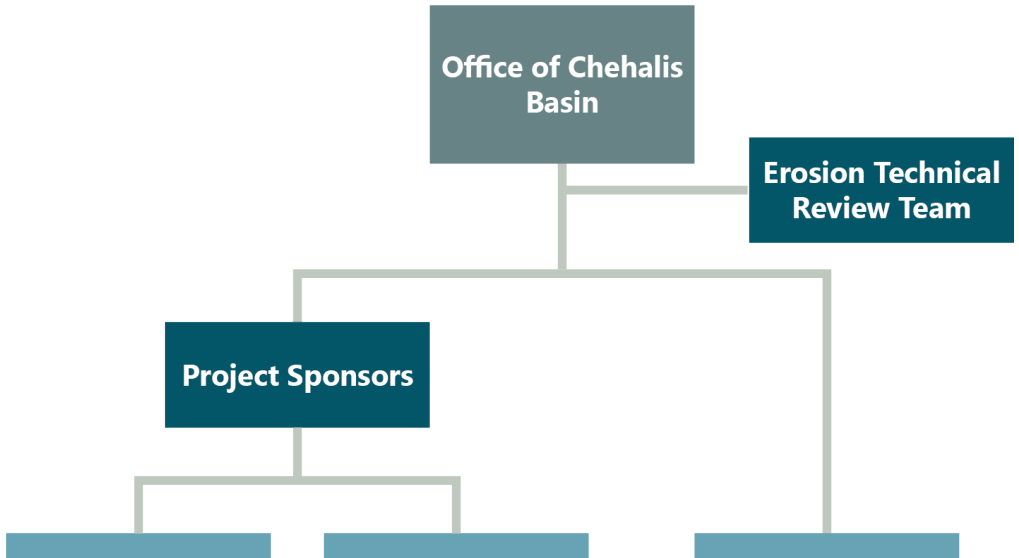
The purpose of this program is to reduce the use of hard bank stabilization practices within the Chehalis Basin that degrade habitats and instead to promote the use of bioengineering techniques that can provide effective erosion management while also improving aquatic habitat conditions. The program will work with willing landowners with both urgent and longer-term erosion concerns. Because erosion is a beneficial natural process of rivers, it will be important to track projects over time to avoid the cumulative stabilization of long reaches or cumulatively degrading habitat areas. The program will be most effective over the long term by working with basin jurisdictions to support their land use regulations with technical resources, such as channel migration zone mapping, reduce future development in erosion hazard areas, and ultimately reduce the needs for erosion management.

Program Structure

The proposed erosion management program would be staffed through OCB and would provide funding support for technical assistance, technical advancement studies, and erosion management projects within the Chehalis Basin. It is further proposed that a small technical review team (potentially composed of some of the members of the workgroup) also be funded to support technical reviews of projects proposed for funding.

The program will be housed within OCB for program management. It is envisioned that consultant support would be necessary for both program management and to provide technical reviews and vetting of projects. Additionally, funding is recommended for conservation districts to sponsor and shepherd projects through with private landowners. Public landowners could also sponsor projects. Projects that meet program criteria would be funded using allocated funds in each biennium. The RCO will provide fiscal and contracting support.

Proposed Erosion Management Program Structure



Program objectives include the following:

- Address urgent and imminent erosion threats to eligible structures and lands while also protecting and/or improving habitat conditions.
- Incentivize proactive projects that can address reach-scale erosion concerns for multiple landowners while also providing substantial habitat benefits.
- Provide technical assistance and resources to support basin jurisdictions to reduce future development of structures and infrastructure in erosion hazard areas.

Urgent: An immediate threat (within 60 days or one major storm event)
Imminent: Channel migration, avulsion, or major bank erosion threat in less than 2 years
Proactive: Trending channel migration or bank erosion threat that does not require immediate action

As urgent and imminent[2] erosion concerns both require action to be taken quickly to prevent substantial damages, it is recommended to combine both types of projects into one funding track. To address the three objectives, we recommend that the program have three separate funding tracks: 1) urgent and imminent projects; 2) proactive reach-scale projects; and 3) technical advancement across the basin.

Erosion Project Eligibility Criteria

The types of projects that are eligible for the program would include properties and infrastructure as follows: public infrastructure, private residential or commercial structures, and agricultural lands. To be eligible for project funding, the following criteria must also be met:

- A local sponsor (such as a conservation district, municipal agency, non-profit) will develop and manage the project (including financial management), including ensuring all necessary permits are acquired.
- The landowner(s) will sign an agreement to support a bioengineered solution, allow construction of the erosion management solution on their land, and commit to maintaining the project over the long term.[3]
- The landowner will commit to maintaining any mitigation elements required as part of the permitting process.

Public Infrastructure: Publicly owned roads, bridges, utilities, schools, park facilities and other structures that serve an essential public function
Private Residential Structures: Private residences, barns, or garages and integral utilities such as septic systems or water/sewer pipes (not including sheds or similar minor structures)
Commercial Structures: Businesses, warehouses, manufacturing facilities, etc. where primary business purposes are contained
Agricultural Land: Privately owned lands that are actively used for revenue-generating agricultural production

[2] Imminent is used in this document as defined for this program, which is not the same as the definition of imminent used in regulatory programs such as the Hydraulic Project Approval.
[3] Typically, a 10-year landowner agreement would be required.

Project proposals are preferred that can relocate structures/infrastructure to avoid risks later in time (provide permanent protection from erosion). If relocation is not feasible, then a solution must be composed of bioengineering techniques. Relocating utilities that do not pose a harm to the environment as the only element (e.g., electrical conduits) will generally not be eligible. The use of rock must be minimized or used only as a temporary measure (which may require removal in the following season as part of mitigation requirements). Temporary measures are allowed, if necessary, to address urgent issues (e.g., if there is not sufficient time to install a permanent solution). However, they require removal and replacement with a long-term solution in the following in-water work window (and would also be required by permitting agencies to be removed).

Erosion management solutions need to enhance aquatic habitat to the extent practicable for the scale of the solution or may be required to include mitigation to avoid a net loss of habitat. A solution also should not exacerbate erosion risks at nearby parcels, either through being designed to minimize off-site effects or by including elements on nearby parcels (with adjacent landowner participation) to minimize this risk. The program will also likely have a cut-off date for eligibility; for example, no structures/infrastructure constructed after January 1, 2024, will be eligible for funding.

Funding

Program funding would be allocated to three funding tracks: 1) urgent and imminent projects; 2) proactive reach-scale projects; and 3) program technical advancement studies.

Urgent/imminent projects are proposed to be funded on a rolling basis as project proposals come in during a biennium. This allows for rapid response to high-risk situations where structures and infrastructure are threatened. Projects that can be fully bioengineered with habitat benefits and that do not require mitigation are preferred. Project sponsors are encouraged to apply for funding early in a year (e.g., spring) to allow for project design and implementation to occur during the in-water work window and prior to the next winter season. However, applications would be accepted at any time. When all urgent/imminent project funding available in a biennium has been obligated to projects, the projects could still remain on the list for funding in the next biennium, if not separately funded through other programs.

Proactive reach-scale projects are proposed to be funded through a biennial grant round with project proposals due in the fall of each new biennium (e.g., fall 2023) for funding through the biennium. Projects proposals will be ranked and prioritized based on program criteria (see below). If proactive reach-scale funds have not been fully allocated within a few months from the end of the biennium, these funds could be released to the urgent/imminent project funding track.

Technical advancement studies will support basin jurisdictions by funding or developing technical resources that can support land use regulations, monitoring and tracking of projects to support management of the program, and development of materials and educational presentations for landowners, real estate professionals, and other interested parties.

Proactive Reach-Scale Project Prioritization

A technical review team would be engaged to review and rank the proactive reach-scale project proposals that are submitted for biennial grant funding. The following criteria have been initially developed. It is anticipated that the criteria and scoring may be revised periodically based on monitoring and lessons learned through each biennial funding cycle. Each ranking criterion can be scored from 0 to 5 with a score of 0 least meeting the criterion and a score of 5 fully meeting the criterion.

RANKING CRITERION	SCORING
Longevity of benefits	0–5
Reach-scale processes	0–5
Assets at risk	0–5
Immediate habitat or water quality benefits	0–5
Multiple benefits	0–5
No alternative funding available	+3 or +5
Easement or acquisition	+5
MAXIMUM SCORE	**35**

Ranking Criteria Definitions

- **Longevity of benefits:** How long the benefits achieved by a project are likely to last. This element evaluates both the site context and the project design. A site where a highly active river or stream might destroy or meander away from the project in as soon as one season should score 0 or 1. A site where the geomorphology and hydrology is well understood and the project is designed to withstand flows up to a 1% annual chance event should score 4 or 5. A project where some or all assets will be relocated out of the migration zone of the stream or river should score 4 or 5.
- **Reach-scale processes:** Does the project consider and address riverine processes beyond the immediate location? Smaller projects can score highly on this criterion as long as they are carefully designed and placed to continue to work with channel migration, aggradation and erosion, and other processes that occur at a reach scale. A project that reinforces one bank on a single meander without accounting for these processes should score 0 or 1. A project with interventions at multiple spots on multiple meanders, accounting for summer low flows, channel-forming flows, and major flooding, should score a 4 or 5.
- **Assets at risk:** Projects that protect assets of greater value should score higher on this criterion. A project that protects a garage, driveway, or other ancillary structure should score a 0 or 1. A project that protects one or more primary residences and/or critical infrastructure should score a 4 or 5. Reviewers should be aware that this criterion is <u>not</u> analogous to monetary value, but rather values projects that protect multiple assets and landowners, and assets of high value to their owners.

- **Immediate habitat or water quality benefit:** Would implementing this project create an immediate benefit to aquatic resources? A project that reduces erosion that is beneficial to the aquatic environment and is surrounded by high-quality habitat should score a 0 or 1. A project that would remove existing riprap or other hard bank armoring, reduce a source of fine sediment pollution, or create habitat or habitat diversity in an otherwise low-quality or low-diversity stream (e.g., large wood that could create pools), should score a 4 or 5.
- **Multiple benefits:** Projects that embody "integrated" floodplain work by addressing both human and environmental needs should score higher on this criterion. A project that only provides a single benefit, such as habitat benefit or just protecting assets, should receive a 0 or 1, regardless of how well the project addresses the primary concern. A project that protects valuable assets and reduces maintenance, while enhancing in-stream or near-stream habitat, should score a 4 or 5.
- **No alternative funding available:** When the shoreline owner has no other means of funding the project, the project should receive a higher score. Governmental agencies are generally assumed to have additional means of funding at their disposal and will mostly score 0. Private landowners and businesses may or may not have access to funding sources, such as grants or loans, and are more likely to score 3 (have not exhausted all other funding options, like local or federal programs) or 5 (severe hardship and/or have been turned down by multiple potential funding sources).
- **Easement or acquisition:** Landowners who are willing to grant a property right should receive a score of +5. Many project proposals may not receive a score if landowners are only willing to sign a landowner agreement. This is intended as a bonus score for projects where one or multiple landowners will grant an easement or acquisition, and the project sponsor has arranged for a qualified organization such as a land trust to hold the property right.

Technical Advancement and Support

In addition to funding erosion management projects, there are additional studies, mapping efforts, and outreach to stakeholders and residents within the Chehalis Basin that are intended to develop useful products to further support the purpose and goals of the program. Outreach and engagement elements are described in the Communication and Outreach section below. Several key efforts that have been identified include (in general order of priority):

1. **Mapping erosion hot spots within the Chehalis Basin:** Based on local knowledge and recent permit requests, expand upon historical channel tracing and relative elevation maps prepared in 2021 (Anchor QEA 2021b). Make GIS maps and data publicly available.
2. **Channel Migration Zone (CMZ) mapping:** Provide funding and/or technical assistance to counties, cities, and Tribes within the Chehalis Basin to conduct CMZ mapping in priority areas based on their planning and regulatory priorities. It is recommended that jurisdictions use the Ecology-approved CMZ guidance and methodologies for consistency across the basin.

3. **Mapping locations of existing riprap bank protection within the Chehalis Basin:** Priority areas include the mainstem Chehalis River, Newaukum River (and its forks), Skookumchuck River, Satsop River, and Wynoochee River. Expand to smaller tributaries as funds are available (e.g., Cloquallum Creek). When existing riprap locations are known, this could inform projects that could include riprap removal through this program or other Chehalis Basin Strategy programs.
4. **Erosion management project monitoring:** Provide monitoring of projects funded through this program including documenting stability of any structures installed, geomorphic changes and aquatic habitat formation on the site (e.g., pools, sediment deposition), survival and growth of any plantings installed, and documenting if any continued erosion is occurring at the site or adjacent to the site, among other key parameters. This monitoring could be conducted on a rotating basis with any individual site monitored approximately every 3 years and approximately 1/3 of the sites monitored in any given year.
5. **Evaluation of the performance of experimental erosion management measures:** Several types of experimental measures are likely to be proposed and used over time. Monitoring is recommended for experimental measures to improve the program. Currently, log jacks have been used on both the Satsop and Wynoochee rivers, and understanding how this type of combination wood-rock structure affects the riverine environment will help guide the further use of wood-rock structures. The first evaluation proposed would evaluate the effects of log jacks to include structural stability, effectiveness at reducing erosion, types of geomorphic changes, effects on aquatic and riparian habitats, and presence of fish. Other measures to be evaluated include the use of temporary measures such as gravel-filled sacks to temporarily reduce erosion during the rainy season while a long-term project can be designed and implemented. This could help determine how effective limited measures can be in reducing erosion.

In future years, additional studies would be identified based on the input from jurisdictions, project sponsors, and other stakeholders.

Coordination and Collaboration with Other Chehalis Basin Strategy and Ecology Programs

The erosion management program is part of the Chehalis Basin Strategy Integrated funding, which means that it must provide both flood/erosion damage reduction and aquatic species benefits. As such, it can potentially collaborate with other Strategy programs such as the Community Flood Assistance and Resilience (CFAR) program, the Aquatic Species Restoration Plan (ASRP), and the Flood Authority. If the Local Actions Non-Dam (LAND) program that is under development is implemented in the future, it could also partner on erosion management projects.

The CFAR program is a clear intersection of common purpose and goals with the erosion management program, as likely many of the structures that are threatened by bank erosion and

channel migration are also within the 100-year floodplain and also experience flooding. The erosion management program encourages relocation of structures and associated utilities if that is feasible, and as part of a relocation the CFAR program could fund elements to elevate the structure or remove it from the floodplain. Alternatively, the erosion management program could implement a bioengineered solution to reduce erosion and the CFAR program could fund elevating a structure.

The ASRP program has common goals with the erosion management program regarding protection and restoration of aquatic species habitat. Some erosion projects may be located within ASRP priority geographical spatial units (GSUs). Both urgent/imminent and proactive reach-scale erosion management projects in ASRP priority GSUs could add to ASRP projects by extending bioengineered features beyond the boundaries of the ASRP project. They could also be advance measures conducted to address urgent erosion issues before a larger ASRP project can be implemented (as with one of the pilot erosion projects on the Satsop River). It is likely that erosion management projects will tend to be smaller scale than ASRP projects. This is not intended to conflict with ASRP projects because additional habitat features could be added to an erosion management project (with a willing landowner) or expand to landowners who would not otherwise participate in an ASRP project. To reduce the risk of conflicting with ASRP projects, the responsibilities of local sponsors and OCB will include coordination with ASRP. In areas of the basin that are not ASRP priorities, there is less need for explicit coordination, but general program coordination with ASRP for awareness of ongoing work is recommended.

The Chehalis Basin Flood Authority solicits proposals for and funds local flood and erosion damage reduction projects from local governments each biennium. Addressing erosion issues is one of several priorities for the Flood Authority. The Flood Authority has been involved in the development of the erosion management program, and two of the pilot projects funded in the 2021–2023 biennium were in collaboration with the Flood Authority. OCB will continue to coordinate with the Flood Authority. In the future, erosion projects would primarily be funded by the erosion program, with the Flood Authority in a collaborative role.

The LAND program is still in development and it is yet to be determined what may be recommended and funded in future years. However, similar to CFAR, ASRP, and the Flood Authority, the erosion management program could potentially expand or supplement local flood damage reduction projects. OCB will continue to coordinate with the LAND Steering Group and consultants on potential areas of collaboration with the erosion program.

Ecology has several programs and staff available to help collaborate and provide technical assistance with this program and to stakeholders in the basin. Ecology's Shorelands and Environmental Assistance program provides technical assistance, grants, and guidance, and also oversees the state rules regarding floodplain management, shorelines, coasts, and wetlands. The Flood Team is engaged in flood risk reduction, habitat restoration, and channel migration issues.

The Shoreline Management staff are engaged in planning and implementation of Shoreline Master Programs, which have a channel migration and flooding component.

Communication and Outreach

Several key issues were identified during the development of this program where communication and public education is currently lacking that this program could fill. The following communication and outreach activities are recommended:

- Developing a landowner- and construction contractor-focused guidebook that describes the types of bioengineering techniques recommended for the Chehalis Basin. This could include techniques that landowners could implement themselves as well as common bioengineering techniques for contractors to use.
- Developing outreach materials and conducting outreach to real estate professionals in the Chehalis Basin about erosion hazards for properties along streams and rivers. While real estate disclosures currently require disclosure of information about flooding or floodplains, they do not require disclosure about erosion hazards.
- Continuing outreach with local jurisdictions and Tribes about what data and outreach materials can best support their programs and help to reduce the development of new structures and infrastructure in erosion hazard zones.
- Conducting webinars for local jurisdictions and Tribes about bioengineering techniques, permitting, and materials available for the public.
- Providing periodic webinars for a public audience about erosion hazards and this program as part of the overall Chehalis Basin Strategy public outreach program.

Adaptive Management

To track the progress of the program in accomplishing the program purpose and objectives, a number of metrics will be tracked over time, including the following:

- Linear feet of rock riprap removed
- Linear feet or acres of riparian plantings
- Number and type of structures and/or infrastructure that were at risk and are now protected
- Number of landowners requesting assistance and number funded to participate in the program

Continued feedback from project sponsors and the results of the monitoring and evaluation studies will also be reviewed on at least a biennial basis to identify appropriate changes to eligibility criteria or prioritization criteria, which bioengineering techniques are successfully functioning and are most resilient to ongoing river forces, which techniques are providing aquatic habitat benefits, and which techniques can be most effectively constructed.

Permitting Considerations

Permitting is required for most erosion management projects from federal, state, and local agencies, if there is work below the ordinary high water (OHW) line of a stream or has the intent to interact or manipulate waters of the state in any way. Modifications to critical areas (e.g., riparian areas or frequently flooded areas) will likely require county or city permitting.

For work below the OHW, permits would be required from the U.S. Army Corps of Engineers (Corps; Section 404 and/or Section 10 permit); Washington Department of Fish and Wildlife Hydraulic Project Approval (HPA); Washington Department of Ecology Water Quality Certification (may be preapproved through Corps process); Washington Department of Natural Resources approval; and county or city shoreline, critical areas, and/or floodplain reviews.

For urgent projects, an emergency or expedited HPA permit is required before work can begin, although both Corps and local permits can be granted after the fact for emergencies. However, even for emergency projects, mitigation or removal may be required and project sponsors are encouraged to implement projects that meet the permit criteria to avoid having to remove rock later as part of the mitigation.

References

Anchor QEA, LLC, 2021a. Erosion Management Strategy in Priority Erosion Hazard Areas. Memorandum prepared for the Office of Chehalis Basin, March 31, 2021.

Anchor QEA, LLC, 2021b. Initial Historical Channel Mapping and Floodplain Topography in Priority Erosion Hazard Areas. Memorandum (and maps) prepared for the Office of Chehalis Basin, May 14, 2021.

ATTACHMENT A
EROSION MANAGEMENT WORKGROUP PROCESS

Erosion Management Workgroup Process

To facilitate the development of this proposed erosion management program, a workgroup representing multiple Chehalis Basin stakeholders and members with expertise in erosion management was convened in November 2021. The workgroup included representatives from the Washington Departments of Ecology and Fish and Wildlife, Quinault Indian Nation, Confederated Tribes of the Chehalis Reservation, Thurston County, Grays Harbor County, Lewis Conservation District, and Grays Harbor Conservation District. The working group generally met monthly with the following goal and program elements as listed below.

Goal: Develop an erosion management program that can be implemented by the Office of Chehalis Basin (OCB) and partners to provide technical assistance and funding to both public and private landowners to reduce erosion damages (both current and future) and manage high rates of erosion to protect infrastructure and high-value structures and land uses while also protecting and enhancing aquatic habitats.

Program Elements:

1. Provide definitions of emergency and non-emergency projects.
2. Develop eligibility criteria and prioritization for accepting projects into program.
3. Discuss and approve potential pilot projects. Conduct site visits.
4. Discuss erosion management techniques.
5. Discuss cost-sharing.
6. Discuss potential technical advancement studies.
7. Review program framework.

Members of the group met monthly throughout 2022, with two site visits conducted in May to potential pilot project sites. Each element of the program was discussed in at least two of the meetings to provide sufficient time for all workgroup members to provide input and consider each topic and the different perspectives between meetings. Input from outside experts was also sought, such as from counties outside the basin that provide technical assistance to landowners or fund public erosion management projects. This draft memorandum will be reviewed by the workgroup and will incorporate their input.

Key discussion topics included not using the term "emergency" to ensure there is no confusion with local or state-declared emergencies or code language; discussing which agricultural lands could be eligible for the program, and how to incentivize bioengineering and reduce the installation of hard armor in the basin, but still allowing for some flexibility with very urgent issues. As learned from the pilot projects, if too much rock is included in the bioengineering elements it can be difficult or not possible to obtain permits.

The cost-sharing topic was explored extensively with the workgroup and whether it should be required for project funding. Advantages include landowners having more personal investment in maintaining erosion management solutions over the long term, ability to use on-site materials and equipment when available, and allowing program funds to be stretched to more projects. Disadvantages include administrative burden to receive and use funds, bias towards wealthier landowners with match available, and difficulty in verifying hardship status for landowners that may need cost-share waivers. Other state programs have trended towards eliminating cost-share requirements in recent years due to the challenges and administrative burdens that do not make cost-sharing a benefit to programs. At this time, OCB does not propose to require a cost-share. Landowners are encouraged to contribute on-site materials or equipment if they are available.

ATTACHMENT B
EROSION MANAGEMENT PILOT PROJECTS

Introduction

As part of the funding that the Chehalis Basin Board allocated towards developing the erosion management program in the 2021–2023 biennium, funds were also available to fund an estimated two to three pilot erosion management projects (designs and/or construction). The pilot projects funded to date are described below. The pilot projects have been very favorably received by project sponsors, stakeholders, and landowners and there is considerably more interest in funding than can be accommodated within the 2021–2023 funding.

Pilot Projects Funded to Date

Cloquallum Creek: Private residence with eroding bank in imminent danger of eroding septic system. Grays Harbor Conservation District agreed to be the project sponsor. This was brought forward for funding in November 2021. Regulatory agencies agreed that it was an emergency situation; the Emergency HPA was approved within 3 weeks and construction occurred in late 2021 to protect the house and septic system during the winter season. The landowner agreed to support a bioengineering approach. The project included rock toe protection with large wood incorporated into the bank and toe and plantings above the toe protection. Overall, the project was approximately 300 linear feet. Mitigation is required to be implemented after the emergency work that includes additional plantings downstream along approximately 400 linear feet. Some of the rock installed may also be removed. Funding was provided by a combination of landowner cost-share, erosion management program funding, and Flood Authority funds.

Cloquallum Creek Pilot Project, before and after stabilization

Note: Photographs courtesy of A. Waldrop, Grays Harbor Conservation District

Port of Grays Harbor Haul Road: An eroding bank along the mainstem Chehalis River near river mile 16 threatens the Port of Grays Harbor Haul Road and the utilities buried in the right-of-way, including the main water pipeline serving the business park. The Chehalis Basin Board directed OCB to provide the Port with $60,000 in funding in their 2021–2023 budget. Erosion happened very rapidly in January 2022, changing this project from long-term planning to urgent/imminent stabilization. Erosion management funding was provided in February 2022 for data collection, alternatives analysis, and design, and the Board directed additional funds for construction in the summer of 2022. The site has been temporarily stabilized as of winter 2022, but further intervention is needed.

Port of Grays Harbor Haul Road, before and after temporary stabilization

Note: Photographs courtesy of Port of Grays Harbor

Satsop River Mile 3.5-4.0: An eroding bank along the lower Satsop River within a portion of a reach funded for reach-scale design through the ASRP with Grays Harbor Conservation District as the project sponsor. ASRP design and permitting is not complete, so construction of the ASRP project is delayed until 2023 or 2024. The landowner was interested in an interim solution to address rapid erosion that eroded away the existing riparian zone and is now eroding through agricultural field. This experimental pilot project installed large-size willow and cottonwood cuttings and poles set back about 20 feet from the bank (to account for ongoing erosion) to rapidly root and grow and provide temporary erosion protection. The project will continue to be monitored for success and survival of cuttings. This was a very low budget approach (<$15,000) funded entirely by the erosion management program.

Satsop River Mile 3.5 Experimental Planting, before and after planting

Note: Photographs courtesy of A. Waldrop at Grays Harbor Conservation District

South Fork Newaukum: A private residence with bank erosion along the right bank of the South Fork Newaukum River occurring within 20 feet of the house. Sediment deposition on the left bank gravel bar across the river has been substantial in the winter of 2021/2022. The erosion program funding provided for design in summer/fall of 2022, and the Chehalis Basin Board subsequently provided direct funding for construction, which was completed in fall 2022.

South Fork Newaukum Pilot Project, before and after stabilization

Note: Photographs courtesy of B. Amrine at Lewis Conservation District

Wildcat Creek Emergency Watershed Protection: Two locations along Wildcat Creek with erosion threatening homes were identified by Grays Harbor Conservation District and Mason Conservation District. Erosion management funds supplemented primary funding by the United Stated Department of Agriculture Natural Resources Conservation Service (USDA NRCS) Emergency Watershed Protection program. The Mason site was completed, but the Grays Harbor site could not be permitted as designed, and the erosion management funds were used to provide temporary stabilization while the Grays Harbor Conservation District works on an alternative design.

ATTACHMENT C
EROSION MANAGEMENT TECHNIQUES

Introduction

A number of guidance documents and state and local regulations and codes are currently available to Chehalis Basin landowners and jurisdictions. The existing documents and codes were reviewed by Anchor QEA (2020) for applicability to the Chehalis Basin and this erosion management program. Table C-1 summarizes bioengineering techniques and their advantages and disadvantages. The following narrative also briefly describes the types of techniques summarized in Table C-1 and more recent techniques used in the pilot projects funded to date by this program (Appendix B).

Bioengineering Techniques

Fabric Stabilization Materials: A variety of biodegradable fabric materials are available to be used in combination with native vegetation plantings (described in Table C-1) and wood or other natural materials. Jute and coir (coconut fiber) fabrics are widely available and come in various weaves and thicknesses that minimize surface erosion (such as from rainfall/runoff) and can provide erosion resistance to stream forces over typically a short-term basis (up to 5 years) until vegetation can become established and provide longer term bank stabilization. Coir logs are also available that prevent surface runoff of soil and provide some limited toe protection in low velocity areas.

Plantings: A variety of plants and planting methods can be used to provide bank and slope stabilization, including plantings of cuttings, bare-root, potted stock, or seeding; brush mattresses; fascines (bundles of live cuttings buried in the slope); or brush layers. Brush mattresses, fascines, and brush layers can incorporate both live and dead branches and cuttings and are layered and fastened onto bank slopes, buried in trenches, or partially backfilled to fill in holes and slumps. The cuttings are intended to root close to the water table and sprout for rapid cover and stabilization. These techniques can also be used in combination with fabric and large wood materials. Willow and cottonwood pole fencing can also be used to protect the toe of banks or planted farther upslope or on floodplains to rapidly grow to provide roughness to slow down and deflect flows.

Large Wood Materials: Many variations of wood structures can be installed in-channel, at or above the toe of bank, or in the floodplain to deflect flows, provide toe protection, reduce velocities and scour, and spread flows out on the floodplain. Techniques include live cribs, log toes, and log deflectors that provide scour protection along the toe of a slope and/or deflect flows away from the bank. Engineered log jams in-channel can split flows, deflect flows, and reduce velocities. Buried or surface large wood and fencing on floodplains can reduce velocities of flow across the floodplain and collect debris and promote sediment deposition, while providing a hard point to slow erosion farther back into the floodplain. On bank slopes, log revetments and terraces can be used to stabilize soils and reduce erosion above the toe. These techniques are more effective and provide greater habitat benefits if combined with native plantings.

Excavation and Grading Activities: Bank erosion can also be reduced in some cases by grading back the bank to a more stable slope that can then be vegetated or terraced and vegetated. If space and access are available (such as across the stream from an eroding bank), excavating or reconnecting flows into former side channels or through chutes in adjacent gravel bars will more effectively spread flow and lower velocities along the eroding bank, allowing vegetation to become established. These alternate flow paths may not persist for more than a few years but can allow vegetation to become established to more effectively resist erosion in the future. Removing fill or other materials that may have artificially confined the channel or floodplain can also reduce velocities.

References

Anchor QEA, LLC, 2020. Local Actions Program Near-Term Technical Analyses for Office of Chehalis Basin: Summary and Evaluation of Potential Bank Protection Strategies. Memorandum prepared for the Office of Chehalis Basin, October 23, 2020.

Table C-1
Potential Bioengineering Techniques for the Chehalis Basin

TREATMENT CATEGORY	TECHNIQUE	DESCRIPTION	STREAM SIZE	EROSIVE ENERGY	ADVANTAGES	DISADVANTAGES
Fabric Stabilization	Coir Logs	Cylindrical fabric "logs" that may be composed of coir (coconut husk) fibers bound within a mesh net or bound together with twine to place as mini terraces on a slope to trap sediment, which encourages plant growth within the fiber roll	Small Streams to Large Rivers	Low to Moderate	• Forms mini terraces on a streambank • Captures sediment from rainfall/runoff and stream flows • Protects cuttings planted above from lower velocity toe erosion • Enhances conditions for natural colonization of native vegetation • Appropriate where exposed streambanks are threatened by high flows prior to vegetation establishment • Composed of biodegradable materials	• Not suitable for high velocity sites unless used in combination with wood toe protection placed below the coir logs • Not appropriate where scour and undercutting can undermine the coir logs • Expensive for large sites • Limited to the slope above base flow levels • Should not be used on slopes that are too steep to be stable
	Fabric Encapsulated Lifts	Constructed soil lifts (up to 1-foot high) encapsulated with fabric (such as coir), with live cuttings installed in each layer	Small Streams to Large Rivers	Low to Moderate	• Allows rapid establishment of willows and other vegetation on fully fabric-covered terraces • Composed of biodegradable materials only	• Only lasts 3 to 5 years, and relies on plant establishment for long-term success
	Erosion Control Blanket	Biodegradable, open-weave blankets that provide temporary cover and support for establishing vegetation on bare soil areas	Small Streams to Medium Rivers	Low	• Excellent for reducing surface erosion • Composed of biodegradable materials	• Expensive for large sites • Requires numerous wood stakes or live stems to secure the blanket • Blankets are easily damaged or pulled free from their stakes
Live Plantings	Brush Mattress	Combination of live stakes, live bundles, and non-living branch cuttings installed to cover and physically protect streambanks; eventually to sprout and establish numerous individual plants	Small Streams to Medium Rivers	Low to Moderate	• Forms an immediate protective cover on slopes • Captures sediment during rainfall events and flood flows • Protects cuttings while they root and grow • Rapid growth • Enhances conditions for colonization of other native vegetation	• Limited to the slope above water levels • Will not resist high velocity flows
	Live Stakes	Live, woody cuttings that are tamped into the soil to root, grow, and create a living root mat that stabilizes the soil by reinforcing and binding soil particles together, and can provide rapid cover	Small Streams to Large River	Low to Moderate	• Quickly and inexpensively establishes riparian vegetation • Applicable at low or high bank sites • Appropriate for repair of small earth slips and slumps that are frequently wet • Can be used to stake down surface erosion control materials • Enhances conditions for colonization of other native vegetation	• Requires toe protection where toe scour is anticipated • Only effective where the water table is high enough for cuttings to reach it • Not effective in high velocity sites without wood toe protection
	Live Fascines	Dormant branch cuttings bound together into long, log-like cylindrical bundles and placed in shallow trenches on slopes to reduce erosion and shallow sliding	Small Streams to Medium Rivers	Low to Moderate	• Effective stabilization technique for streambanks, requiring a minimum amount of site disturbance • Applicable at low or high bank sites • Captures sediment from rainfall/runoff • Enhances conditions for colonization of native vegetation	• Requires toe protection where toe scour is anticipated • Not appropriate for treatment of slopes undergoing mass movement • Not effective in high velocity sites as a toe protection technique
	Brush Layering/ Branch Packing	Alternate layers of live branches and compacted backfill, which stabilize and revegetate slumps and holes in streambanks	Small Streams to Large Rivers	Low to Moderate	• Beneficial where streambank has already scoured out • Enhances plant colonization • Provides soil reinforcement	• Not effective in larger slump areas
	Rooted Stocks	Any tree, woody shrub, or herbaceous plant with established roots, including rooted cuttings, balled and burlap, bare-root, and containerized plants	Small Streams to Large Rivers	Low to Moderate	• May be used for planting during the growing season when unrooted cuttings may not survive • Useful on upslope sites above water table • Good as supplemental plantings where native vegetation already exists • Rooted stock provides immediate vegetative cover and habitat improvement	• Relatively high cost compared to cuttings • Even with established roots, rooted stock at some sites may require irrigation for one or more seasons

TREATMENT CATEGORY	TECHNIQUE	DESCRIPTION	STREAM SIZE	EROSIVE ENERGY	ADVANTAGES	DISADVANTAGES
	Herbaceous Cover	Consists of planted or seeded herbaceous vegetation used to improve soil and bank stability and provide rapid cover for wildlife habitat and site aesthetics	Small Streams to Large Rivers	Low to Moderate	• Relatively rapid protection against surface erosion (several weeks) • Applicable as a stand-alone treatment on a streambank that has a relatively stable toe but has poor vegetative cover and possibly some surficial erosion or modest, reach-based aggradation • May also be an excellent choice as ground cover in parks and urban areas where flood conveyance and ease of maintenance is important	• Cannot be used as the primary method to control major bank erosion problems • Due to the relatively shallow rooting depths of grasses, this treatment is not very resistant to scour • Does not provide significant shade or cover to the stream, thus only minimally improving fish habitat
	Willow Fencing	Short fence or wall built of living cuttings that may have a brush layer base intended to slow and redirect floodwaters away from a bank or floodplain area	Small Streams to Medium Rivers	Low to Moderate	• Can reduce slope angle, providing a stable platform for vegetation to establish • Willow fences trap sediment and also protect vegetation growing lower on the slope • Willow fences provide support for small shallow translational or rotational failures	• Significant quantity of plant material is required • Only applicable lower on banks near the water table
Large Woody Materials	Live Cribwall	Box-like interlocking arrangements of untreated log or timber members with or without rootwads, filled with alternate layers of soil material and live branch cuttings that root and gradually take over the structural functions of the wood members	Small Streams to Large Rivers	Low to High	• Effective in high velocity areas • Appropriate both above and below the water, where the channel is not incising • Provides toe protection to the streambank in areas with near vertical banks where bank sloping options are limited • Affords a natural appearance, immediate protection, and accelerates the establishment of woody species • Effective on outside of bends of streams where high velocities are present	• Relatively expensive • Structure may have only limited ability to adjust to toe scour • Should be used with plantings to stabilize the upper bank • Site must be accessible to heavy equipment
	Log Toe	Logs with root masses attached, placed in and on streambanks to provide streambank erosion, trap sediment, and improve habitat diversity; often includes boulders for ballast (can be buried in the bank)	Small Streams to Large Rivers	Low to Medium	• Can be anchored with pilings, boulders, streambed cobble, or wedged through existing trees • Will tolerate high velocity and shear stress if well anchored • Provides cover and typically forms scour pools and gravel deposition • Can be combined with riparian plantings and other treatments	• Site must be accessible to heavy equipment • Relatively expensive
	Large Wood Deflector (i.e., Bank Barb)	Wood structures that protrude from either streambank, but do not extend entirely across a channel, to deflect flows away from the bank and scour pools by constricting the channel and accelerating flow	Creek to Large River	Low to High	• Can tolerate high velocity and shear stress • Works best in series and if used on alternating banks can produce a meandering thalweg and associated structural diversity • Provides cover and typically forms scour pools and promotes gravel deposition	• Should be combined with vegetative plantings to stabilize upper banks/slopes • Relatively expensive • Not very suitable in sand bedded areas • Site must be accessible to heavy equipment • Response must be carefully considered during design to avoid exacerbating erosion to adjacent properties or damaging existing habitat features
	Engineered Log Jam	Structures composed of large woody materials installed in the channel to redirect flows	Creek to Large River	Low to High	• Can tolerate high velocity and shear stress if well anchored • Can be anchored with pilings, streambed cobble, boulders, or wedged through existing trees • Can provide substantial benefits to stream habitat complexity by promoting scour pools and gravel deposition	• Site must be accessible to heavy equipment • Relatively expensive • Response must be carefully considered during design to avoid exacerbating erosion to adjacent properties

TREATMENT CATEGORY	TECHNIQUE	DESCRIPTION	STREAM SIZE	EROSIVE ENERGY	ADVANTAGES	DISADVANTAGES
	Buried Wood	Buried large wood, typically rootwad logs installed on the floodplain in an excavated trench to limit for future channel migration	Creek to Large River	Low to Medium	• Does not require working in the channel, minimal environmental impacts	• Site must be accessible to heavy equipment • Relatively expensive • Directed towards future erosion trends, does not immediately reduce erosion
	Floodplain Roughness and Fencing	Combination of timber pilings and other woody materials buried into the floodplain to limit meander migration and accumulate additional woody material as bank erosion occurs	Creek to Large River	Low to High	• Helps recruit additional large wood, creating a more natural feature • Effective in a range of energy environments	• Site must be accessible to heavy equipment and have room for excavation and installation • Directed towards future erosion trends, does not immediately reduce erosion
	Tree Revetment	Whole trees cabled together and held in place with rock or other anchors buried in the bank	Creek to Large River	Low to Medium	• Relatively inexpensive • Slows and deflects high bank velocities, limits toe erosion • As it collects sediment and begins to revegetate, it becomes more natural in appearance and function • Can provide cover for aquatic species	• Cables and other anchor materials are seen as non-natural and may not be desired • Has a limited life and must be replaced periodically. Loss of trees through damage or deterioration will expose the bank to the current. If revetment is not repaired, bank will continue to undercut and erode.
	Log Terracing	Anchored and/or buried logs on slope to stop surface erosion on eroding slopes	Creek to Large River	Low	• Logs create terraces reducing length and steepness of slope, provides stable areas for establishment of other vegetation such as trees and shrubs	• Labor intensive and with potential safety hazards on steep slopes
	Bank Shaping or Benching	Regrading streambanks to a stable slope (e.g., 2:1 or flatter), or excavating a bench above ordinary high water. Intended to be seeded and planted. May need fabric protection on exposed soils.	Small Streams to Large Rivers	Low	• Applicable at low or high bank sites • Successful on streambanks where moderate erosion and channel migration are anticipated • Enhances conditions for colonization of native species	• Additional toe reinforcement may be necessary • Must be used in conjunction with other planting and soil surface protection
Grading Activities	Reconnection of Side Channel	Excavating to promote flow into an existing or constructed side channel to reduce energy acting on an adjacent eroding bank	Small to Large River	Low to High	• Promotes natural processes • May not require any additional bank stabilization measures	• Site must be accessible to heavy equipment • Can be higher in cost if extensive channel excavation is required • Only suitable for locations with existing channels or swales or low floodplain • Is not a permanent solution because channel may naturally block off
	Gravel Bar Chute	Excavating one or more channels through an adjacent gravel bar (e.g., on opposite bank) to reduce energy acting on an eroding bank	Small Streams to Large Rivers	Low to High	• Cheap and relatively simple approach • May not require any additional bank stabilization measures	• May only reduce energy over short term (1 to 5 years) • Site must be accessible to heavy equipment
	Removal of Fill	Removing fill from channel or floodplain to create more room for the river and promote natural stream processes	Small Streams to Large Rivers	Low to High	• Removes confining fill or hillslopes that are causing high velocities and erosion • May not require any additional bank stabilization measures	• Site must be accessible to heavy equipment • Need a disposal site for these materials