

Scott Boettcher

From: Scott Boettcher
Sent: Tuesday, July 3, 2018 2:13 PM
To: 'Trent Lougheed'
Cc: colronjanaverill@comcast.net
Subject: City of Chehalis - Flood Storage Master Plan Phase II
Attachments: Flood Authority Funding Request - City of Chehalis - Flood Storage Master Plan Phase II; RE: Flood Authority Funding Request - City of Chehalis - Flood Storage Master Plan Phase II; RE: Flood Authority Funding Request - City of Chehalis - Flood Storage Master Plan Phase II; RE: Flood Authority Funding Request - City of Chehalis - Flood Storage Master Plan Phase II

Thank you Trent. Your proposal (4 emails with attachments) has been rec'd on time.
Scott

Scott Boettcher, Staff
Chehalis River Basin Flood Authority
360/480-6600
scottb@sbgh-partners.com

Scott Boettcher

From: Trent Lougheed <tlougheed@ci.chehalis.wa.us>
Sent: Tuesday, July 3, 2018 11:57 AM
To: Scott Boettcher
Subject: Flood Authority Funding Request - City of Chehalis - Flood Storage Master Plan Phase II
Attachments: City of Chehalis - Flood Storage Basin - 2019-21 Local Flood Relief Project Recruitment Form 6-12-2018 V.2.docx; Chehalis Flood Storage Master Plan - Phase II Scope of Work - June 2018.pdf; Section A.pdf; Section B.pdf; Summary Report_15070-12_Flood Storage Master Plan Phase 1.pdf

Scott,

Here you go. Let me know if you need anything else.

Trent

P.S. I have one or two more good projects, but wanted to prioritize in case there were a lot of applications. If all of the funding is not requested, or if the USEDAs provides a lot of match money (per our conversation this morning), make sure to let me know if you extend the application period.

P.S.S. Due to file sizes, I will be sending a few emails.



**2019-21 Local Projects Recruitment Form
Chehalis Basin Local Flood Relief**

A. What are local flood relief projects? -- In general, local projects provide predominantly localized, quantifiable benefit, are capable of being completed within the funding cycle, are supported by the jurisdiction within which the project is proposed, and are vetted and advanced through a public entity like a City, County, Conservation District, Port, etc. Local projects are additionally envisioned as helping with local flood relief (reducing flood damage and impacts), not adverse to fish, wildlife, or habitat, and (where possible) providers of multiple, quantifiable benefits (per Part IV below).

B. What kinds of local flood relief projects are likely to be logical funding candidates for 2019-21?

- Projects that complete an effort previously funded/started.
- Projects that advance improved emergency response.
- Projects that advance improved public infrastructure protection.
- Projects that advance improvements in local or community flood hazard reduction, including local flood proofing projects (e.g., elevations, buy-outs, foundation venting, etc.).
- Projects that advance Conservation District initiated flood hazard reduction (e.g., farm pads, evacuation routes, bank erosion/bank stabilization, etc.)
- Projects that demonstrate innovation (e.g., thinking beyond traditional bank stabilization techniques in favor of natural system designs), partnerships, cost-sharing/leveraging resources, multiple benefits, public engagement and community planning, and proactive vetting with agencies and tribes.
- Projects that demonstrate informed decision-making through hydraulic analysis/understanding.
- Projects that demonstrate early planning involvement, information exchange with regulatory agencies.
- Projects typically not in excess of \$3M for the stage/phase being funded.

C. Are there projects that would not be good candidates?

- Projects that seek to utilize State Capitol Budget dollars for uses not typically allowed (e.g., maintenance and repair work, cost-sharing under select circumstances, etc.).
- Projects likely to increase potential for flood damage upstream or downstream.
- Projects with unmitigable adverse environmental impacts, significant uncertainty regarding potential environmental impacts, or significant concerns about obtaining regulatory approval.
- Projects not sponsored by a public entity.
- Projects not located in the Chehalis Basin.
- Projects that do not show quantifiable benefit.

Instructions:

- a. Please submit project requests (via this form) to scottb@sbgh-partners.com no later than 5:00 p.m., 7/03/2018.
- b. Please submit one request form for each project proposed, even past projects previously or partially funded.
- c. Note: Parts III and IV [marked by "(**)"] will be scored for review/evaluation. Parts I, II, and V will not be scored.
- d. See Appendix A for overview of 2019-21 Local Projects Recruitment Process (and schedule), or https://www.ezview.wa.gov/site/alias_1492/37282/2019-21-Local-Projects-Recruitment-Process.aspx.



Part I General	
1. Date:	June 21, 2018
2. Project Name:	NE Hwy 6 Sub-basin Flood Storage and Habitat Enhancement Master Plan – Phase II
3. Project Location -- Please identify location of the project as precisely as possible, including providing decimal degree latitude/longitude coordinates.	156 acre basin located between the Chehalis River and Louisiana Avenue, and between Highway 6 and Airport Road in Chehalis, WA
4. Project Contact -- Please identify who will be responsible for overseeing and managing the project (i.e., name, email, telephone number, etc.).	Trent J. Lougheed, P.E. tlougheed@ci.chehalis.wa.us (360) 345-2227
5. Sponsor -- Please identify the sponsor, lead organization, primary entity, etc. responsible for this project. Please identify key partners responsible for assisting in delivery or implementation of project.	City of Chehalis

Part II Description, Timing, and Cost	
6. Project Description -- Please describe the project, what is intended to be accomplished, the benefits to be accrued (flood hazard reduction and otherwise) and to whom. Please also identify what phase/stage of the project funding is being sought for (e.g., planning, preliminary engineering, final design and permitting, construction, etc.).	<p>The Master Plan will include evaluation of the potential flood storage volume within this area to determine the resultant reduction of the flood stage nearby, estimate storage volumes, estimate cost to construct, determine required permitting, and determine environmental impacts and mitigation. Schematic plans will be provided with the method of controlling flood waters entering and exiting the flood storage facility.</p> <p>Phase I of the master plan, funded by the Flood Authority, was completed in June 2017. The initial efforts were focused on data gathering, preliminary design and staging options, and environmental evaluation to determine the level of SEPA documentation required.</p> <p>The proposed Scope of Work for Phase II of the plan includes all elements to develop the Flood Storage Project to completion. The effort outlined below will complete the Flood Storage Project to an approximate 30% design level:</p> <p>Data development:</p>



	<ul style="list-style-type: none"> • Piezometer installation and monitoring to determine ground water levels • Geotechnical test pits and soils/groundwater elevation analysis <p>Construction staging options:</p> <ul style="list-style-type: none"> • Planning-level staging layouts • Hydraulic modeling provided by Watershed Science and Engineering (WSE) • Utility determination and mapping • Property acquisition staging • Planning-level conceptual earthwork volumes • Conceptual inlet and outlet design with operational and maintenance options • Planning-level cost estimates <p>Environmental screening:</p> <ul style="list-style-type: none"> • Wetland delineation • Wetland mitigation options • Habitat restoration opportunities • Critical areas analysis • Contact with the US Army Corps of Engineers for Section 404 of the Clean Water Act • Contact W.S. Ecology for Section 401 of the Clean Water Act (Water Quality Certification) • Endangered Species Act (ESA) investigation; consultation with NOAA Fisheries and USFWS • Draft Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife • Draft Shoreline Substantial Development Permit • Draft SEPA Checklist to determine if the project has significant environmental impacts and requires an Environmental Impact Statement. <p>Concepts for development of an interpretive area:</p> <ul style="list-style-type: none"> • Parking lot • Trails • Interpretive signing <p>Once the master plan is completed, implementation would commence with completion of the environmental documentation for the total project and a staging plan/agreement for an iterative process to develop property acquisition activities and construction plans.</p>
7. Project Timeline -- Please describe the timeline and	Phase I of the Master Plan was completed in June, 2017.



<p>phases for completion of the overall project and describe the timeline for completion of the phase to be funded by 19-21 funding.</p>	<p>Phase II will commence immediately after funds become available. The Master Plan would be completed by June 30, 2020 (12 months).</p>
<p>8. Project Cost and Funding -- What is the cost of the overall project (or anticipated cost)? What is the cost of the phase to be funded by 19-21 funding? What are the on-going maintenance and operation requirements and costs? Is it clear who will be responsible for covering on-going maintenance and operation costs?</p>	<p>Phase II Costs: (Phase I completed: \$25,000)</p> <p>Consultant Fees= \$469,091 (see attached scope) Env. Review/Permitting: \$18,900 (by Lewis County)</p> <p><u>Total Requested 19-21 Funding: \$487,991</u></p> <p>As this funding application is for a Master Plan (Planning/Design document), maintenance costs are not applicable.</p>
<p>9. Other Funding -- Please explain the extent to which other funding sources, funding partners are available for this phase and any other phase of the project.</p>	<p>No other funding sources are available at this time (for the Master Plan). However, the United States Economic Development Administration (USEDA) has indicated that they may be able to fund a large portion of the property acquisition and construction with undesignated disaster mitigation funds. <u>The Master Plan will aid greatly in obtaining other funding sources for project implementation.</u></p> <p><u>Additionally, if this project is awarded, the USED A representative indicated that supplemental funding can be applied for and awarded at 50% of the cost with a letter of obligation from the Flood Authority for Phase II of the Master Plan. This additional funding would pay for 50% of the Scope of Work identified within this application, and any additional remaining funds being able be used to progress with final design or property acquisition (if identified in the application to the USED A).</u></p> <p>The City is highly dedicated to this project. The City will be providing significant staff time and effort during the development of this project, and the City owns a significant portion of the land within the basin. The City will be dedicating a large portion of these properties to the project in perpetuity.</p> <p>Also, the City has recently adopted an ordinance allowing for a fee-in-lieu-of the Compensatory Excavation requirements of the City's Zero-Rise Ordinance. This "Compensatory Excavation Bank" will provide funds for future flood reduction/storage projects</p>



	within the City, and is intended to be a "revolving fund" for basin projects, understanding current funding sources are not guaranteed to be available in the long term.
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Part III (**) Completion, Doability, Alternatives, and Impacts	
10. Project Completion -- Does the funding requested complete, substantially complete, or continue a project already started? If so, please explain.	Yes, absolutely. The Flood Authority previously provided \$25,000 to complete Phase I of the Master Plan utilizing unspent funds that were undesignated in the 2015-2017 budget cycle. The requested funding would complete the Master Plan, which will then be utilized to acquire funding for property acquisition, final design, and implementation.
11. Project Doable -- Can this project or the stage/phase for which funding is sought be completed by June 30, 2021? Please describe any circumstances with potential to impact the project's doability or timeline (e.g., permitting or regulatory unknowns, lack of availability of other cost-share funding resources, etc.). Please describe any advance coordination or vetting with agencies, tribes, other entities, etc. and the outcomes of that effort.	Yes, absolutely. The City has assurances with the consultant selected for the project that this effort can commence as soon as authorization is provided, and will be completed within 12 months (to be completed by the end of June, 2020). The consultant has previously discussed the project with multiple agencies/entities during Phase I development, and discussions will continue throughout the development of the plan. Overall, conceptual support has been provided by: <ul style="list-style-type: none"> • Chehalis Tribe • U.S. Army Corps of Engineers • NOAA Fisheries • W.S. Department of Ecology • U.S./W.S. Fish & Wildlife • U.S. Environmental Protection Agency
12. Project Alternatives -- Please describe alternatives to the project that were considered (including doing nothing), and the rationale for selecting the project described, proposed here.	"Do nothing" is really the only alternative to this project. The Master Plan will address phasing of development of the flood storage basin (addressing obstacles such as reluctant property owners), however, this is a unique area within the City limits where a large scale flood reduction/mitigation project can be realized within a "feasible" cost.
13. Project Impacts Avoided, Mitigated -- Please identify how project impacts will be avoided and	This project is strictly providing large-scale flood storage and wildlife/aquatic species habitat enhancement.



mitigated, and if that mitigation will be accomplished by June 30, 2021?	The main objective of this project is to reduce the flood levels on the Chehalis River, preventing as much damage to private and public property as possible. The “essence” of this project is solely following the goals and objectives of the Flood Authority and the Office of the Chehalis Basin.
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Part IV (**) Benefits Stated and Quantified	
14. Emergency Response Benefits -- Please describe (and quantify) how this project enhances emergency response in a flood emergency (e.g., does it keep critical access roads and transportation facilities open/functional, does it enable easy movement of cattle, equipment and farm chemicals out of harm's way, is it part of a larger hazard mitigation plan, etc.).	Upon implementation, the project is intended to reduce flood elevations within the Chehalis River Basin by providing a very large flood storage area (that will also enhance fish and wildlife habitat). This would result in lower river levels and increased road access for emergency vehicles during flood events. The decrease in flood elevations will also increase the safety and access for local farms and their livestock.
15. Essential Infrastructure Protection Benefits -- Please describe (and quantify) how this project protects essential infrastructure and the risks or consequences of not acting this funding cycle.	Reduction in floodwater elevations in the area of the proposed basin will aid in protection of the City of Chehalis Wastewater Treatment Plant, as well as the Chehalis-Centralia Airport (capable of being an Emergency Operations Center); both being essential public facilities.
16. Public Health, Safety and Welfare Benefits -- Please describe (and quantify) how this project protects public health, safety, and welfare.	Reduction in floodwater elevations within the sub-basin would result in lower river levels and increased road access for safe travel/evacuation during flood events, as well as preventing flood damage of structures and property. Reduction in floodwater elevations will also help prevent a catastrophic breach of the City's Wastewater Treatment Plant which could result in raw sewage discharging into the river.
17. Residential, Commercial and/or Agricultural Protection Benefits -- Please describe (and quantify) how this project protects residential communities, commercial, and/or agricultural interests and benefits of acting (or consequences of not acting) this funding cycle. Consider factors like number of structures and people at risk, historic frequency of flood damage, magnitude of benefit for the cost, etc.	The estimated zone of influence benefiting from the reduction of floodwater elevations will be determined during the development of the hydraulic model in the Master Plan. Therefore, it is not possible to accurately calculate these factors at this time.
18. Habitat Benefits – Please describe (and quantify) how this project benefits or improves existing or	The project will include 156 acres of increased habitat for native wildlife and aquatic species. The restoration of



<p>future habitat conditions.</p>	<p>all disturbed lands within the sub-basin will be completed in a manner that provides the most benefit to native wildlife and aquatic species as possible.</p> <p>The conceptual habitat restoration design will be developed as part of the proposed Master Plan.</p>
<p>19. Costs and Benefits – Project funders (and the public they represent) value cost-effective, sound funding decisions. To that end, please describe (and quantify) in general terms benefits gained for funds requested and frequency, time-scale benefits will be realized. Please also describe (and quantify):</p> <ul style="list-style-type: none"> a. Funds requested. b. Costs avoided if funded (and on what frequency, time-scale). c. Costs incurred if funded (and on what frequency, time-scale). d. Benefits gained if funded (and on what frequency, time-scale). e. Impacts incurred if funded (and on what frequency, time-scale). f. Impacts and implications of not funding (and on what frequency, time-scale). <p>Guidance Note (1): For this question, it will be helpful to think in terms of what will be the dollar value of assets protected, dollar value of impacts avoided, dollar value of monies retained or recouped, etc. for the amount of public monies invested.</p> <p>Guidance Note (2): Part V is intended to help project reviewers concisely summarize, compare funding requests. Answers here (and in related questions on this form) should be consistent with Part V.</p>	<p>The sooner the project is funded, the greater the likelihood of implementation prior to the next significant flood event. Since this Master Plan will help identify the extent of assets protected, it will be the tool that helps identify the overall benefits gained, including frequency and time-scale.</p>
<p>20. Other Project Benefits -- Please describe (and quantify) any other project benefits not already discussed. This could include how this project compliments, leverages, or implements another project or planning process already underway.</p>	<p>Shoreline Management Act promotes public access and recreation within areas of SMA jurisdiction. The proposed site restoration, with trails and interpretive signing will be a public benefit, as it will provide public recreation opportunities within a shoreline area. This phase will include planning for recreation opportunities.</p>
<p>21. Anything Else -- Please offer any additional information (e.g., photos, maps, video, drawings, drone, etc.) that would help to better understand the scope, timing, and benefits of this project.</p>	<p>Attached to this application is a detailed Scope of Work provided by the consultant that completed Phase I of the Master Plan. Phase I of the Master Plan (funded by the Flood Authority) is also attached to this application, which includes a detailed overview of the project with</p>



mapping and schematic level details of the project.

Part V
Summary of Benefits, Impacts, Costs

	22. Benefits – Please summarize, tally project economic and non-economic benefits as described.	23. Impacts -- Please summarize, tally project economic and non-economic impacts as described.	24. Costs -- Please summarize, tally project economic and non-economic costs as described.
Quantify	Since this Master Plan will identify the extent of assets protected, it will be the tool that identifies the overall benefits gained, including frequency and time-scale.	As this application is for a planning effort, this section is not applicable.	Total Project Cost for Master Plan: <u>\$487,991</u>
Describe	Reduction of flood elevations results in: <ul style="list-style-type: none"> • Reduced roadway flooding • Less residential and commercial property damage • Protection of Essential Facilities 	As this application is for a planning effort, this section is not applicable.	As this application is for a planning effort, this is the total cost of the project. Implementation costs will be estimated during the development of the plan, including final design, land acquisition, and construction costs.

Appendix A

Process/Schedule Overview
(current as of 6-12-2018)

June 12, 2018	<ul style="list-style-type: none"> • Post and distribute local projects recruitment request. • Allow three weeks for project proposals/submittals (i.e., due no later than 5:00 p.m., Tuesday, July 3, 2018). • Due to Scott Boettcher, scottb@sbgh-partners.com.
July 3, 2018	<ul style="list-style-type: none"> • Receive proposals/submittals.
July 5, 2018 (or July 12, 2018)	<ul style="list-style-type: none"> • Update Chehalis Basin Board on numbers received, types of projects received, distribution, dollar value, etc.
July 19, 2018 (or August 16, 2018)	<ul style="list-style-type: none"> • Update Flood Authority on numbers received, types of projects received, distribution, dollar value, etc.
September 20, 2018	<ul style="list-style-type: none"> • Update Flood Authority on status of Projects Committee's effort to



	review, rank, discuss with Tribes, discuss with agencies, sort and rank, etc. • Review/discuss PRELIMINARY DRAFT ranked and prioritized list.
October 4, 2018	• Update Chehalis Basin Board on status of Projects Committee's effort to review, rank, discuss with Tribes, discuss with agencies, sort, and rank, etc. • Review/discuss DRAFT ranked and prioritized list.
October 18, 2018 (SPECIAL MEETING)	• Seek Flood Authority approval of FINAL ranked and prioritized list.
November 8, 2018	• Seek Chehalis Basin Board approval of FINAL ranked and prioritized list.
June 2018 through November 2018	• Work with agency, OCB, and CBB technical staff on refining and finalizing recruitment instrument, scoring criteria, scoring instrument, categorization, and ranking, developing draft and final lists, etc.

Legend:

Chehalis Basin Board	Flood Authority
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EXHIBIT A
SCOPE OF WORK

Prepared for:

CITY OF CHEHALIS
FLOOD STORAGE MASTER PLAN PROJECT

June 26, 2018

The City of Chehalis has retained Skillings Connolly, Inc. (Consultant) to provide professional services to assist in preparation of a Flood Storage Master Plan for that area of the City between the Chehalis River and Louisiana Ave., south of Airport Road and north of Highway 6, an area about 150 acres. The Master Plan includes evaluation of the potential flood storage volume within this area to determine the resultant reduction of the flood stage nearby, estimated storage volumes, estimates of cost to construct, determination of required permitting, and determination of environmental impacts and mitigation. Stage construction of the project will be outlined and the information above for each stage provided so that a work schedule can be matched with available funding. Schematic plans will also be provided along with method of controlling flood waters entering and exiting the flood storage facility. Existing grade will be modeled based on LiDAR information or potentially new aerial topographic study if LiDAR for the entire site is not available.

This Scope of Work includes all elements to develop the Flood Storage Project to completion. Due to funding constraints, the Flood Storage Project will need to be developed in phases. The initial efforts will be focused on data gathering, preliminary design and staging options, and environmental evaluation to determine the level of SEPA documentation required. Tasks include:

- Data development, to include:
 - Piezometer installation and monitoring to determine ground water levels
 - Geotechnical test pits and soils/groundwater elevation analysis by HWA GeoSciences or Landau
- Construction staging options, to include:
 - Planning-level staging layouts
 - Hydraulic modeling provided by Watershed Science and Engineering (WSE)
 - Utility determination and mapping
 - Property acquisition staging
 - Planning-level conceptual earthwork volumes
 - Conceptual inlet and outlet design with operational and maintenance options
 - Planning-level cost estimates
- Environmental screening, to include:
 - Wetland delineation
 - Wetland mitigation options
 - Habitat restoration opportunities
 - Critical areas analysis
 - Contact with the US Army Corps of Engineers
 - Section 404 of the Clean Water Act
 - Contact with Ecology
 - Section 401 of the Clean Water Act
 - Endangered Species Act (ESA) investigation leading to consultation with NOAA Fisheries and USFWS.
 - Draft Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife

- Draft Shoreline Substantial Development Permit from the City of Chehalis
- DRAFT SEPA Checklist for City use in determining if the project has significant environmental impacts and requires an Environmental Impact Statement.
- Concepts for development of an interpretive area, to include:
 - Parking lot
 - Trails
 - Interpretive signing

The effort outlined above will complete the Flood Storage Project to an approximate 30% design level. The next steps will be completion of the environmental documentation for the total project and a staging plan/agreement for an iterative process to develop property acquisition activities and construction plans.

Assumptions

- LiDAR data from the Puget Sound LiDAR Consortium website will be used for initial design and field verified in the field as necessary
- The City will be the lead agency for all SEPA (or NEPA) environmental documentation
- Completion of the Flood Storage Master Plan Project will occur from approximately June 30, 2019 to June 30, 2020.

Task 10 Project Management

Tasks:

1. Peer/Principal review
2. Progress Reports/Invoicing
3. Project scheduling
4. Meetings
5. Coordination with sub- consultants
6. Project management and coordination

Deliverables:

- Monthly invoices and earned value reports

Task 20 Data Development – Ground Water Level

Assumptions:

- Base maps from the Master Plan Preliminary Project will be used and refined as necessary
- Assumed excavation level is 160' NAVD 88 as defined in the Master Plan Preliminary Project
- Assumed excavation level will be confirmed by piezometer analysis and geotechnical test pits

Tasks:

1. Place piezometers on City owned properties, up to 10 locations, and monitor to determine approximate ground water level. Adjust for seasonal differences. (Skillings Connolly and well drilling contractor)
2. Test pits by geotechnical firm to verify soil types

Deliverables:

- Ground water level to be used in hydraulic modeling
- Soils typing for use in stage develop design

Task 30 Flood Storage Volume Calculations
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Assumptions:

- Flood storage for two options are required:
 - Option 1 Berm elevation 184.5 feet (approximately 1.5 feet above the highest 100-year flood elevation), bottom elevation 160 feet (NAVD 88)
 - Option 2 Berm elevation 179 feet (approximately 1.5 feet above the highest 2-year flood elevation), bottom elevation 160 feet (NAVD 88)
- The 160-bottom elevation is assumed to be above the highest ground water level to be defined in Task 20; if the highest ground water level is above elevation 160 another bottom elevation will be required
- The City does not currently own all the properties in the planned 150+ acre site; therefore, berm construction and flood storage will be developed in stages

Tasks:

1. Provide a preliminary layout of flood storage area for Options 1 and 2; consider highest ground water level in bottom elevation assumption
2. Prepare a Civil 3D model and calculate excavation and storage volumes using Civil 3D for Options 1 and 2
3. Calculate berm construction quantities for Options 1 and 2
4. Prepare order of magnitude cost estimate for Options 1 and 2
5. Review with City to reach agreement on:
 - a. Choice of options or proceed to hydraulic modeling with both
 - b. Choose up to four (4) staging alternatives for project development
6. Prepare a Civil 3D model and calculate excavation and storage volumes using Civil 3D for the staging alternatives
7. Calculate berm construction quantities for staging alternatives
8. Prepare order of magnitude cost estimate for staging alternatives

Deliverables:

- Civil 3D models of:
 - Total project Option 1
 - Total project Option 2
 - Staging alternatives
- Excavation and storage volumes for:
 - Total project Option 1
 - Total project Option 2
 - Staging alternatives
- Order of magnitude excavation and berm construction costs for:
 - Total project Option 1
 - Total project Option 2
 - Staging alternatives

Task 40 Inlet/Outlet Design Concepts

Assumptions:

- Inlet and outlet designs are required for Option 1 and 2
- Outlet designs will be needed for each staging alternative, assumes inlet unchanged from Option 1 and 2

Tasks:

1. Research alternative methods for inlet and outlet controls for flood storage facility
2. Provide discussion of potential methods for inlet and outlet control to include
 - a. Sketches
 - b. Sizes and locations for Option 1 and 2
 - c. Sizes and locations for staging alternatives
 - d. Flood storage operation for Option 1 and 2 and staging alternatives

Deliverables:

- Memorandum outlining:
 - potential alternatives for inlet and outlet controls for Option 1 and 2
 - potential alternatives for inlet and outlet controls for staging alternatives
 - description of flood storage operation for all options and alternatives

Task 50 Hydraulic Analysis of Options and Alternatives

Assumptions:

- Hydraulic analysis will be provided by Watershed Science and Engineering, Inc. (WSE)
- WSE assumptions:
 - Option 1 and 2 geometries will be based on ground surface contours provided by Skillings Connolly. The berm geometry will include flow inlets and outlets (with sizes defined by Skillings Connolly) to provide hydraulic connections between the flood storage and the Chehalis River.
 - The potential for groundwater to partially fill the flood storage area will not be considered, thus assuming that the full volume of the excavated area will be available for flood storage.
 - Options seek to maximize flood storage during the 100-year flood. Results of the 2-year and 10-year flood simulations will also be examined to understand potential flood impacts of the project during smaller flood events.
- WSE will use the RiverFlow2D hydraulic model developed for the Chehalis River Basin Flood Authority (CRBFA).
- Note: WSE current scope and budget (gated 8/25/17 only account for Option 1 and Option 2 hydraulic modeling; hydraulic modeling for staging alternatives, if desired, will need to be negotiated (current budget may also requires updating because it is more than 60-days old)

Tasks:

1. Provide coordination with hydraulic modeling sub-consultant WSE
2. WSE will use the RiverFlow2D hydraulic model developed for the CRBFA to:

- a. Run the existing condition model to simulate the 2-year, 10-year, and 100-year flood. Results will represent baseline conditions for impact assessment.
 - b. Create an “Option 1” model by updating the existing condition model geometry to represent the proposed Option 1 ground conditions.
 - c. Create an “Option 2” model by updating the existing condition model geometry to represent the proposed Option 2 ground conditions.
 - d. Run the Option 1 and Option 2 models to simulate the 2-year, 10-year, and 100-year flood.
 - e. Compare peak water surface elevations under Options 1 and 2 with baseline conditions to determine impacts at the WWTP location or in adjacent reaches of the Chehalis River model.
3. Alternatives refinement:
 - a. WSE will work with Skillings Connolly to refine inlet and outlet configurations for each option.
 - b. Results of initial model runs will be used to inform modifications to the location and geometry of river and storage area connections in order to maximize project flood benefit.
 - c. WSE will update and re-run the hydraulic model up to two (2) times for each option to improve inlet and outlet connections.
 4. Draft and Final impacts letter:
 - a. WSE will provide Skillings Connolly with a brief draft letter report to document the methods and results of the hydraulic investigation. Results will include figures detailing water surface impacts along the project site and:
 - i. Extending downstream to Mellen Street and
 - ii. Upstream to the confluence with the Newaukum River.
 - b. Skillings Connolly and City review.
 - c. WSE will incorporate any comments and provide final letter

Deliverables:

- Draft impacts letter for City review
- Final Impacts letter

Task 60 Dam Safety Requirements
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Assumptions:

- Washington State Department of Ecology Dam Safety Office has jurisdiction of flood control projects that retain 10 Acre-feet or more of water
- DOE jurisdiction comes from the Flood Control Act (1935) RCW 86.16
- A construction permit from DOE is required; the permit requires:
 - DOE approval of the project plans and specifications
 - DOE approval of a Construction Inspection Plan
- DOE will also require:
 - An Operation and Maintenance Plan
 - An Emergency Action Plan

Tasks:

1. Coordinate with the City and DOE Dam Safety office on required documents
2. Submit plans and specifications for DOE review and approval
3. Prepare Construction Inspection Plan
4. Prepare Operation and Maintenance Plan
5. Prepare Emergency Action Plan

Deliverables:

- Plans and specifications acceptable to DOE Dam Safety Office
- Construction Inspection Plan
- Operation and Maintenance Plan
- Emergency Action Plan

Task 70 Flood Storage Plans and Specifications

Assumptions:

- Washington State Department of Ecology Dam Safety Office will require their approval of the plans and specifications for the flood storage dike and inlet/outlet structures
- DOE approved plans and specifications will be required for:
 - Option 1 or 2 or both depending on staging
 - Each staging alternative as they are constructed

Tasks:

1. Prepare plans for the flood storage dike and inlet/outlet structures
 - a. Option 1 or 2 or both depending on staging
 - b. Each staging alternative as they are constructed
2. Prepare specifications meeting DOE requirements for options and staging alternatives.
3. Modify specifications for each construction project as needed while maintaining DOE requirements

Deliverables:

- Plans and specifications for the flood storage dike and inlet/outlet structures
 - Option 1 or 2 or both depending on staging
 - Each staging alternative as they are constructed

Task 80 Habitat Enhancement and Interpretive Area
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Assumptions:

- The City plans to use the project site as an opportunity for public use and understanding of area habitats
- Environmental mitigation from Task 120 may be an opportunity for interpretation
- A small parking area is desired
- Interpretive trails and signing are desired
- Restrooms are not included
- Interpretive parking, trails, and signing may be inundated during Chehalis River flooding

Tasks:

1. Develop alternative habitat enhancement features program
2. Provide alternative schematic phase designs for park features
3. Provide parking plan for up to ten (10) cars
4. Develop trail plan
5. Develop interpretive sign ideas and plans

Deliverables:

- Full build out parking, trail, and interpretive signing plans
- Staging plans for parking, trail, and interpretive signing plans to match project staging

Task 90 Existing and Proposed Utilities**Assumption:**

- City will provide as-built utility maps
- Existing wells within the flood storage area will need to be capped per DOE regulations
- Parking and interpretive area will not be lighted

Tasks:

1. Provide an overview of the existing utilities (water, sewer, drainage, septic, CTV, power, gas, etc.) to determine which will be removed, relocated or replaced.
2. Determine need for new utilities to serve proposed flood storage facility
3. Prepare plans for utilities work in staging alternatives

Deliverables:

- List of utilities that are affected
- Plans for utilities work in staging alternatives
- As-built utility locations

Task 100 Cost Estimates**Assumptions:**

- Cost estimates will be required for:
 - Total project Option 1
 - Total project Option 2
 - Staging alternatives
 - Interpretive area parking, trails, signing

Tasks:

1. Prepare estimate for:
 - a. abandonment of existing utilities,
 - b. demolition of buildings and roads,
 - c. excavation and construction of dikes,
 - d. flood control inlet/outlet controls and equipment,
 - e. interpretive area parking, trails, and signing.

Deliverables:

- Detailed Preliminary Cost Estimate for:
 - Total project Option 1
 - Total project Option 2
 - Flood storage staging alternatives
 - Interpretive area parking, trails, signing

Task 110 Environmental Screening

Assumptions:

- The City will be the lead agency for all SEPA (or NEPA) environmental documentation
- NEPA documentation may be an advantage if any Federal monies are expected or received in the future
- Interested/involved parties to environmental documentation may be:
 - Chehalis River Basin Flood Authority (CRBFA)
 - The Chehalis Tribe
 - US Army Corps of Engineers (USACE)
 - US Coast Guard (if Chehalis River here is considered navigable)
 - US Environmental Protection Agency (EPA, for any hazardous materials in area)
 - US Fish and Wildlife Service
 - NOAA Fisheries
 - Washington State Department of Archeology and Historic Preservation (DAHP)
 - Washington State Department of Ecology (WSDOE)
 - Washington State Department of Fish and Wildlife (WSDFW)
- If it is determined through SEPA Checklist review that the proposed project does not have a significant impact, it is assumed that the City will issue a Determination of Non-significant impact (DNS) or if proposed mitigation alleviates significant impacts, the City will issue a Mitigation DNS.

Tasks:

1. Perform wetlands survey to determine wetlands extent, classification, and impacts within the total project area (assumes we may need right of entry on private properties)
2. Determine if Clean Water Act Section 404 Permit for any fill in wetlands, or Clean Water Act Section 401 Permit may be required
3. Determine if there are Endangered Species in the project area, possible consultation with:
 - US Fish and Wildlife Service
 - NOAA Fisheries
 - WSDFW
4. Contact DAHP for any registered sites in area; seek their requirement for a cultural resource site investigation– Complete EZ-1 Form for submittal to DAHP.
5. Perform cultural resource site investigation (Tierra Right of Way Services), consult with Chehalis Tribe.
6. Determine from WSDOE if there may be hazardous material sites in project area
7. Determine extent of all environmental impacts; complete DRAFT SEPA Checklist for City determination of impact significance.

Deliverables:

- Wetlands survey, classification, and impacts
- Determination of need for Section 404 and Section 401 permits
- ESA determination
- Cultural resources assessment
- Hazardous materials assessment

Task 120 Environmental Impact Mitigation

Assumptions:

- This Task will only be required if the City determines there are significant environmental impacts that must be mitigated, including impacts to Waters of the United States. Waters of the United States includes special aquatic areas as defined by Section 404 of the Clean Water Act.
- Proposed mitigation will be conceptual in nature, at a high enough level to support future permitting with the U.S. Army Corps of Engineers, Department of Ecology, and WDFW. Mitigation planning will not include final PS&E at this time.
- It is assumed that environmental impacts will be associated with proposed disturbance of aquatic resources, which will require mitigation in the form of stream/riparian area enhancement and wetland mitigation.
- Mitigation Plan prepared under this task will be used in support of SEPA review and will be submitted with the SEPA Checklist.
- Data from Task 110 will be used for this Task

Tasks:

1. For any impact determined significant from Task 110 prepare a mitigation plan(s).
 - a. Meet with City staff and affected stakeholders on-site to determine viable mitigation options.
 - b. Prepare Mitigation Plan
2. Review with City for agreement/acceptance
3. Coordinate/consult with resource agencies for their agreement/acceptance of the mitigation plan(s), including the Chehalis Tribe

Deliverables:

- Mitigation plans for significant impacts

Task 130 Environmental Impact Statement (EIS)

The level of potential impact and project support from a number of stakeholders is unknown at this time. If community input or SEPA review determines that the proposed project has significant impacts, the project will be reviewed under a SEPA Environmental Impact Statement. As outlined here, Task 130 represents a roadmap of the level of effort required to complete a Draft and Final EIS.

Assumptions:

- This Task will only be required if the City determines there are significant environmental impacts that cannot be mitigated as defined in Task 42, resulting in a SEPA Determination of Significant Impact (DS), after which a SEPA Environmental Impact Statement (EIS) is required.
- Due to the nature of the EIS process and the need for an EIS Scoping Meeting, a preliminary budget for the following tasks associated with development of the EIS documents has not been included. The budget for completion of the SEPA EIS process will be supplemented to this Scope of Work on City's request.
- Data from Tasks 110 and 120 will be used for this Task
- City will issue a Determination of Significance and Scoping Notice for 28 Day Comment Period
- City will publish and distribute DRAFT and FINAL EIS
- City will issue Notice of Action Taken (NAT)

Tasks:

1. Establish project Purpose and Need.
2. Attend EIS Scoping Meeting with City and affected stakeholders
3. Prepare DRAFT EIS, to include elements for:
 - a. Earth
 - b. Air
 - c. Water –surface water, ground water, runoff including stormwater
 - d. Plants
 - e. Animals
 - f. Energy and Natural Resources
 - g. Environmental health (hazardous materials)
 - h. Noise
 - i. Land and shoreline use
 - j. Housing
 - k. Aesthetics
 - l. Light and glare
 - m. Recreation
 - n. Historic and cultural preservation
 - o. Transportation
 - p. Public services
 - q. Utilities
4. City review DRAFT EIS
5. Make edits from City review
6. City publish DRAFT EIS for review and comment period
7. Collaborate with City for edits and responses to public and agency comments, including Chehalis Tribe
8. Revise Draft EIS with comment responses, resulting in Final EIS
9. City publish FINAL EIS
10. City wait 7 days before taking action, City action
11. City Issue Notice of Action Taken

Deliverables:

- DRAFT EIS for City review
- Edits to DRAFT EIS from City review
- DRAFT EIS for City publication
- Edits and responses to comments
- FINAL EIS for City review
- Edits to FINAL EIS from City review
- FINAL EIS for City publication

Task 140 Public Involvement/Public Outreach**Assumptions:**

- Public meetings will be required for presentation of SEPA documentation/EIS
- City may desire to present project plans to public
- There will be project presentations to the City Council

- Firm will not complete this task unless authorized, along with Task 130 (EIS), by the City. This task can be utilized for project outreach in general, but is described here to highlight the level of Public outreach necessary to complete the SEPA EIS process.

Tasks:

1. Set up public outreach/public outreach program with City
2. Prepare for and attend public meetings and other meetings with City and City Council (up to 10)
3. Provide project display boards for public meeting, up to ten (10)
4. Assist client with providing materials for City web site

Deliverables:

- Public outreach program with City cooperation
- Attendance at ten (10) public or City Council meetings
- Display boards for public meeting, up to ten (10)
- Project materials for City web site
- Memorandum of public outreach/public outreach program

Task 150 Environmental Permitting

Assumptions:

- An appropriate SEPA document has been acted upon by the City
- Environmental permits may be obtained for the total project or for individual stages depending on resource agency requirements

Tasks:

1. Prepare total project JARPA for USCAE Clean Air Act Section 401 and 404 permits, City submit
2. Prepare cultural resources documentation for City submittal to DAHP
3. Prepare Hydraulic Permit Approval for City submittal to WSDFW
4. DRAFT Shoreline Substantial Development Permit for City review and approval

Deliverables:

- JARPA for City submittal
- Cultural resources documentation for City submittal
- HPA documentation for City submittal
- DRAFT Shoreline Substantial Development Permit for City review and approval

Task 160 Property Acquisition

Assumptions:

- It is preferred to follow the US Uniform relocation Act for property acquisitions and relocations to preserve the future ability to utilize federal funds
- City intends to purchase private properties within the project site; probably in stages to match staging alternatives
- All acquisitions will be total takes, relocations will be required
- Property acquisition and relocation assistance services will be provided by Tierra Right of Way Services (Tierra)

Tasks:

1. Determine properties required for each staging alternative
2. City to provide current property owner contacts
3. City to provide current title reports
4. Tierra will provide:
 - a. Property appraisals to include cost of relocations
 - b. Appraisal reviews
 - c. Offer letters for City review and signature
 - d. Negotiation services including recommendations for administrative settlements to City
 - e. Signed negotiation packets to City for payment
 - f. Transfer of ownership recording
 - g. Relocation assistance including recommendations for administrative settlements to City
 - h. Notice to City relocation has been completed and payment due

Deliverables:

- Acquisition plans and legal descriptions
- Property acquisition and relocation services

Task 170 Funding Application Assistance and Meetings**Assumptions:**

- City will require grant writing assistance to obtain project funding

Tasks:

1. Provide assistance to City in order to prepare applications for project funding.
2. Attend meetings with City as requested, ten (10) estimated

Deliverables:

- Grant applications

END SCOPE OF WORK

Prepared by: Gerald E. Smith, PE _____

Reviewed by: Thomas E. Skillings, PE _____

EXHIBIT B-1
CONSULTANT COST COMPUTATION – MAN-HOURS

PROJECT NO: 17127 CITY OF CHEHALIS FLOOD STORAGE MASTER PLAN PROJECT		PRINCIPAL-IN-CHARGE	SENIOR PROJECT MANAGER	SENIOR PROJECT ENGINEER	ENVIRONMENTAL MANAGER	PROJECT SCIENTIST	STAFF SCIENTIST	ENGINEER	TECHNICIAN	SURVEY MANAGER	2 MAN SURVEY CREW	PROJECT ADMINISTRATOR
TASK #	TASK DESCRIPTION											
10	PROJECT MANAGEMENT											
1	Peer/Principal review	80	40									
2	Progress Reports/Invoicing			24								40
3	Project scheduling		4	16								
4	Meetings.		40	40	24	16	16					16
5	Coordination with subconsultants.			40								
6	Project management and coordination		40	40								
20	DATA DEVELOPMENT - GROUNDWATER LEVEL											
1	HWA Geoscience item - Skillings coordination			24		8						
2	Skillings stake 200' grid									8	32	
	HWA Geoscience Tasks											
3	Place piezometers on City-owned properties, up to 10 locations, and monitor to determine approximate groundwater level. Adjust for seasonal differences (Skillings Connolly, Inc. and well drilling contractor).											
4	Test pits by geotechnical FIRM TO VERIFY SOIL TYPES											
30	FLOOD STORAGE VOLUME CALCULATIONS											
1	Provide a preliminary layout storage area for Options 1 and 2; consider highest groundwater level in bottom elevation assumption.		2	8				40				
2	Prepare a Civil 3D model and calculate excavation and storage volumes using Civil 3D for Options 1 and 2.			4				24				
3	Calculate berm construction quantities for Options 1 and 2.			2				16				
4	Prepare order of magnitude cost estimate for Options 1 and 2.			4				16				
5	Review with City to reach agreement on:											
a	Choice of options or proceed to hydraulic modeling with both.		4	4								
b	Choose up to four (4) staging alternatives for project development.		4	4								
6	Prepare a Civil 3D model and calculate excavation and storage volumes using Civil 3D for the staging alternatives.			4				24				
7	Calculate berm construction quantities for staging alternatives.			4				8				
8	Prepare order of magnitude cost estimate for staging alternatives.			4				16				

PROJECT NO: 17127 CITY OF CHEHALIS FLOOD STORAGE MASTER PLAN PROJECT		PRINCIPAL-IN-CHARGE	SENIOR PROJECT MANAGER	SENIOR PROJECT ENGINEER	ENVIRONMENTAL MANAGER	PROJECT SCIENTIST	STAFF SCIENTIST	ENGINEER	TECHNICIAN	SURVEY MANAGER	2 MAN SURVEY CREW	PROJECT ADMINISTRATOR
TASK #	TASK DESCRIPTION											
40	INLET/OUTLET DESIGN CONCEPTS											
1	Research alternative methods for inlet and outlet controls for flood storage facility.		2	8				16				
2	Provide discussion of potential methods for inlet and outlet control to include:											
a	Sketches.		1	2				8				
b	Sizes and locations for Option 1 and 2.		1	2				4				
c	Sizes and locations for staging alternatives.		1	2				4				
d	Flood storage operation for Option 1 and 2 and staging alternatives.		1	2				8				
50	HYDRAULIC ANALYSIS OF OPTIONS AND ALTERNATIVES											
1	Provide coordination with hydraulic modeling subconsultant WSE.		16	16				24				
2	WSE will use the River Flow 2D hydraulic model developed for the CRBFA to:											
a	Run the existing condition model to simulate the 2-year, 10-year, and 100-year flood. Results will represent baseline conditions for impact assessment.											
b	Create an "Option1" model by updating the existing condition model geometry to represent the proposed Option 1 ground conditions.											
c	Create an "Option 2" model by updating the existing condition model geometry to represent the proposed Option 2 ground conditions.											
d	Run the Option 1 and Option 2 models to simulate the 2-year, 10-year, and 100-year flood.											
e	Compare peak water surface elevations under Options 1 and 2 with baseline conditions to determine impacts at the WWTP location or in adjacent reaches of the Chehalis River model.											
3	Alternatives refinement:											
a	WSE will work with Skillings Connolly to refine inlet and outlet configurations for each option.											
	• Extending downstream to Mellen Street.											
	• Upstream to the confluence with the Newaukum River.											
b	Results of initial model runs will be used to inform modifications to the location and geometry of river and storage area connections in order to maximize project flood benefit.											

PROJECT NO: 17127 CITY OF CHEHALIS FLOOD STORAGE MASTER PLAN PROJECT		PRINCIPAL-IN-CHARGE	SENIOR PROJECT MANAGER	SENIOR PROJECT ENGINEER	ENVIRONMENTAL MANAGER	PROJECT SCIENTIST	STAFF SCIENTIST	ENGINEER	TECHNICIAN	SURVEY MANAGER	2 MAN SURVEY CREW	PROJECT ADMINISTRATOR
TASK #	TASK DESCRIPTION											
c	WSE will incorporate any comments and provide final letter.											
60	DAM SAFETY REQUIREMENTS											
1	Coordinate with the City and DOE Dam Safety Office on required documents.		2	4				4				
2	Complete plans and specifications for DOE's review		4	8				60				
3	Prepare Construction Inspection Plan		1	4				16				
4	Prepare Operation and Maintenance Plan.		1	4				16				
5	Prepare Emergency Action Plan.		1	4				16				
70	FLOOD STORAGE PLANS AND SPECIFICATIONS											
1	Prepare plans for the flood storage dike and inlet/outlet structures:											
a	Options 1 or 2 or both depending on staging.			16				40				
b	Each staging alternative as they are constructed.			16				40				
2	Prepare specifications meeting DOE requirements for options and staging alternatives.			8				60				
3	Modify specifications for each construction project as needed while maintaining DOE requirements.			8				16				
80	HABITAT ENHANCEMENT AND INTERPRETIVE AREA											
1	Develop alternative habitat enhancement features program.		4	8	8	8						
2	Provide alternative schematic phase designs for park features.			2		8		16				
3	Provide parking plan for up to ten (10) cars.			2				8				
4	Development trail plan.		4	8	8	8						
5	Develop interpretive sign ideas and plans.		4	8		8						
90	EXISTING AND PROPOSED UTILITIES											
1	Provide an overview of the existing utilities (water, sewer, drainage, septic, CTB, power, gas, etc.) to determine which will be removed, relocated or replaced.		2	8				16				
2	Determine need for new utilities to serve proposed flood storage facility.			8				16				
3	Prepare plans for utilities work in staging alternatives.			8				24				
100	COST ESTIMATES											
1	Prepare estimate for:		4									
a	Abandonment of existing utilities.			2				8				
b	Demolition of buildings and roads.			1				8				
c	Excavation and construction of dikes.			2				8				
d	Flood control inlet/outlet controls and equipment.			4				16				

PROJECT NO: 17127 CITY OF CHEHALIS FLOOD STORAGE MASTER PLAN PROJECT		PRINCIPAL-IN-CHARGE	SENIOR PROJECT MANAGER	SENIOR PROJECT ENGINEER	ENVIRONMENTAL MANAGER	PROJECT SCIENTIST	STAFF SCIENTIST	ENGINEER	TECHNICIAN	SURVEY MANAGER	2 MAN SURVEY CREW	PROJECT ADMINISTRATOR
TASK #	TASK DESCRIPTION											
e	Interpretive area parking, trails, and signing.			2		8	8	8				
110	ENVIRONMENTAL SCREENING											
1	Perform wetlands survey to determine wetlands extent, classification, and impacts within the total project area (assumes we may need right of entry on private properties).				8	40	84					
2	Determine if Clean Water Act Section 404 Permit for a fill in wetlands, or Clean Water Act Section 401 Permit may be required.				8							
3	Determine if there are Endangered Species in the project area, possible consultation with:				2	24	8					
a	US Fish and Wildlife Service.											
b	NOAA Fisheries.											
c	WSDFW.											
4	Contact DAHP for any registered sites in area; seek their requirement for a cultural resource site investigation.					8						
5	Perform cultural resource site investigation (Tierra Right of Way Services), consultant with Chehalis Tribe.		1		4							
6	Determine from WSDOE if there may be hazardous material sites in project area.				2		8					
7	Determine extent of all environmental impacts; complete DRAFT SEPA DNS/Checklist for City determination of impact significance.				2	4	16		8			
8	If City determines there no significant impacts:											
a	City to publish DNS.											
b	City issues Notice of Action Taken (NAT).											
120	ENVIRONMENTAL IMPACT MITIGATION											
1	For any impact determines significant from Task 110, prepare a mitigation plan(s).				8	24	40		16			
2	Review with City for agreement/acceptance.				4	4						
3	Coordinate/consult with resource agencies for their agreement/acceptance of the mitigation plan(s), including the Chehalis Tribe.			16	16	16						
4	City issues a Mitigated Determination of Non-Significance, takes action after appropriate public review period.											
5	City fill issue Notice of Action Taken (NAT)											

PROJECT NO: 17127 CITY OF CHEHALIS FLOOD STORAGE MASTER PLAN PROJECT		PRINCIPAL-IN-CHARGE	SENIOR PROJECT MANAGER	SENIOR PROJECT ENGINEER	ENVIRONMENTAL MANAGER	PROJECT SCIENTIST	STAFF SCIENTIST	ENGINEER	TECHNICIAN	SURVEY MANAGER	2 MAN SURVEY CREW	PROJECT ADMINISTRATOR
TASK #	TASK DESCRIPTION											
130	ENVIRONMENTAL IMPACT STATEMENT (EIS)											
1	Prepare DRAFT EIS, to include elements for:											
a	Earth											
b	Air											
c	Water - surface water, groundwater, runoff including stormwater											
d	Plans											
e	Animals											
f	Energy and Natural Resources											
g	Environmental health (hazardous materials)											
h	Noise											
i	Land and shoreline use											
j	Housing											
k	Aesthetics											
l	Light and glare											
m	Recreation											
n	Historic and cultural preservation											
o	Transportation											
p	Public services											
q	Utilities											
2	City will review DRAFT EIS.											
3	Make edits from City review.											
4	City will public DRAFT EIS for review and comment period.											
5	Collaborate with City for edits and response to public and agency comments, including Chehalis Tribe.											
6	City will publish FINAL EIS.											
7	City will wait 7-days before taking action, City action.											
8	City will issues Notice of Action Taken.											
140	PUBLIC INVOLVEMENT/PUBLIC OUTREACH											
1	Set-up public outreach/public outreach program with City.											
2	Prepare for and attend public meetings and other meetings with City and City Council.											
3	Provide project display boards for public meeting, up to ten (10).											
4	Assist City with providing materials for City website.											
150	ENVIRONMENTAL PERMITTING											
1	Prepare total project JARPA for USCAE Clean Air Act Section 401 and 404 permits for City submittal.											

PROJECT NO: 17127 CITY OF CHEHALIS FLOOD STORAGE MASTER PLAN PROJECT		PRINCIPAL-IN-CHARGE	SENIOR PROJECT MANAGER	SENIOR PROJECT ENGINEER	ENVIRONMENTAL MANAGER	PROJECT SCIENTIST	STAFF SCIENTIST	ENGINEER	TECHNICIAN	SURVEY MANAGER	2 MAN SURVEY CREW	PROJECT ADMINISTRATOR
TASK #	TASK DESCRIPTION											
2	Prepare cultural resources documentation for City submittal to DAHP.											
3	Prepare Hydraulic Permit Approval for City submittal to WSDFW.											
4	DRAFT Shoreline Substantial Development Permit for City review and approval.											
160	PROPERTY ACQUISITION											
1	Determine properties required for each staging alternative.											
2	City to provide current property owner contacts.											
3	City to provide current title reports.											
4	Tierra will provide:											
a	Property appraisals to include cost of relocations.											
b	Appraisal reviews.											
c	Offer letters for City review and signature.											
d	Negotiation services including recommendations for administrative settlements to City.											
e	Signed negotiation packets to City for payment.											
f	Transfer of ownership recording.											
g	Relocation assistance including recommendations for administrative settlements to City.											
h	Notice to City relocation has been completed and payment due.											
170	FUNDING APPLICATION ASSISTANCE & MEETINGS											
1	Provide assistance to City in order to prepare applications for project funding.		8	24								4
2	Attend meetings with City as requested, ten (10) estimated.		32	32								
	HOURS PER DISCIPLINE	80	224	461	94	184	180	604	24	8	32	60

EXHIBIT B-2
CONSULTANT COST COMPUTATION – SUMMARY

NEGOTIATED HOURLY RATE (NHR):					
<u>Classification</u>	<u>Man Hours</u>	<u>X</u>	<u>Rate</u>	<u>=</u>	<u>Cost</u>
PRINCIPAL-IN-CHARGE	80	x	\$230.26	=	\$18,420.83
SENIOR PROJECT MANAGER	224	x	\$187.33	=	\$41,962.39
SENIOR PROJECT ENGINEER	461	x	\$194.76	=	\$89,783.02
ENVIRONMENTAL MANAGER	94	x	\$181.17	=	\$17,029.92
PROJECT SCIENTIST	184	x	\$110.63	=	\$20,355.63
STAFF SCIENTIST	180	x	\$95.78	=	\$17,240.79
ENGINEER	604	x	\$118.13	=	\$71,351.34
TECHNICIAN	24	x	\$102.17	=	\$2,452.02
SURVEY MANAGER	8	x	\$146.87	=	\$1,174.93
2 MAN SURVEY CREW	32	x	\$269.47	=	\$8,622.95
PROJECT ADMINISTRATOR	60	x	\$105.62	=	\$6,336.95
Total Hours =	1951				Total NHR = \$294,730.77
REIMBURSABLES:					
Mileage	1,200	x	\$0.545	=	\$654.00
Miscellaneous Expenses	\$1,537.00	x	10%	=	\$1,690.70
					Total Expenses= \$2,344.70
SUBCONSULTANT COST (See Exhibit G):					
HWA GeoSciences	\$83,860.00	x	10%	=	\$92,246.00
WATERSHED	\$18,750.00	x	10%	=	\$20,625.00
Tierra ROW	\$15,000.00	x	10%	=	\$16,500.00
					Total Subconsultants = \$129,371.00
SUB-TOTAL (NHR + REIMBURSABLES + SUBCONSULTANTS):					
					Sub Total = \$426,446.47
MANAGEMENT RESERVE FUND:					
SUB TOTAL =	\$426,446.47	x	10%	=	MRF = \$42,644.65
GRAND TOTAL					
			GRAND TOTAL	=	\$469,091
<div> <div> PREPARED BY: <u>Gerald E. Smith, PE</u> </div> <div> DATE: <u>06/26/2018</u> </div> </div> <div> <div> REVIEWED BY: <u>Thomas E. Skillings, PE</u> </div> <div> DATE: <u>06/26/2018</u> </div> </div>					

EXHIBIT B-3
CONSULTANT COST COMPUTATION – EXPENSES

Item	Description	Basis	Quantity	Rate	Total
1	Telephone	Month			\$0.00
2	Auto Rental	Each			\$0.00
3	Lodging	Day			\$0.00
4	Per Diem-Meal	Day			\$0.00
5	Photo Copies - Blk & White	Each	100	\$0.10	\$10.00
6	Photo Copies - Color	Each	20	\$0.35	\$7.00
7	Half Sized Prints	Each	40	\$0.50	\$20.00
8	Full Sized Prints	Each		\$6.00	\$0.00
9	Postage	Month			\$0.00
10	Shipping	Month			\$0.00
11	FAXs	Each			\$0.00
12	Miscellaneous Project Costs	Month			\$0.00
13	Miscellaneous Survey Costs	Estimated	1	\$1,500.00	\$1,500.00
14	Traffic Control	Estimated			\$0.00
	Total Miscellaneous Expenses				\$1,537.00
	Mileage	Per Mile	1200	0.545	\$654.00
	Total Expenses				\$2,191.00
Assumptions					
1	Telephone	Estimated			
2	Auto Rental	Estimated trips			
3	Mileage	Estimated miles			
4	Lodging				
5	Per Diem-Meal				
6	Photo Copies - Blk & White	Estimated			
7	Photo Copies - Colored	Estimated			
8	Half Sized Prints				
9	Full Sized Prints				
10	Postage	Estimated			
11	Shipping	Estimated			
12	FAXs	Estimated			
13	Miscellaneous Project Costs	Estimated			
14	Miscellaneous Survey Costs	Estimated			
15	Purchase Order	Estimated			
Prepared by: Gerald E. Smith, PE		06/26/2018			

Section A

Master Plan Report Draft Outline



Project Name:	Chehalis Flood Storage Master Plan – Phase 1				
Project No.:	15070-12				
Date:	6/20/17	By:	K. Hoffer		
Sheet:	Master Plan Outline	Page	1	Of	2

Summary Report Outline

- Executive Summary
- Introduction
 - a. Discussion of flooding issues along the Chehalis
 - b. Background to the work being done
- Initial Plan Development Methodology
 - a. Preliminary planning level calculations only
 - b. Use of LiDAR data
 - c. NRCS soil mapping, no field testholes or borings anticipated at this time
 - d. Assumed excavation depth
- Profile of Study Area and Flood Hazard
 - a. Discussion of FEMA Flood maps
 - b. Discussion of property ownership within the project area
 - c. List of existing utilities within the project area
 - i. Discussion of need for new utilities within the project area
 - ii. Preliminary plans outlining utilities work
 - d. Groundwater information within the project area (well log information)
- Relevant Programs and Regulations
- Critical Areas and Mitigation (environmental screening)
 - a. Discussion of critical areas within the project area*
 - b. Preliminary environmental screening report that identifies:
 - i. Critical habitat
 - ii. Endangered species
 - iii. Other critical environmental components
 - c. Studies and reports needed for the project
 - d. Permits needed for the project
 - e. Coordination with USACOE to discuss the project and solicit their input
 - f. Watershed information*
 - g. Endangered species list*
- Planned Facilities description
 - a. Rough order of magnitude cut/fill volumes*
 - b. Rough order of magnitude storage volumes*
 - c. Alternative inlet/outlet design concept
- Habitat enhancement and park features
 - a. Discussion of habitat enhancement features
 - b. Discussion of conceptual designs for park features
- Flood/River/Basin Modeling
 - a. Modeling Report



Project Name: Chehalis Flood Storage Master Plan – Phase 1

Project No.: 15070-12

Date: 6/20/17

By: K. Hoffer

Sheet: Master Plan Outline

Page 2

Of 2

- b. Hydrologic Modeling methodology
 - c. Up to three alternatives
 - d. Selection of preferred alternative
 - e. Compare results to baseline conditions to determine impact compared to the City's no-rise ordinance
- Cost Estimates
- Public Involvement Efforts
- Construction staging/phasing alternatives
- Next Steps for future phases
- Exhibits
 - a. Existing topography**
 - b. Proposed flood storage area layout**
 - c. Existing utilities*
 - d. Property ownership within project area**
 - e. Soil types**
 - f. Critical area
 - g. Wetlands
 - h. Land features
 - i. Groundwater information
 - j. Endangered plants
- Appendices

* Preliminary work started in Phase 1. Will need to be refined in future phases

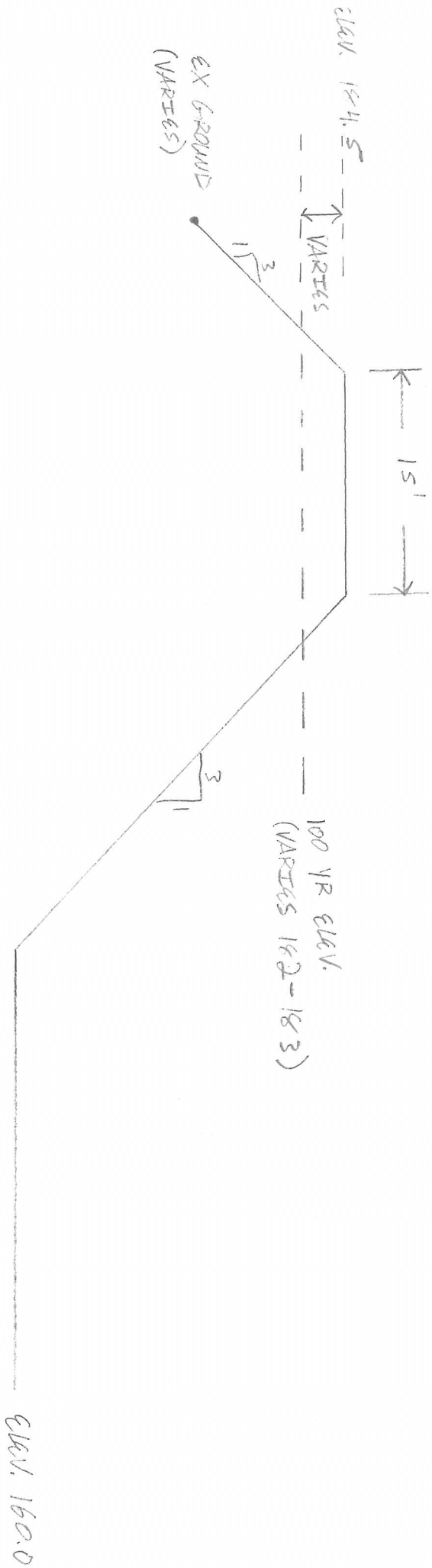
**Completed in Phase 1.

Section B

Cut/Fill/Storage

OPTION 1

15070-15
FLOOD STORAGE
6/12/17
RLH



Cut/Fill Report

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By user: khoffer

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Volume Summary							
Name	Type	Cut Factor	Fill Factor	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Earthworks Volume Surface - Option 1	full	1.000	1.000	6372902.58	2562065.12	378365.46	2183699.66<Cut>

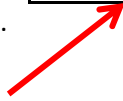
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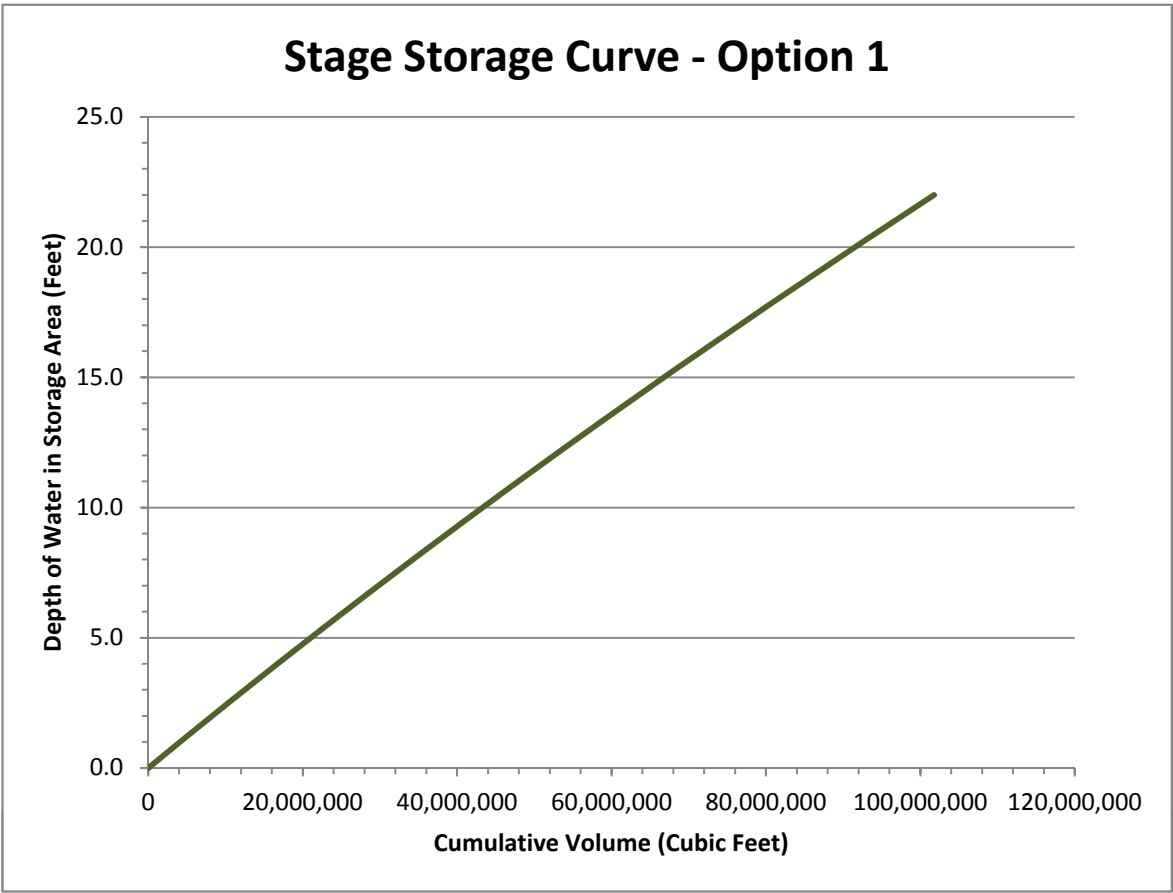
* Value adjusted by cut or fill factor other than 1.0

Storage Volume - Option 1

<i>Elev</i>	<i>Depth</i>	<i>Area (SF)</i>	<i>Stage Volume (CF)</i>	<i>Volume (CF)</i>	<i>Volume (Acre-Ft)</i>
160.0	0.0	4,080,727.60	0.00	0.00	0.00
161.0	1.0	4,131,585.68	4,106,156.64	4,106,156.64	94.26
162.0	2.0	4,180,942.81	4,156,264.24	8,262,420.88	189.68
163.0	3.0	4,230,325.31	4,205,634.06	12,468,054.94	286.23
164.0	4.0	4,279,733.17	4,255,029.24	16,723,084.18	383.91
165.0	5.0	4,329,166.41	4,304,449.79	21,027,533.97	482.73
166.0	6.0	4,378,625.02	4,353,895.71	25,381,429.69	582.68
167.0	7.0	4,428,108.99	4,403,367.00	29,784,796.69	683.77
168.0	8.0	4,477,618.33	4,452,863.66	34,237,660.35	785.99
169.0	9.0	4,527,153.04	4,502,385.69	38,740,046.04	889.35
170.0	10.0	4,576,713.12	4,551,933.08	43,291,979.12	993.85
171.0	11.0	4,626,298.57	4,601,505.85	47,893,484.97	1,099.49
172.0	12.0	4,675,909.39	4,651,103.98	52,544,588.95	1,206.26
173.0	13.0	4,725,545.58	4,700,727.48	57,245,316.44	1,314.17
174.0	14.0	4,775,207.13	4,750,376.35	61,995,692.79	1,423.23
175.0	15.0	4,824,894.05	4,800,050.59	66,795,743.38	1,533.42
176.0	16.0	4,874,606.35	4,849,750.20	71,645,493.58	1,644.76
177.0	17.0	4,924,344.01	4,899,475.18	76,544,968.76	1,757.23
178.0	18.0	4,974,107.04	4,949,225.52	81,494,194.28	1,870.85
179.0	19.0	5,023,895.43	4,999,001.23	86,493,195.51	1,985.62
180.0	20.0	5,073,709.20	5,048,802.32	91,541,997.83	2,101.52
181.0	21.0	5,123,548.34	5,098,628.77	96,640,626.60	2,218.57
182.0	22.0	5,176,010.23	5,149,779.28	101,790,405.88	2,336.79

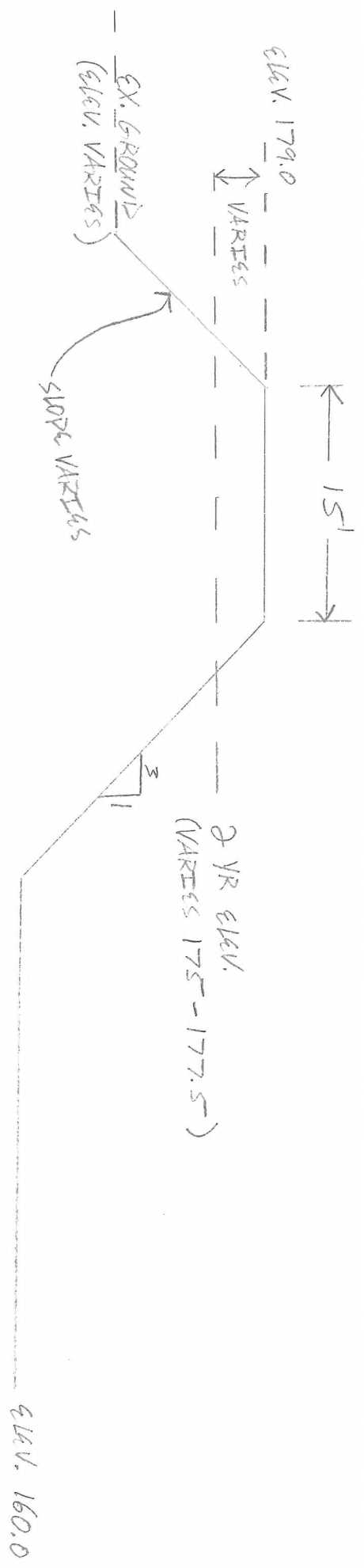
Approx.
100 Yr
Flood
Elev.





OPTION 2

15070-1+
FLOOD STORAGE
6/21/17
KLH



Cut/Fill Report

Generated: 2017-06-21 13:46:54

By user: khoffer

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Volume Summary							
Name	Type	Cut Factor	Fill Factor	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Earthworks Volume Surface - Option 2	full	1.000	1.000	6022712.23	2713509.11	114626.84	2598882.27<Cut>


Totals				
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Total	6022712.23	2713509.11	114626.84	2598882.27<Cut>

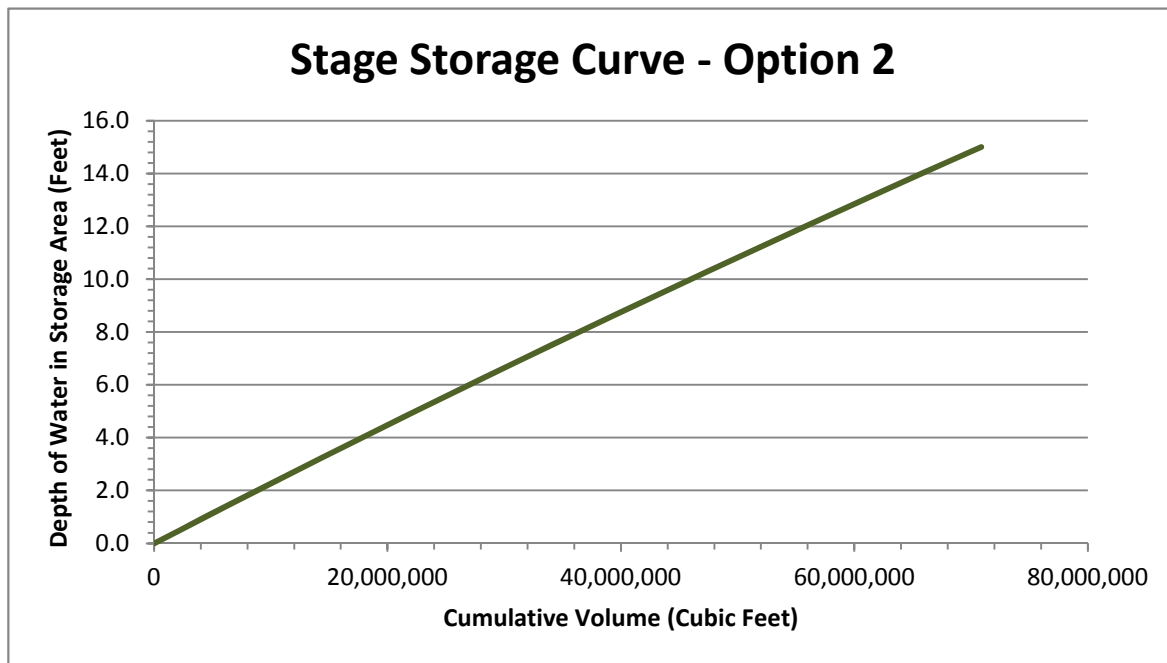
* Value adjusted by cut or fill factor other than 1.0

Storage Volume - Option 2

<i>Elev</i>	<i>Depth</i>	<i>Area (SF)</i>	<i>Stage Volume (CF)</i>	<i>Volume (CF)</i>	<i>Volume (Acre-Ft)</i>
160.0	0.0	4,349,841.48	0.00	0.00	0.00
161.0	1.0	4,400,449.75	4,375,145.61	4,375,145.61	100.44
162.0	2.0	4,450,181.19	4,425,315.47	8,800,461.08	202.03
163.0	3.0	4,499,941.25	4,475,061.22	13,275,522.30	304.76
164.0	4.0	4,549,729.95	4,524,835.60	17,800,357.90	408.64
165.0	5.0	4,599,547.27	4,574,638.61	22,374,996.50	513.66
166.0	6.0	4,649,393.22	4,624,470.24	26,999,466.74	619.82
167.0	7.0	4,699,267.79	4,674,330.50	31,673,797.25	727.13
168.0	8.0	4,749,171.00	4,724,219.39	36,398,016.64	835.59
169.0	9.0	4,799,102.83	4,774,136.91	41,172,153.55	945.18
170.0	10.0	4,849,063.28	4,824,083.05	45,996,236.61	1,055.93
171.0	11.0	4,899,052.37	4,874,057.83	50,870,294.43	1,167.82
172.0	12.0	4,949,070.08	4,924,061.23	55,794,355.66	1,280.87
173.0	13.0	4,999,116.42	4,974,093.25	60,768,448.91	1,395.05
174.0	14.0	5,049,191.39	5,024,153.91	65,792,602.82	1,510.39
175.0	15.0	5,099,294.99	5,074,243.19	70,866,846.01	1,626.88

Approx. 2
Yr Flood
Elev.





Section C

Flood Elevation Information

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevation** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevation (BFEs) shown on this map apply only landward of 0.0' National Geodetic Vertical Datum (NGVD). Users of this FIRM should be aware that coastal flood elevations may also be provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map is Universal Transverse Mercator (UTM) zone 10. The **horizontal datum** is NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit their website at www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by the Lewis County Department of Public Works.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

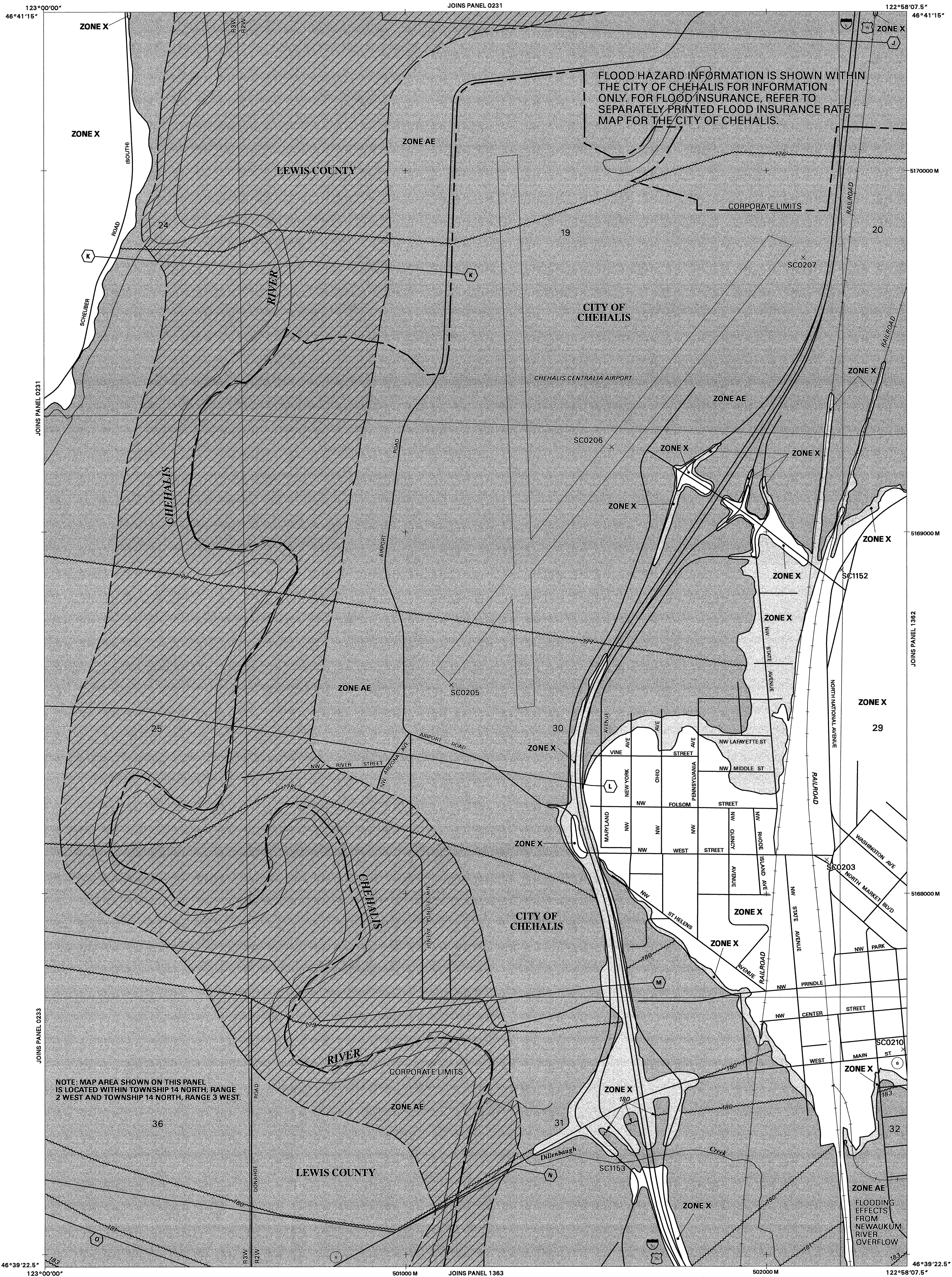
Please refer to the separately printed **Map Index** for an overview map showing the layout of map panels for this jurisdiction.

An accompanying Flood Insurance Study report, Letters of Map Revision or Letters of Map Amendment revising portions of this panel, and digital versions of this PANEL may be available. Contact the **FEMA Map Service Center** at the following phone numbers and Internet address for information on all related products available from FEMA:

Phone: 800-358-9616
FAX: 800-358-9620
www.fema.gov/msc

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at www.fema.gov.

This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report may reflect stream channel distances that differ from what is shown on this map.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently deteriorated. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood event.

ZONE A99 Area to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no base flood elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Legend Symbols:

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or velocities.
- Base Flood Elevation line and value; elevation in feet*
- Base Flood Elevation value where uniform within zone; elevation in feet*

***Referenced to the National Geodetic Vertical Datum of 1929**

Legend Symbols:

- Cross Section Line
- Transect Line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid values, zone 10
- 5000-foot grid ticks
- Bench mark (see explanation in Notes to Users section of this FIRM panel).
- River Mile

MAP REPOSITORY

Division of Public Services, 350 North Market Boulevard, Chehalis, WA 98532-2626 (Maps available for reference only, not for distribution.)

INITIAL IDENTIFICATION

NOVEMBER 29, 1974

FLOOD HAZARD BOUNDARY MAP REVISIONS

NOVEMBER 29, 1977

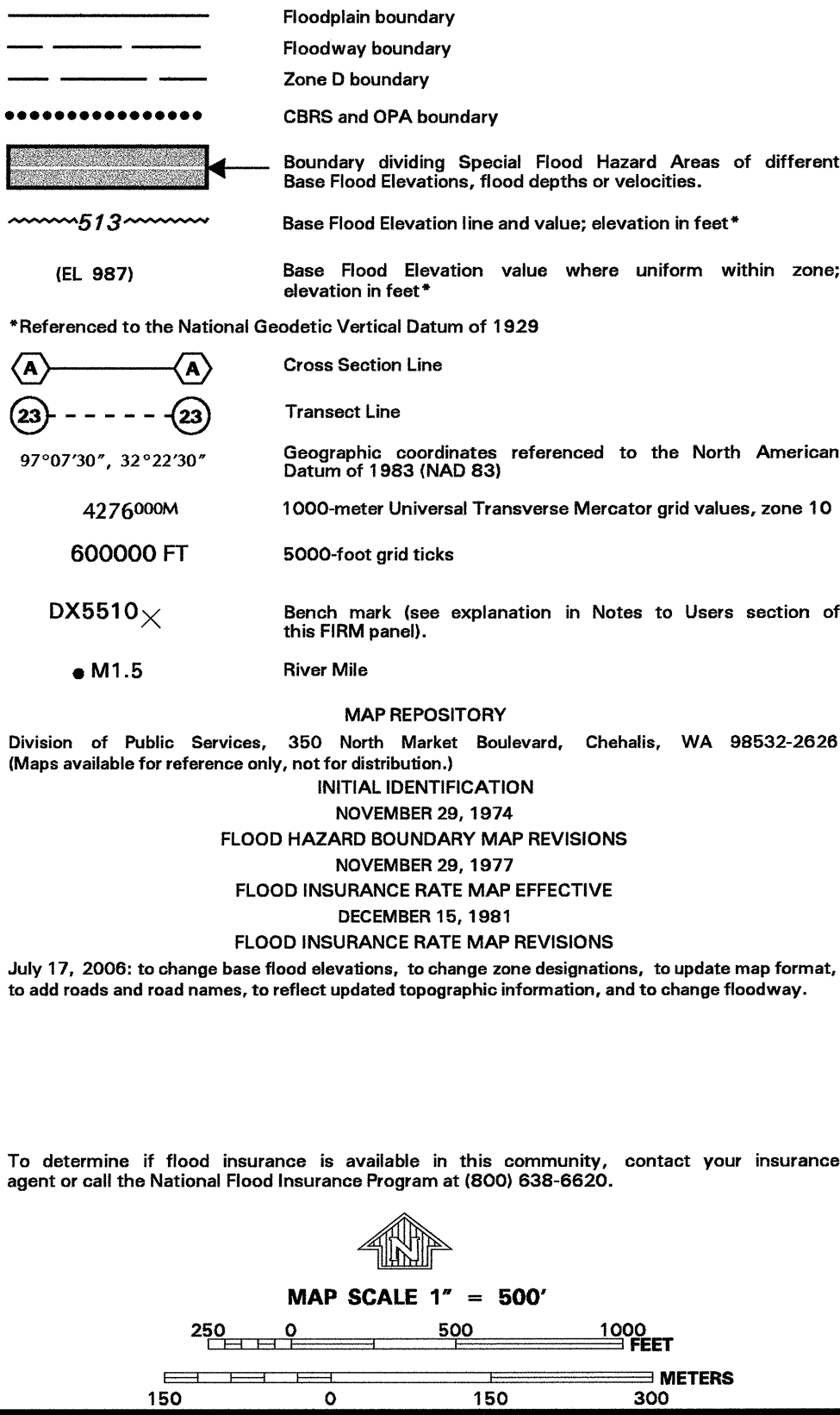
FLOOD INSURANCE RATE MAP EFFECTIVE

DECEMBER 15, 1981

FLOOD INSURANCE RATE MAP REVISIONS

July 17, 2009: to change base flood elevations, to change zone designations, to update map format, to add roads and read names, to reflect updated topographic information, and to change floodway.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1361C

FIRM

FLOOD INSURANCE RATE MAP

LEWIS COUNTY, WASHINGTON

(UNINCORPORATED AREAS)

PANEL 1361 OF 2500

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

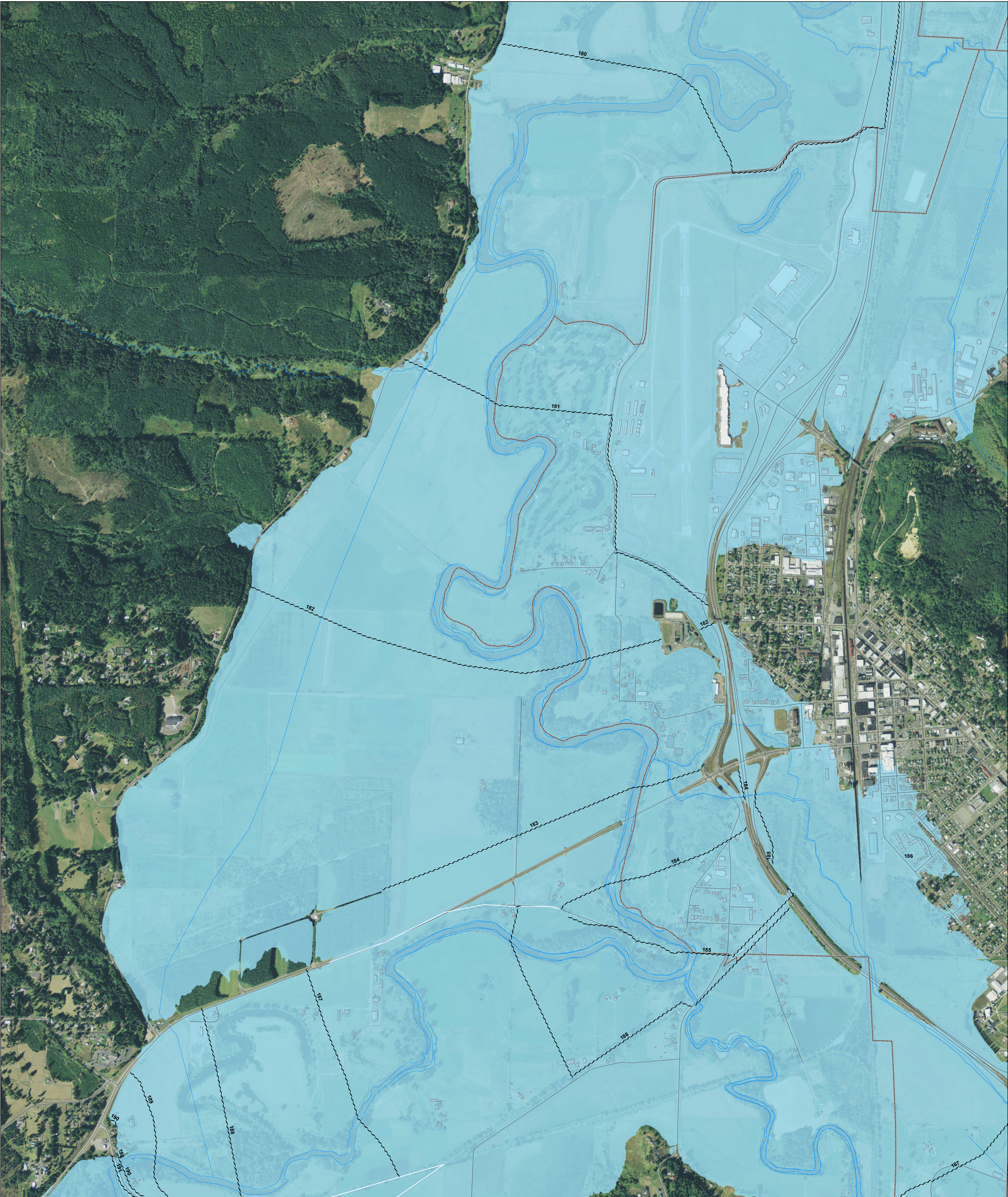
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LEWIS COUNTY, UNINCORPORATED AREAS	530102	1361	C

MAP NUMBER
5301021361C

MAP REVISED:
JULY 17, 2006

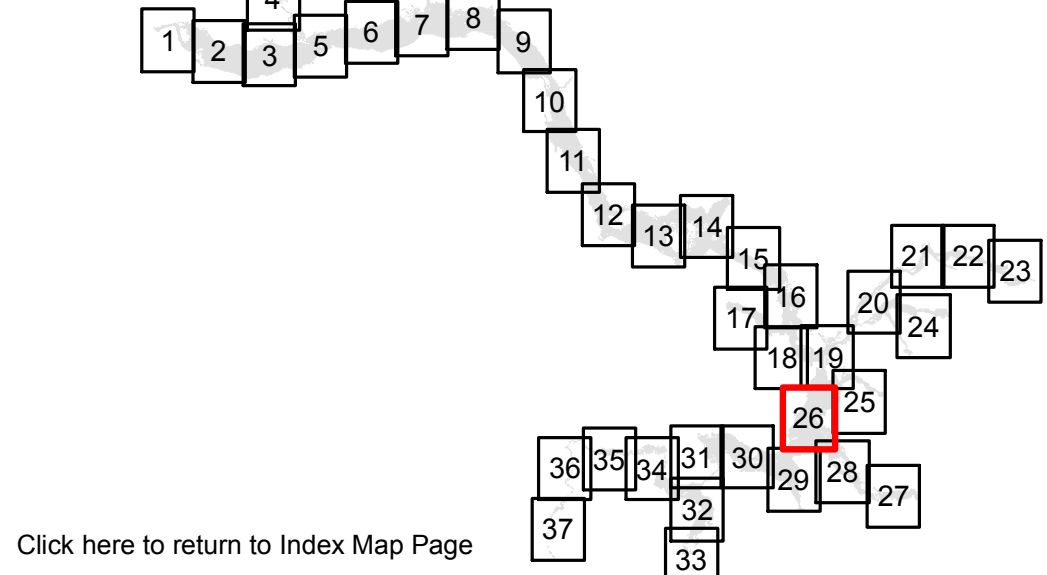
Federal Emergency Management Agency



Legend

- Structures in Structure Survey Database (WSE 2014)
- Roads
- Corporate Boundary
- Rivers and Streams
- 100-year Base Flood Elevation (ft, NAVD88)
- 100-Year Floodplain
- Orthophoto source: USDA-APFO NAIP 2013

Index



[Click here to return to Index Map Page](#)



1 inch = 500 feet
0 250 500 1,000 Feet

Coordinate System: NAD 1983 HARN
StatePlane Washington South FIPS 4602 Feet

Chehalis River Basin Inundation Map

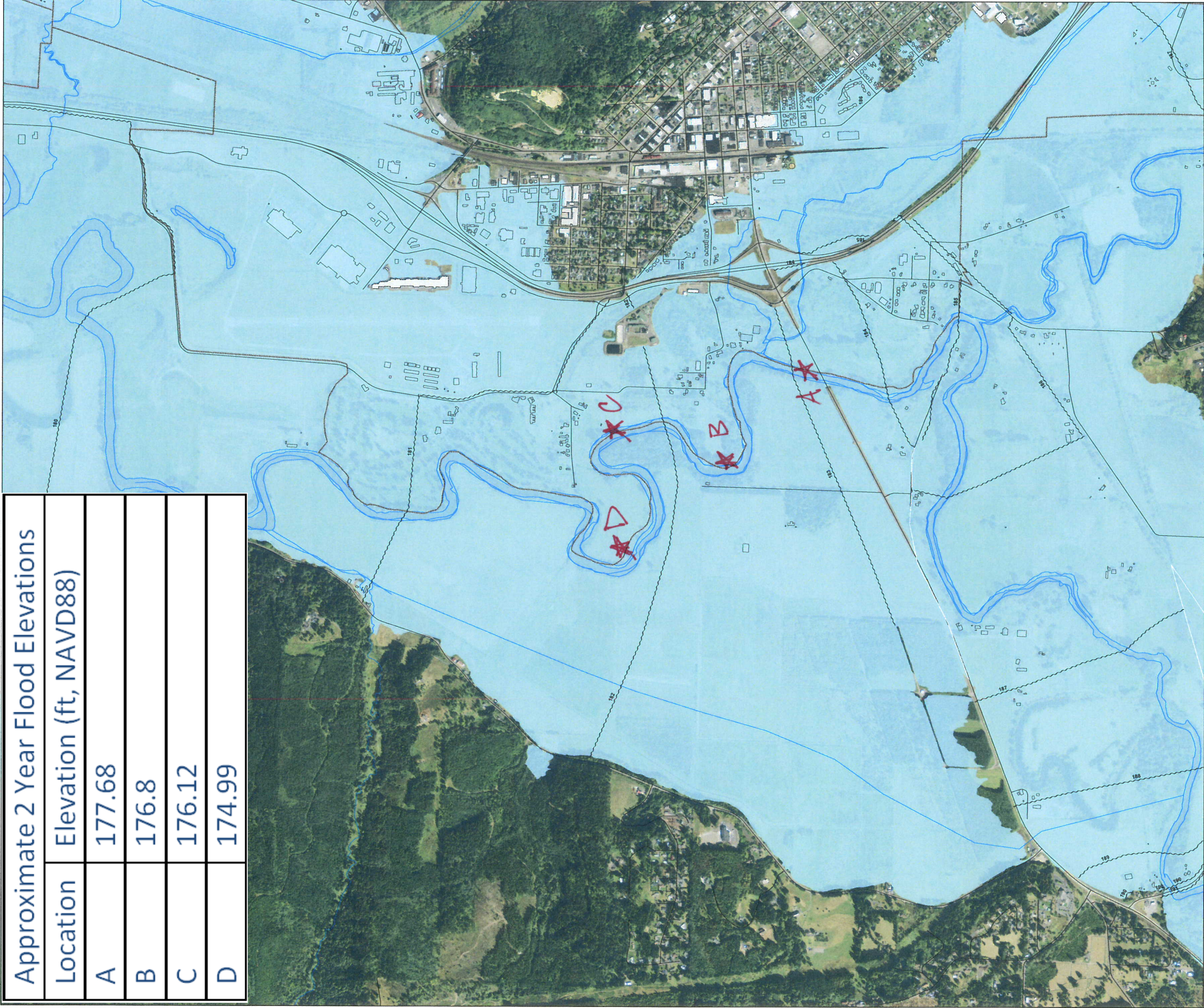


100 - Year Flood

Plate 26

Date: 11/4/2015

Approximate 2 Year Flood Elevations		
Location	Elevation (ft, NAVD88)	
A	177.68	
B	176.8	
C	176.12	
D	174.99	



Legend

- Structures in Structure Survey Database (MSE 2014)
- Roads
- Corporate Boundary
- Rivers and Streams
- 100-year Base Flood Elevation (ft, NAVD88)
- 100-Year Floodplain
- Orthophoto source: USDA-AFPO MAP 2013

Index

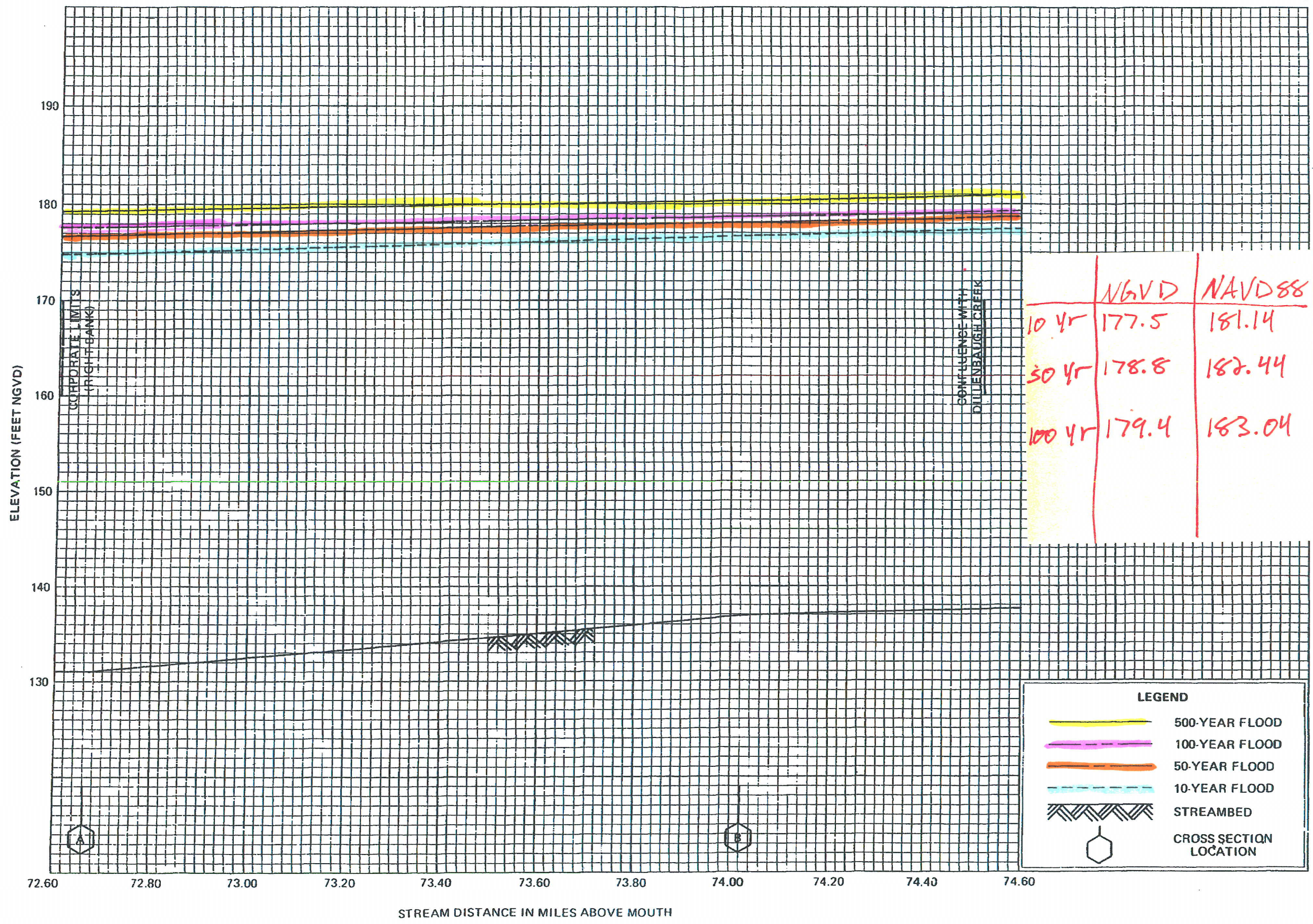
Click here to return to Index Map Page

North Arrow

1 inch = 500 feet

0 250 500 1,000 Feet

Coordinate System: NAD 1983 HARN
Datum: North American Datum 1983
Units: US Survey Feet



FLOOD PROFILES

CHEHALIS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CHEHALIS, WA
(LEWIS CO.)

+3.64 FOR NAVD88

January 19, 2017

David Fleckenstein
Chehalis-Centralia Airport
900 NW Airport Rd
Chehalis, WA 98532

Re: DRAFT Hydraulic Impact Analysis of Waste Water Treatment Plant Removal

Dear Mr. Fleckenstein:

Watershed Science & Engineering (WSE) was retained by the City of Chehalis (City) to evaluate the hydraulic impacts of removing an existing waste water treatment plant (WWTP) located along the Chehalis River in Chehalis, WA. WSE updated an existing HEC-RAS hydraulic model of the Chehalis River to evaluate impacts to base flood elevations (BFEs) within the 100-year floodplain. The objective of this modeling was to determine how much, if any, flood benefit would be gained through the WWTP removal project.

Project Description

The existing WWTP is located along the right (east) bank of the Chehalis River between Highway 6 and the Chehalis-Centralia Airport, see Figure 1. The City is considering modifications to the WWTP property to increase available flood storage, provide additional fish and wildlife habitat, and to enhance recreational use of the site. Preliminary plans include removing existing buildings and excavating approximately 130,000 cubic yards of in-situ material for use off-site. This will provide a source of structural fill for future floodplain development, while increasing available on-site flood storage that will meet the requirements of “compensatory storage” under the City’s “zero-rise” ordinance. Compensatory storage is used to offset the flood impacts of projects that would otherwise fail to meet zero rise criteria. Portions of the WWTP project are located within the Floodway of the Chehalis River, and the project will therefore be required to meet FEMA’s no-rise criteria for projects within the Floodway.

Hydraulic Analysis

The existing Flood Authority unsteady HEC-RAS hydraulic model of the Chehalis River (completed by WSE in 2014) was used to represent existing (baseline) conditions for this investigation. To determine the water surface impacts of the project, WSE:

1. Created an “existing-condition” model geometry by updating the baseline model to add resolution near the project location. Three cross sections were added near the treatment plant (see figure 1) using 2012 LiDAR information to represent the overbank topography and interpolated channel data to represent channel bathymetry at the new sections.
2. Ran the existing condition model to simulate the 100-year flood and the December 2007 flood of record to determine existing condition water surface elevations.
3. Created a “with-project” model by updating the existing condition model to represent the proposed project based on a ground surface (LandXML) provided by Skillings Connolly, Inc. on November 23, 2016.

4. Ran the with-project model to simulate the 100-year flood and the December 2007 flood of record
5. Compared peak water surface elevations in the with-project and existing-condition to determine any impacts at the site location or in adjacent reaches of the Chehalis River model.

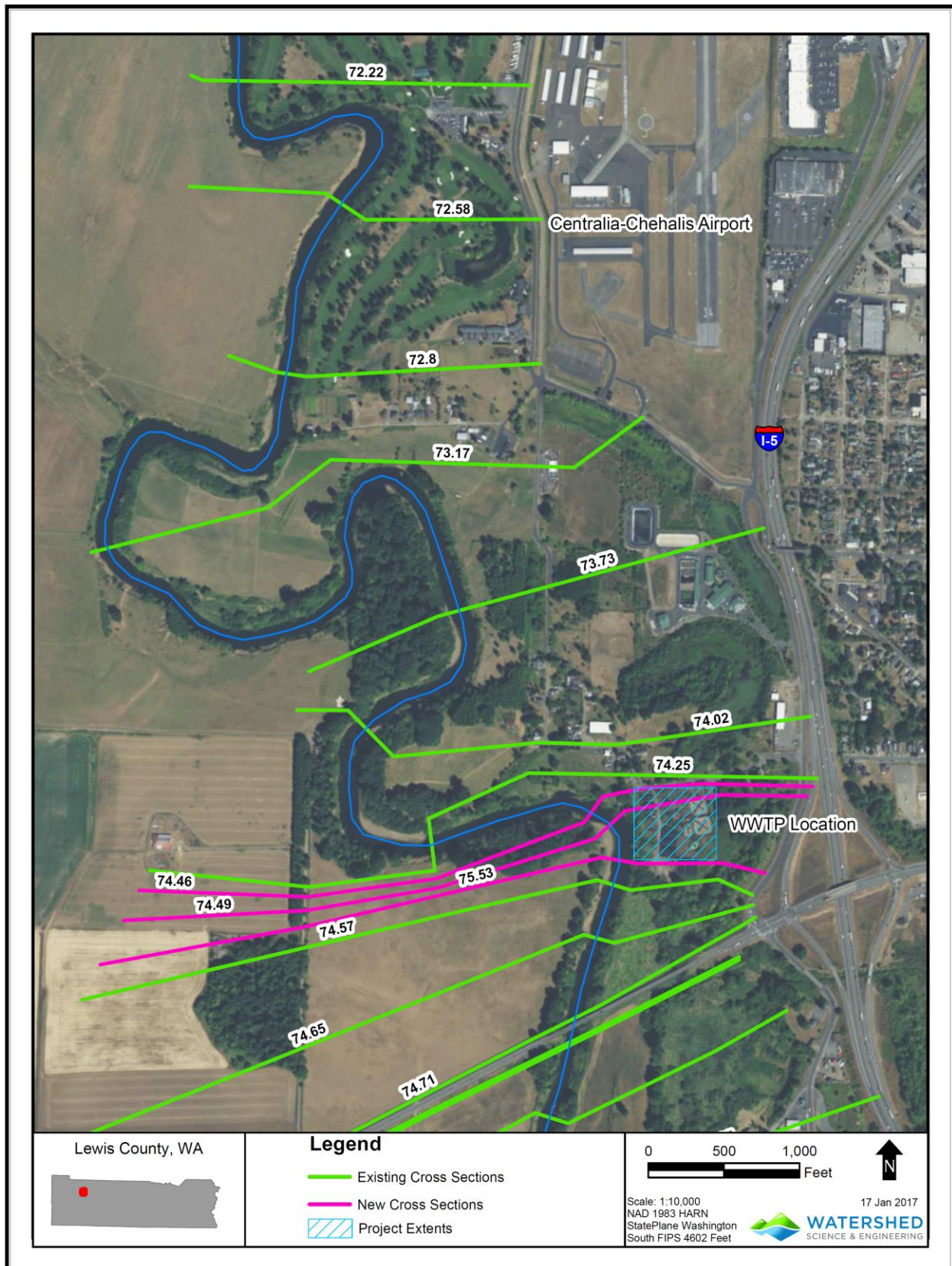


Figure 1. Project Location Map

Results

Changes in the simulated 100-year water surface elevation included a 0.02 foot increase at River Mile (RM) 74.46 located at the project site, and a 0.01 foot decrease in water surface elevation between RM 74.49 and RM 75.09. These results indicate that the “with-project” condition will result in water surface impacts that exceed the threshold typically used in a FEMA No-Rise analysis. Table 1 provides a summary of water surface impacts at Chehalis River model cross sections near the WWTP site.

Table 1. Water Surface Impacts for 100-year Flood Simulation

Location Description	X-section	Max Water Surface Elevation (feet NAVD) or Change in Flood Water Surface (feet)		
		100 Year (ft NAVD)	100 w/Fill (ft NAVD)	Change (ft NAVD)
	74.02	182.26	182.26	0.00
	74.25	182.45	182.45	0.00
Lower extent of project	74.46	182.62	182.64	0.02
	74.49	182.70	182.69	-0.01
Upstream extent of project	74.53	182.81	182.80	-0.01
	74.57	182.90	182.89	-0.01
	74.65	182.95	182.94	-0.01
Downstream Highway 6 Bridge	74.71	183.41	183.40	-0.01
Upstream Highway 6 Bridge	74.73	183.67	183.66	-0.01
	74.82	183.67	183.66	-0.01
	74.95	184.16	184.15	-0.01
	75.08	184.80	184.79	-0.01
	75.09	184.76	184.76	-0.01
Newaukum Confluence	75.2	185.19	185.18	0.00
	75.308	185.70	185.70	0.00
	75.49	185.80	185.80	0.00
	75.71	185.96	185.96	0.00
	75.86	186.03	186.03	0.00
	76	186.13	186.12	0.00
	76.1	186.17	186.17	0.00
	76.36	186.50	186.50	0.00
	76.7	186.93	186.93	0.00

Note: Positive change indicates the alternative raises water levels.

Table 2 and 3 compare “with-project” water surface elevations to baseline water surface elevations at other locations throughout the Chehalis River basin for the 100-year flood and the December 2007 flood of record, respectively. The locations shown in Tables 2 and 3 represent a sampling of sites that have historically been looked at to understand the basin wide impact or benefit of potential projects (see Ruckelshaus Center Report, 2012¹).

¹ William D. Ruckelshaus Center (2012) Chehalis Basin Flood Hazard Mitigation Alternatives Report, Washington State University and the University of Washington, December 19, 2012

Table 2. Summary of With Fill Rise impacts for 100-year Flood Simulation

Location Description	X-section	Max Water Surface Elevation (feet NAVD) or Change in Flood Water Surface (feet)		
		(ft NAVD)	100 Year (ft NAVD)	100 w/Fill (ft NAVD)
Near Doty	100.95	319.23	319.23	0.00
Curtis Store (on S Fork Chehalis)	1.81	232.05	232.05	0.00
Downstream of South Fork	86.42	222.22	222.22	0.00
Near Adna	80.23	197.54	197.54	0.00
Labree Road (on Newaukum R)	4.11	206.37	206.37	0.00
Newaukum Confluence	75.2	185.19	185.18	0.00
Along Airport Levee	71.49	180.51	180.51	0.00
Dillenbaugh Storage Area	SA #301	185.74	185.74	0.00
Airport Storage Area	SA #2	180.27	180.27	0.00
Long Road Storage Area	SA #5	168.00	168.00	0.00
Centralia Storage Area	SA #610	176.48	176.48	0.00
Mellen St	67.43	177.69	177.69	0.00
Bucoda (Skookumchuck R)	11.1	251.90	251.90	0.00
Pearl Street (Skookumchuck R)	2.43	191.36	191.36	0.00
Skookumchuck Confluence	66.88	176.05	176.05	0.00
Upstream of Galvin Road	64.9	168.23	168.23	0.00
Grand Mound (Prather Road)	59.909	147.53	147.53	0.00
Near Rochester	54.476	124.41	124.41	0.00
Anderson Road	51.499	106.29	106.29	0.00
Black River Confluence	46.937	93.48	93.48	0.00
Sickman Ford Bridge	44.175	85.44	85.44	0.00
Porter Creek Road	34.497	56.69	56.69	0.00
Wakefield Road	24.52	41.60	41.60	0.00
Satsop Confluence	19.89	33.89	33.89	0.00
Montesano	12.5	18.64	18.64	0.00
Cosmopolis	1.99	10.72	10.72	0.00

Note: Positive change indicates the alternative raises water levels.

Table 3. Summary of With Project Rise impacts for December 2007 Flood Simulation

Location Description	X-section	Max Water Surface Elevation (feet NAVD) or Change in Flood Water Surface (feet)		
		(ft NAVD)	Dec 07 (ft NAVD)	Dec w/Fill (ft NAVD)
Near Doty	100.95	326.42	326.42	0.00
Curtis Store (on S Fork Chehalis)	1.81	238.70	238.70	0.00
Downstream of South Fork	86.42	228.08	228.08	0.00
Near Adna	80.23	198.72	198.72	0.00
Labree Road (on Newaukum R)	4.11	206.19	206.19	0.00
Newaukum Confluence	75.2	186.42	186.41	-0.01
Along Airport Levee	71.49	182.34	182.34	0.00
Dillenbaugh Storage Area	SA #301	186.85	186.85	0.00
Airport Storage Area	SA #2	182.29	182.29	0.00
Long Road Storage Area	SA #5	179.39	179.38	0.00
Centralia Storage Area	SA #610	177.03	177.03	0.00
Mellen St	67.43	179.07	179.07	0.00
Bucoda (Skookumchuck R)	11.1	243.69	243.69	0.00
Pearl Street (Skookumchuck R)	2.43	185.89	185.89	0.00
Skookumchuck Confluence	66.88	176.91	176.91	0.00
Upstream of Galvin Road	64.9	169.08	169.08	0.00
Grand Mound (Prather Road)	59.909	147.81	147.81	0.00
Near Rochester	54.476	124.60	124.59	0.00
Anderson Road	51.499	106.10	106.10	0.00
Black River Confluence	46.937	93.34	93.35	0.00
Sickman Ford Bridge	44.175	85.31	85.31	0.00
Porter Creek Road	34.497	56.27	56.27	0.00
Wakefield Road	24.52	39.95	39.95	0.00
Satsop Confluence	19.89	32.92	32.93	0.00
Montesano	12.5	16.99	16.99	0.00
Cosmopolis	1.99	10.89	10.89	0.00

Note: Positive change indicates the alternative raises water levels.

Discussion

WSE's analysis found that the proposed WWTP removal project would result in a 0.01 foot reduction in 100-year water surface elevation extending approximately one half a mile upstream from the project site. Slight reductions (less than 0.01 foot) in water surface elevation were also detectable downstream from the project site as far as the Chehalis-Centralia Airport. The magnitude of simulated flood benefits reflects the small scale of the WWTP project relative to the Chehalis River floodplain. The proposed 130,000 cubic yards of additional flood storage would account for less than 0.5% of the existing 100-year flood storage between Highway 6 and the north end of the Chehalis-Centralia Airport.

Analysis also found that the project would cause a 0.02 foot rise in water surface elevation at the WWTP site. Although the rise was confined to one model cross section located along the project site, this exceeds the 0.00 foot rise allowed under the City's zero-rise ordinance and FEMA's no-rise criteria for projects constructed within the Floodway. It may be possible to eliminate this rise through refinement of the project design.

Refinements to the project design may also help to maximize the flood benefit of planned excavation. Model simulations show that most of the proposed flood storage will fill with water before the peak of the flood event, limiting the effectiveness of the project in reducing peak flows and water levels. Before proceeding to final design, we would recommend a hydraulic analysis to compare alternative excavation extents and depths, and to refine the connection between the new storage area and the main river channel in order to maximize flood benefit of the proposed project.

I trust that this analysis and discussion will assist the City in evaluating the hydraulic effects of the proposed WWTP project. Please don't hesitate to contact me with any questions.

Sincerely,

Watershed Science & Engineering, Inc.

A handwritten signature in blue ink, appearing to read "Chris Frei".

Chris Frei, P.E.
Senior Hydraulic Engineer

Section D

Groundwater Information



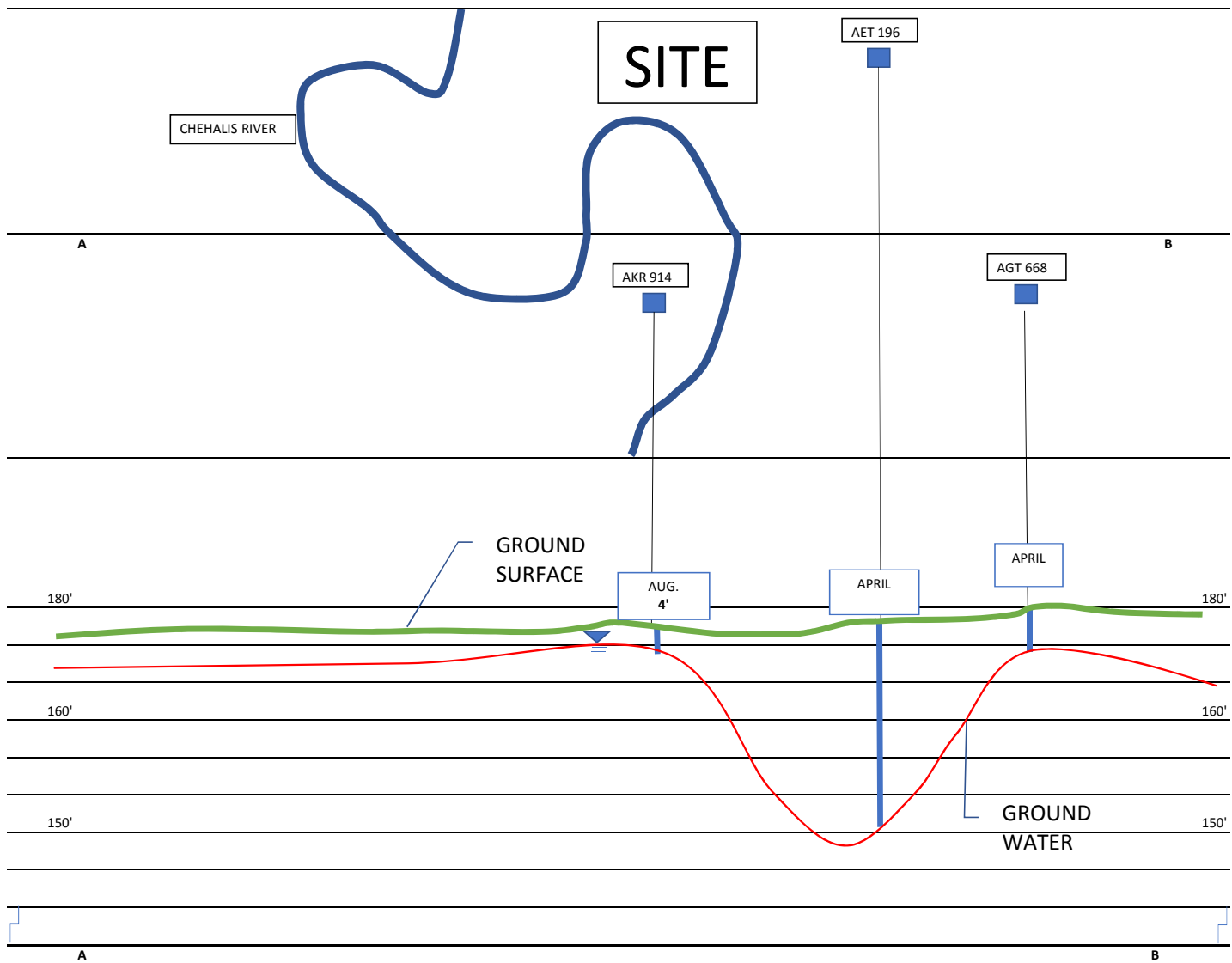
Project Name:	Chehalis Flood Storage Master Plan – Phase 1		
Project No.:	15070-12		
Date:	6/23/17	By:	J. Sauer
Sheet:	Well Log Summary	Page	1 Of 1

Well information for site located East of the Chehalis River, bounded to the North by NW River St, to the East by Interstate 5 and to the south by State Route 6. Multiple wells are located within or immediately outside of these boundaries. Table 1 below contains well identification numbers and associated measured water level elevations at different times of year:

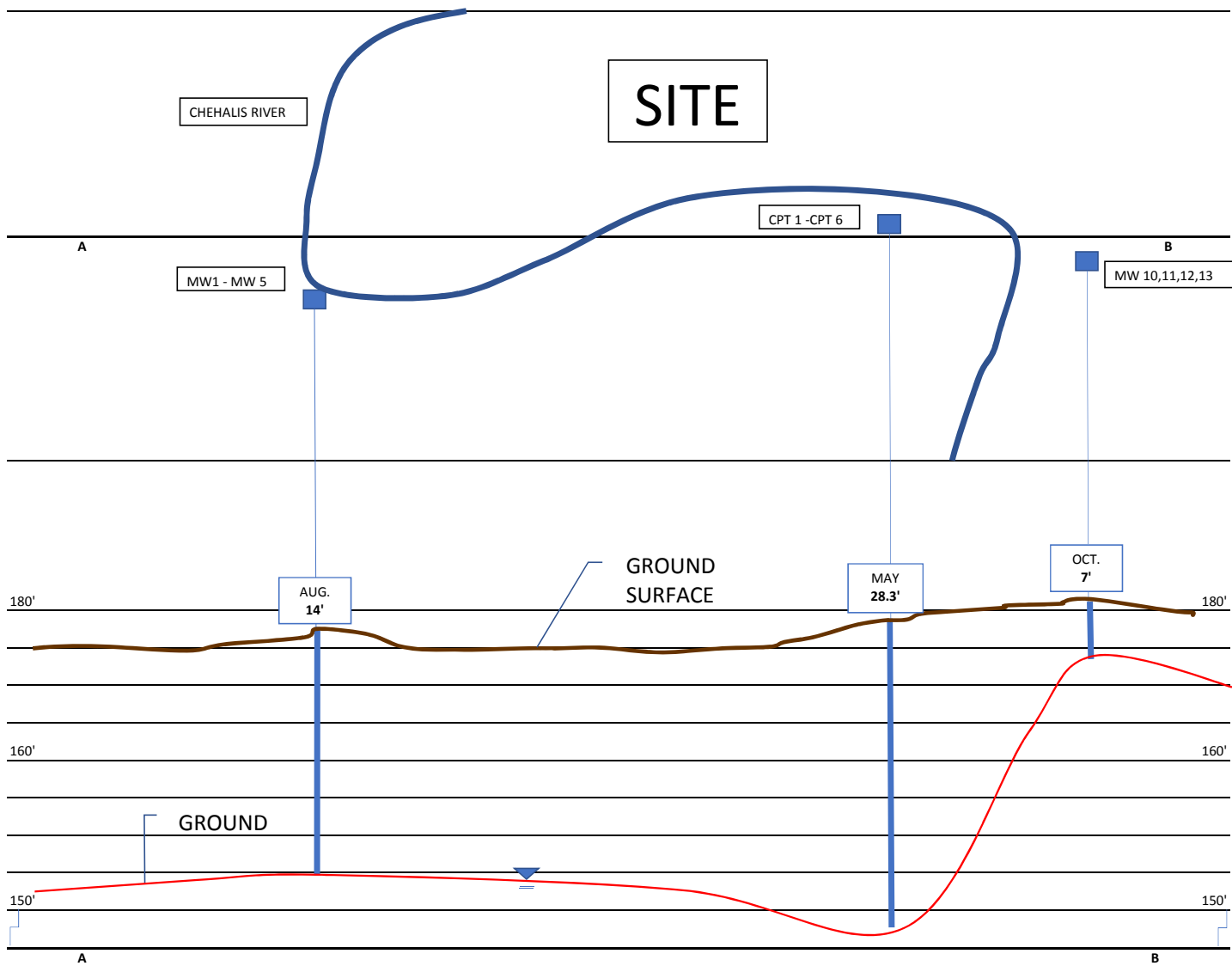
Table 1: Site water table levels during the year

Well ID	Water Table Level (ft)	Time of Year
MW 1-5	14	August
CPT1 - CTP6	28.3	May
MW1 - MW5	7	October
AKR 914	4	August
AGT 668	7	April
AHE 542	10	September
AET 196	24	April

Wells MW 1 – MW5, CPT1 – CPT6, and AKR 914 are located immediately outside the site on the west bank of the Chehalis River, the remaining wells are located within the boundaries of the site.



CHEHALIS FLOOD STORAGE
EXHIBIT 1: GROUND WATER PROFILE
ENTERED BY: JOY SAUER
CHECKED BY: R.C.
DATE: 6-22-17



CHEHALIS FLOOD STORAGE
EXHIBIT 2: GROUND WATER PROFILE
ENTERED BY: JOY SAUER
CHECKED BY: R.C.
DATE: 6-22-17

98334

(1) OWNER: Dennis Tobin		Address: 151 Tatchell, Carlalla, Wa	
(2) LOCATION OF WELL County: Lewis "E 1/4, C.W. 1/4, Sec 30, T 14 N, R 2 W. WM.			
(2a) STREET ADDRESS OF WELL (or nearest well sec) 151 Carlalla, Wa. 98501			
(3) PROPOSED USE: Domestic		WELL LOG	
(4) TYPE OF WORK: New		MATERIAL	
Purge to number of well		If more than one	
Material: A. L. Lately		Type: Sand	
(5) DIMENSIONS: Diameter of well: 6 inches		Color: Shale, Yellow	
Drilled 3' 4". Depth of completed well: 9' ft		Color: Blue Shale	
		Sandstone, Blue	
(6) CONSTRUCTION DETAILS:		Sandstone, Blue W/1" - 3' sand W/Bearing	
Casing installed: 5' Dia. from 72 ft to 70 ft.		Color: Yellow	
P.V.C. Casing 4 1/2" Dia. from 71 ft to 91 ft.			
" Dia. from ft. to ft.			
Perforations: Yes		Notes: Recommended Pump To Be Set Between 65- 75 Ft.	
Type of perforator used: Sauer			
Size of perforations: 1/4 in. by 8 in.			
10 perforations from 71 ft. to 90 ft.			
perforations from ft. to ft.			
perforations from ft. to ft.			
perforations from ft. to ft.			
Screens: No			
Manufacturer's name:			
Type:		Mod. N.	
Dia. slot size: from ft. to ft.			
Dia. slot size: from ft. to ft.			
Gravel packed: No		Size of gravel:	
Gravel placed from ft. to ft.			
Surface seal: Yes		To what depth: 14 Ft.	
Material used in seal: Bentonite Hole Plug			
Did any strata contain unusable water? No			
Type of water:		Depth of strata:	
Method of sealing strata off:			
PUMP: Manufacturer's name:			
Type:		Size: H.P.:	
		Work Started: 4/11/01 Completed: 4/11/01	
(3) WATER LEVELS:		WELL CONSTRUCTOR CERTIFICATION.	
Land-surface elevation above mean sea level: ft.		I constructed and/or accept responsibility for	
Static level: 24 ft. below top of well Date: 4/11/01		construction of this well, and its compliance with all	
Artesian pressure: lbs. per sq. in. Date:		Washington well construction standards. Materials used	
Controlled by:		and the information reported above are true to the best	
		of my knowledge and belief.	
(9) WELL TESTS: Drawdown is amount water level is lowered below static water level		I NAME: WILLIAMS WELL DRILLING, INC.	
Was a pump test made? No If yes, by whom		ADDRESS: 957 Jackson Hwy. Se	
Yield: GPM with ft. drawdown after hrs.		Toledo, Wa. 98591 Phone: 954-2911	
GPM with ft. drawdown after hrs.			
Date of test: 4/11/01		I (Signed) Kenneth Williams	
Barley test: GPM w/ ft. drawdown after hrs.		License No. 1768	
Air test: 25 GPM w/ stem set at 85 ft. for 2 hrs.		Date: 4/11/01	
Artesian flow: GPM Temp: Chemical analysis: No		Cont. Reg. No. WILLIND251R3	

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JUL 19 2001

Washington State
Department of Ecology

Resource Protection Well Report

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission ("x" in circle)

☒ Construction

☐ Decommission ORIGINAL INSTALLATION Notice

RECEIVED

APR 29 2002

CURRENT

Notice of Intent No. R04791

Type of Well ("x" in circle)

☒ Resource Protection

☐ Geotech Soil Boring

114403

of Intent Number

Consulting Firm Squier Associates

DEPARTMENT OF ECOLOGY
WELL DRILLING PERMIT

Owner TrUES Co

Unique Ecology Well ID

Tag No AGT 1668

WELL CONSTRUCTION CERTIFICATION I constructed and/or accept for construction of this well, and it compliance with all Washington construction standards Materials used and the information reported above are true to my best knowledge and belief

Site Address Louisiana Ave

City Chehalis County Wash

Location SW 1/4 SE 1/4 Sec 30 Twn 14N R 2 EWM
or WWM

Lat/Long (s, t, r,
still REQUIRED)

Lat Deg _____ Lat Min/Sec _____

Lat Deg _____ Long Min/Sec _____

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Pete Larsen

Driller/Engineer/Trainee Signature Pete Larsen

Driller or Trainee License No 2514

Tax Parcel No N/A

Cased or Uncased Diameter _____ Static Level 7'

Work/Decommission Start Date 4-5-02

Work/Decommission Completed Date 4-5-02

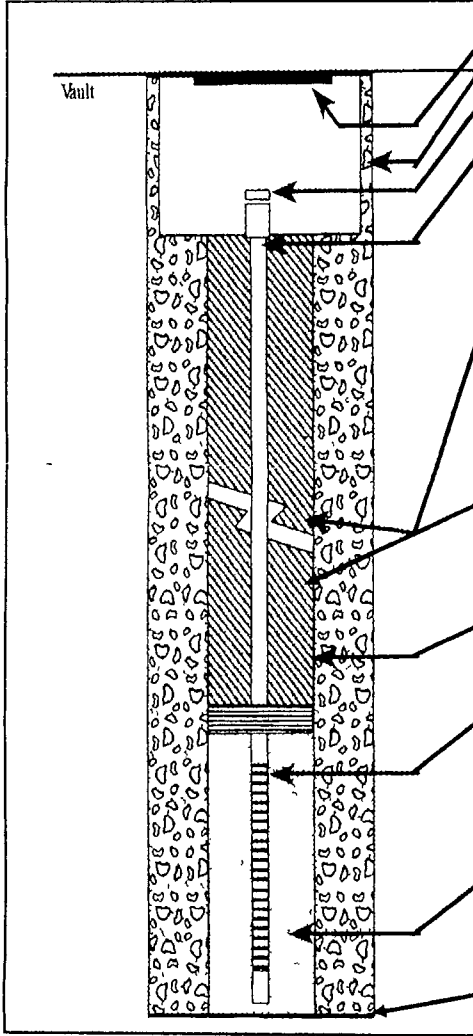
If trainee, licensed driller's

Signature and License no _____

Construction/Design

Well Data

Formation Description

	Water-tight cover Surface flush vault Locking Cap/Lock	0 ft to <u>25</u> ft <u>Sandy Silt.</u>
	Casing Diameter <u>1</u> in Material <u>Pvc</u> Welded <input type="checkbox"/> Threaded <input type="checkbox"/> Glued <input checked="" type="checkbox"/> Well Seal <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> From <u>1</u> ft To <u>14</u> ft Material <u>Bentonite</u> Amount <u>4 bags</u> Grout Weight _____ Drilling Method <input type="checkbox"/> Hollow-Stem Auger <input type="checkbox"/> Air Rotary <input type="checkbox"/> Push Probe <input checked="" type="checkbox"/> Mud Rotary <input type="checkbox"/> Other Borehole diameter <u>5</u> in Screen Material <u>Pvc</u> Interval(s) From <u>15</u> To <u>25</u> From _____ To _____ Slot Size <u>1020</u> in Filter Pack From <u>14</u> ft To <u>25</u> ft Material <u>Gravel</u> Size <u>10-20</u> in Completed Depth <u>25</u>	

Scale 1"= _____

Page _____ of _____

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

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OCT 15 2002

RESOURCE PROTECTION WELL REPORT

Tag# AHE 542

START CARD NO. 63755

DEPARTMENT OF ECOLOGY
PROJECT NAME: Onondaga waste water treatment plant

COUNTY: Lewis

WELL IDENTIFICATION NO. B2

LOCATION: SW 1/4 SE 1/4 Sec 30 Twn 14 R 20

DRILLING METHOD: Mud Rotary

STREET ADDRESS OF WELL: Louisiana Ave

DRILLER: Steve Van Bergen

FIRM: Geo-tech Exploration

WATER LEVEL ELEVATION: 10 Ft.

SIGNATURE: [Signature]

GROUND SURFACE ELEVATION:

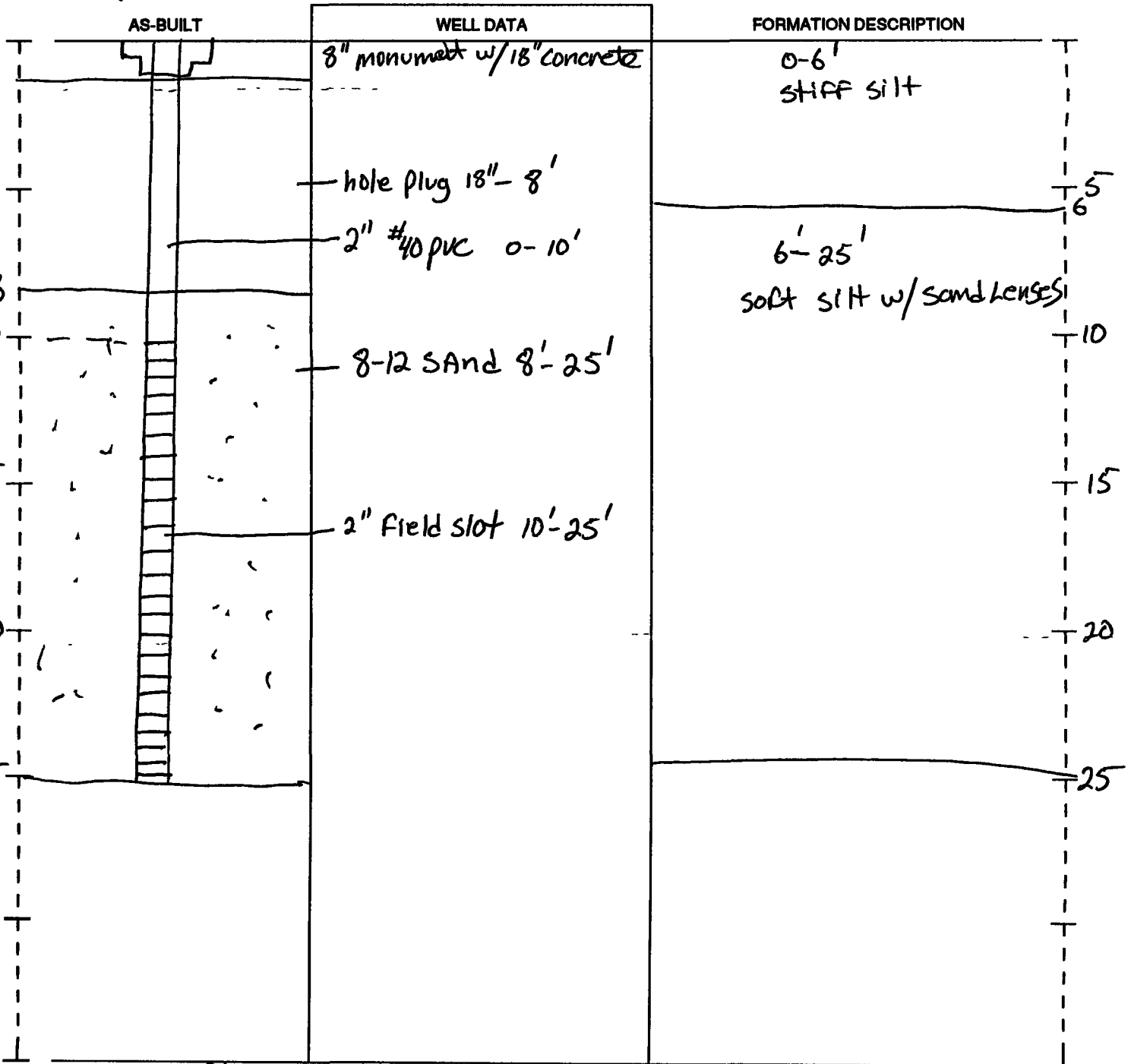
CONSULTING FIRM: Squire Assoc.

INSTALLED: 9-11-02

REPRESENTATIVE: Mitch Schwab

DEVELOPED: NO

123027



SCALE: 1" = 5 Ft.

PAGE 1 OF 1

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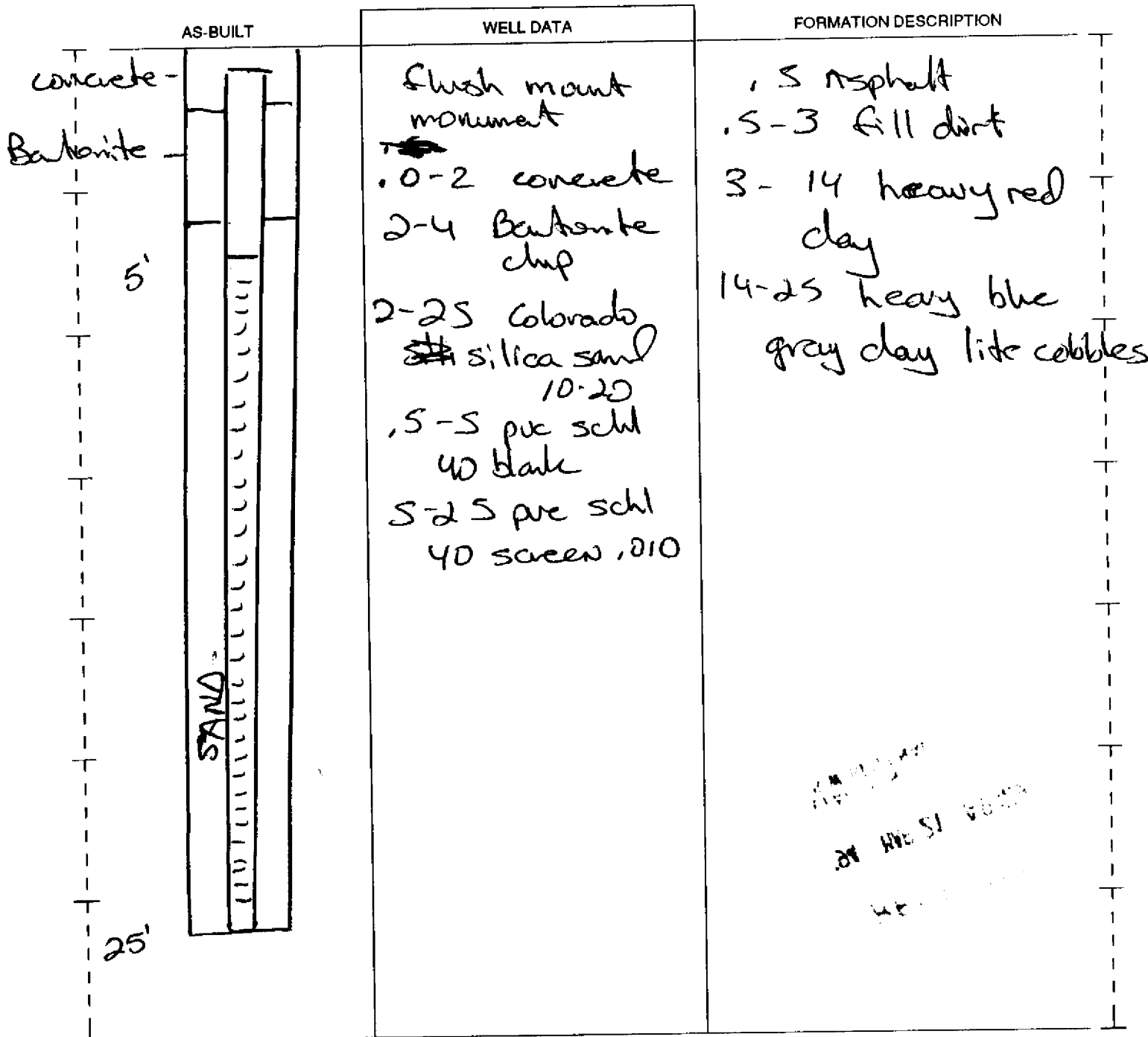
NOV 22 1993

RESOURCE PROTECTION WELL REPORT

DEPT. OF ECOLOGY 650
START CARD NO. 1650

PROJECT NAME: Time Oil
WELL IDENTIFICATION NO. MW-1-5
DRILLING METHOD: HSA
DRILLER: Ken McLanehan
FIRM: McGinnis Drilling Co
SIGNATURE: Ken McLanehan
CONSULTING FIRM: ESE
REPRESENTATIVE: John Day

COUNTY: Lewis
LOCATION: NW 1/4 NW 1/4 Sec 31 Twn 14N R 2W
STREET ADDRESS OF WELL: 2737 Commodore Way
Chenahs
WATER LEVEL ELEVATION: 14'
GROUND SURFACE ELEVATION: 15'
INSTALLED: 8-9-8-11 93
DEVELOPED: _____



SCALE: 1" = _____

PAGE _____ OF _____

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94 MAR 21 A9:29
DEPARTMENT OF ECOLOGY
S.W. REGIONAL OFFICE

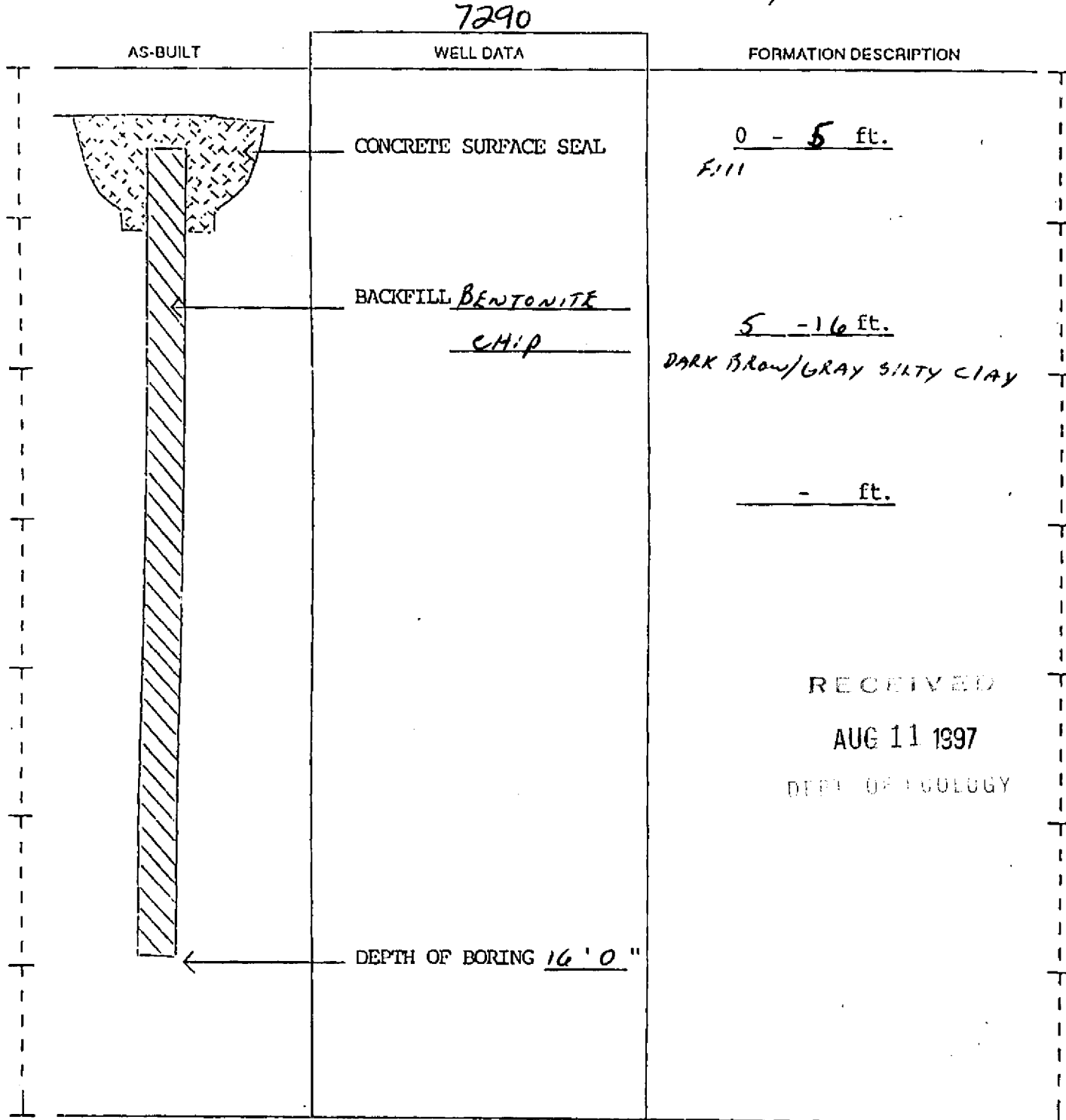
DEPT OF ECOLOGY
NOV 55 1983
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RESOURCE PROTECTION WELL REPORT

START CARD NO. R 28434

PROJECT NAME: J. PANESKO PROPERTY
 WELL IDENTIFICATION NO. 7290
 DRILLING METHOD: Probe / Water Sample
 DRILLER: F. Lynn Goble
 FIRM: Cascade Drilling, Inc.
 SIGNATURE: Lynn Goble
 CONSULTING FIRM: DLH Consultants
 REPRESENTATIVE: Donna Hewitt

COUNTY: LEWIS
 LOCATION: NW 1/4 NE 1/4 Sec 31 Twn 14N R 2W
 STREET ADDRESS OF WELL: 711 Main St. - Chehalis
 WATER LEVEL ELEVATION: N/A
 GROUND SURFACE ELEVATION: N/A
 INSTALLED: 7-10-97
 DEVELOPED: N/A



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 AUG 11 1997
 DEPT. OF ECOLOGY

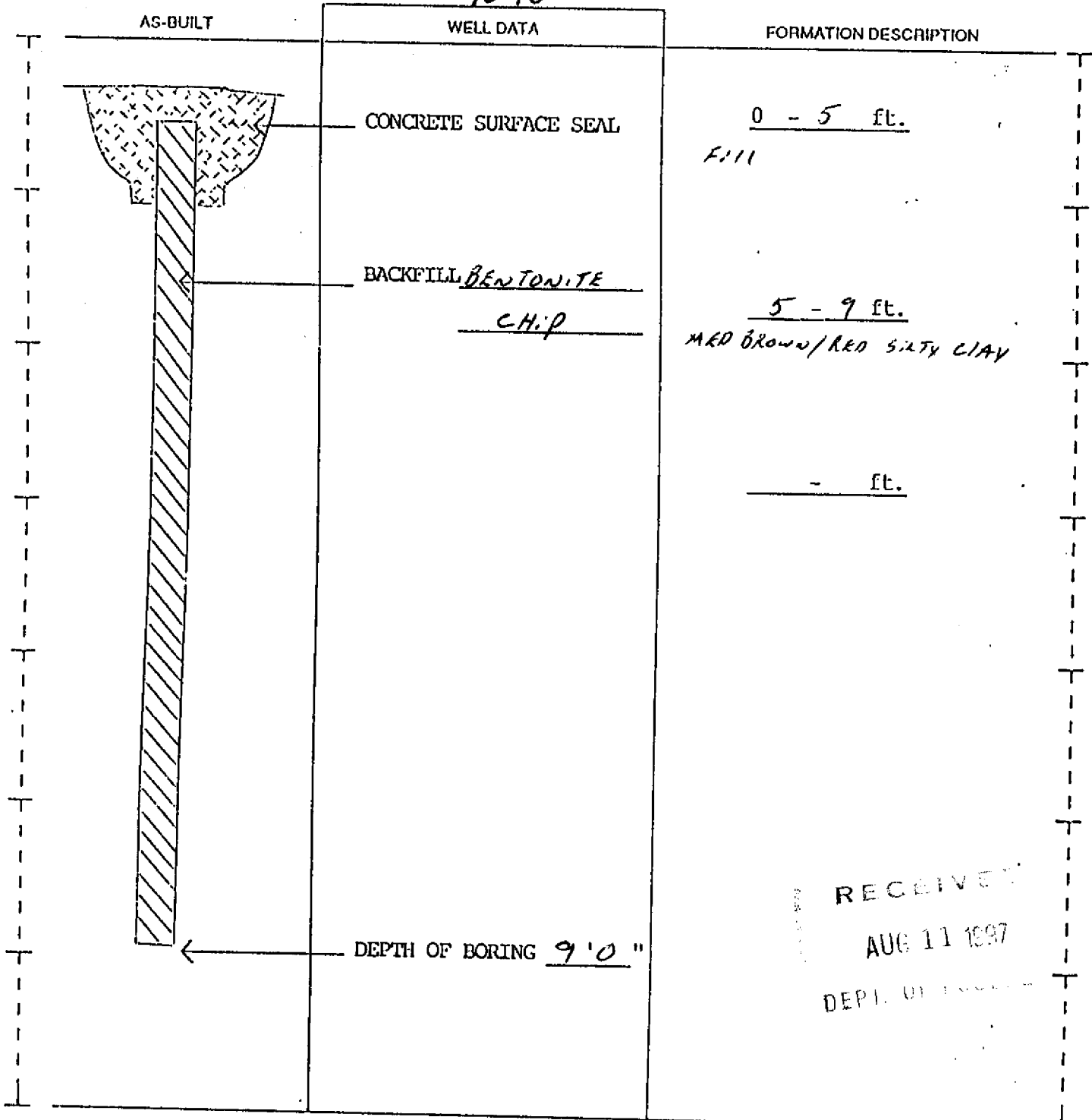
RESOURCE PROTECTION WELL REPORT

START CARD NO. A 28452

PROJECT NAME: J. PANESKO PROPERTY
 WELL IDENTIFICATION NO. n/a
 DRILLING METHOD: Probe / Soil Sample
 DRILLER: F. Lynn Goble
 FIRM: Cascade Drilling, Inc.
 SIGNATURE: Lynn Goble
 CONSULTING FIRM: DLH Consultants
 REPRESENTATIVE: Donna Hewitt

COUNTY: LEWIS
 LOCATION: NW 1/4 NE 1/4 Sec 31 Twn 14 R 2W
 STREET ADDRESS OF WELL: 711 MAIN ST. CHEHALIS
 WATER LEVEL ELEVATION: N/A
 GROUND SURFACE ELEVATION: N/A
 INSTALLED: 7-10-97
 DEVELOPED: N/A

7290



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 AUG 11 1997
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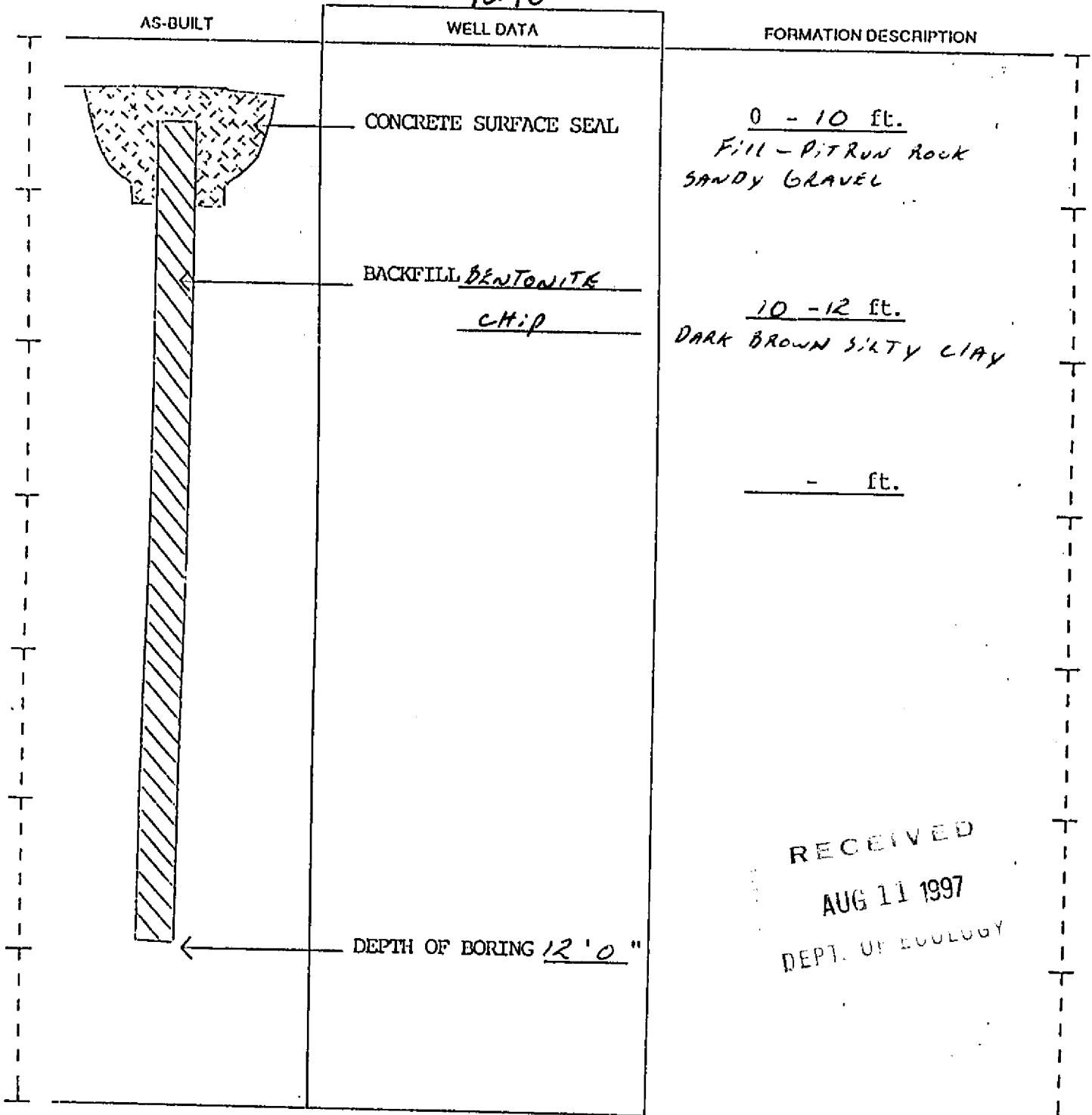
RESOURCE PROTECTION WELL REPORT

START CARD NO. A28452

PROJECT NAME: J. PANESKO PROPERTY
 WELL IDENTIFICATION NO. n/a
 DRILLING METHOD: Probe / 8 in Sample
 DRILLER: F. Lynn Goble
 FIRM: Cascade Drilling, Inc.
 SIGNATURE: F. Lynn Goble
 CONSULTING FIRM: DLH Consultants
 REPRESENTATIVE: Donna Hewitt

COUNTY: LEWIS
 LOCATION: NW 1/4 NE 1/4 Sec 31 Twn 14 R 2W
 STREET ADDRESS OF WELL: 711 MAIN ST. - CHEHALIS
 WATER LEVEL ELEVATION: N/A
 GROUND SURFACE ELEVATION: N/A
 INSTALLED: 7-10-97
 DEVELOPED: N/A

7290



RECEIVED
 AUG 11 1997
 DEPT. OF ECOLOGY

SCALE: 1" = _____

PAGE _____ OF _____

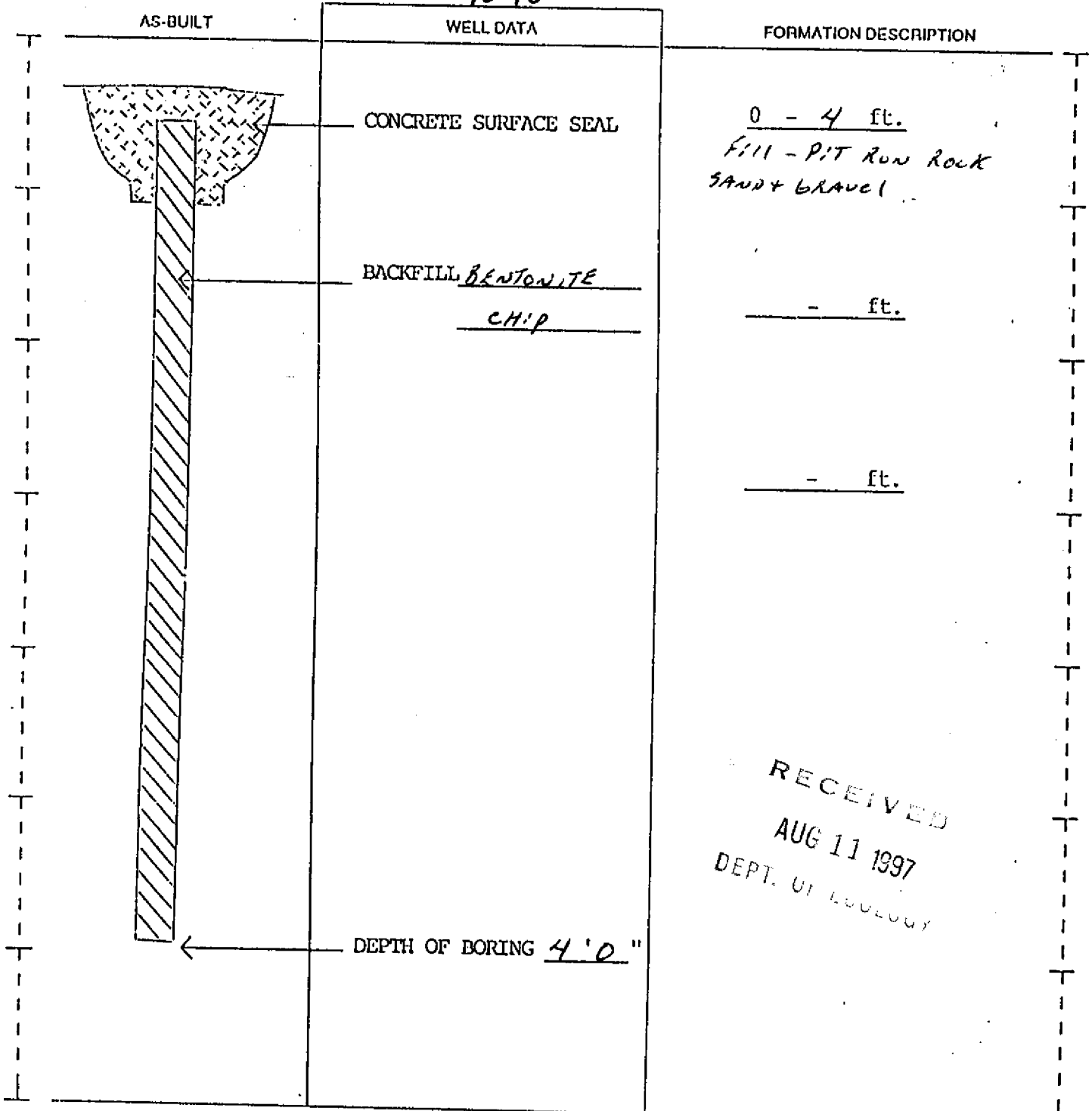
RESOURCE PROTECTION WELL REPORT

START CARD NO. A28452

PROJECT NAME: J. PANESKO PROPERTY
 WELL IDENTIFICATION NO. n/a
 DRILLING METHOD: Probe / Soil Sample
 DRILLER: F. Lynn Goble
 FIRM: Cascade Drilling, Inc.
 SIGNATURE: Lynn Goble
 CONSULTING FIRM: DLH Consultants
 REPRESENTATIVE: Donna Hewitt

COUNTY: LEWIS
 LOCATION: NW 1/4 NE 1/4 Sec 31 Twn 14 R 2W
 STREET ADDRESS OF WELL: 711 MAIN ST. CHEHALIS
 WATER LEVEL ELEVATION: N/A
 GROUND SURFACE ELEVATION: N/A
 INSTALLED: 7-10-97
 DEVELOPED: N/A

7290



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SCALE: 1" = _____

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RESOURCE PROTECTION WELL REPORT

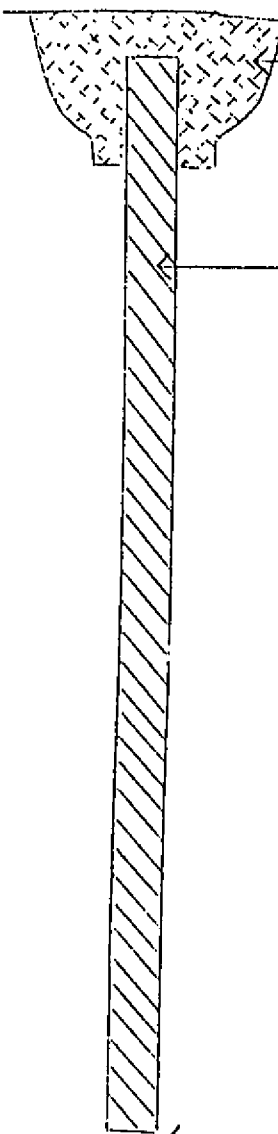
3-TOTAL

START CARD NO. A28452

PROJECT NAME: J. PANESKO PROPERTY
 WELL IDENTIFICATION NO. n/a
 DRILLING METHOD: Probe / Soil Sample
 DRILLER: F. Lynn Goble
 FIRM: Cascade Drilling, Inc.
 SIGNATURE: F. Lynn Goble
 CONSULTING FIRM: DLH Consultants
 REPRESENTATIVE: Donna Hewitt

COUNTY: LEWIS
 LOCATION: NW 1/4 NE 1/4 Sec 31 Twn 14 R 2W
 STREET ADDRESS OF WELL: 711 MAIN ST. CHEHALIS
 WATER LEVEL ELEVATION: N/A
 GROUND SURFACE ELEVATION: N/A
 INSTALLED: 7-10-97
 DEVELOPED: N/A

7290

AS-BUILT	WELL DATA	FORMATION DESCRIPTION
	CONCRETE SURFACE SEAL	0 - 5 ft. FILL
	BACKFILL <u>BENTONITE</u> <u>CHIP</u>	5 - 16 ft. DARK BROWN/GRAY SILTY CLAY
		- ft.
	DEPTH OF BORING <u>16'0"</u>	

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AUG 11 1997

DEPT. OF ECOLOGY

SCALE: 1" = _____

PAGE _____ OF _____

LOG OF TEST BORING



Washington State
Department of Transportation

Start Date No. A-19013 R-26632
County Lewis
Driller Scott Tunison
Company Salisbury
Inspector David A. Nelson 1678
NW 1/4 NE 1/4 Sec. 31 Twn. 14N R. 2 W. WM
S W R E C N A L L P D Job No. 0L-2579

Hole No. H-11-97
Project Rush Rd. to Thurston County Line H.O.V.
Station 2670+50 Offset 64.0 Lt. C
Equipment Winki Casing BX x 50.0
Method of Drilling WET ROTARY
Start Date 14-May-97 Completion Date 14-May-97 Sheet 1 of 3

Depth (ft.)	Profile	(N)	SPT Blows 6"	Sample Type	Sample No.	Description of Material	Ground Water	Instrument
0.0								
1.0								
2.0			4	△	D-1	[MH][2.0 to 3.5] Elastic silt with gravel @ FILL medium stiff, yellowish-brown, wet, stratified. " roots" rec.1.0		HOLE PLUG
3.0		8	4	▽				
4.0			4					
5.0			2	△	D-2	[ML][5.0 to 6.5] Silt @ FILL medium stiff, gray, wet, stratified. rec.0.9		
6.0		10	4	▽				
7.0			6					
8.0			3	△	D-3	[MH][7.5 to 9.0] Elastic silt @ FILL medium stiff, gray, wet, blocky rec0.7		
9.0		8	4	▽				
10.0			4					
11.0			2	△	D-4	[MH][10.0 to 11.5] Elastic silt medium stiff, gray, wet, blocky rec0.7		
12.0		7	3	▽				
13.0			4					
14.0								
15.0			2	△	D-5	@ ORIGINAL GROUND [SP-SM][15.0 to +G8016.5] Poorly graded sand with silt very loose, greenish-gray, saturated, homogeneous rec. 1.5		
16.0		2	1	▽				
17.0			1					
18.0								
19.0								
20.0								HOLE PLUG

LOG OF TEST BORING



Washington State
Department of Transportation

Hole No.	H-11-97		Job No.	0L-2579					
Project	Rush Rd. to Thurston County Line H.O.V.		Sheet	2	of 3				
Depth (ft.)	Profile	(N)	SPT Blows 6 "	Sample Type	Sample No.	Description of Material	Ground Water	Instrument	
20.0			1	△	D-6	[SP-SM][20.0 to 21.5] Poorly graded sand with silt very loose, reddish-brown, saturated, homogeneous rec. 0.6			
21.0		1	1	△					
			0	▽					
22.0									
23.0									
24.0									
25.0				1	△	D-7	[SP-SM][25.0 to 26.5] Poorly graded sand with silt very loose, reddish-brown, saturated, homogeneous rec. 1.0		
26.0		1	0	△					
			1	▽					
27.0									
28.0									
29.0									
30.0			1	△	D-8	[SP-SM][30.0 to 31.5] Poorly graded sand with silt very loose, greenish-gray, saturated, homogeneous rec. 1.0			
31.0	2	1	△						
		1	▽						
32.0									
33.0									
34.0									
35.0			1	△	D-9	[SP-SM][35.0 to 36.5] Poorly graded sand with silt very loose, greenish-gray, saturated, homogeneous rec. 1.0			
36.0	2	1	△						
		1	▽						
37.0									
38.0									
39.0									
40.0									

LOG OF TEST BORING



Washington State
Department of Transportation

Hole No. Project	H-11-97 Rush Rd. to Thurston County Line H.O.V.					Job No. Sheet	3	0L-2579 of	3
Depth (ft.)	Profile	(N)	SPT Blows 6 "	Sample Type	Sample No.	Description of Material	Ground Water	Instrument	
40.0									
			2	◇	D-10	[ML][40.0 to 41.5] Silt with gravel "wood & charcoal "		SUMP	
41.0		8	3	◇		mediun stiff, bluish-gray, wet, homogeneous		FROM	
			5	◇		rec. 0.8			
42.0								40FT.	
43.0								TO	
44.0								46FT.	
45.0									
46.0									
			28	◇	D-11	[GW-GM][45.0 to 46.0] Well graded gravel with silt"sub angular"			
46.0		50/0.5	50/0.5	◇		very dense, greenish-gray, wet,homogeneous		H	
						rec. 1.0		O	
47.0								L	
48.0								E	
49.0								P	
								L	
50.0								U	
								G	
51.0			50/0.5	50/0.5	◇	D-12	[GW-GM][45.0 to 46.0] Well graded gravel with silt"sub angular"		
						very dense, greenish-gray, wet,homogeneous			
						rec.0.7			
52.0									
53.0									
54.0									
55.0									
56.0									
57.0									
58.0									
59.0									
60.0									

Stopped Test Boring at 51.0
Installed piezo with 2.0 stick up.

RESOURCE PROTECTION WELL REPORT

START CARD NO. 26476

PROJECT NAME: Weyerhaeuser
 WELL IDENTIFICATION NO. MW 10, 11, 12, 13
 DRILLING METHOD: Italian stem auger
 DRILLER: Robert D. Rogers
 FIRM: Geotek Explorations
 SIGNATURE: [Signature]
 CONSULTING FIRM: EMCOR
 REPRESENTATIVE: Jim Haderly

COUNTY: Lewis
 LOCATION: 1/4 1/4 NE 1/4 Sec 31 Twp 14N R 2W
 STREET ADDRESS OF WELL: 1100 SW SYLVANUS ST. CHITHAM, WA.
 WATER LEVEL ELEVATION: 7'
 GROUND SURFACE ELEVATION: _____
 INSTALLED: 27 Oct 95
 DEVELOPED: _____

AS-BUILT	WELL DATA	FORMATION DESCRIPTION
	<p>15' - 3' 020 slot screen sch 40 PUL</p> <p>3' - +2.5 sch 40 PUL riser</p> <p>2' to +3 above ground measurement</p> <p>15' - 2.5' 20/40 sand pack</p> <p>2.5' - 0 bent seal</p>	<p>0-4 Gravel fill</p> <p>4-15 clay silt sand</p>

RECEIVED
 95 NOV -9 P2:07
 STATIONED NOV 10 1995
 S.W. NATIONAL WELL

SCALE: 1" = _____

PAGE _____ OF _____

RESOURCE PROTECTION WELL REPORTCURRENT Notice of Intent No. A67858

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission (select one)

☐ Construction☒ Decommission ORIGINAL INSTALLATION Noticeof Intent Number S22358

Type of Well (select one)

☐ Resource Protection☒ Geotech Soil BoringConsulting Firm SQUIER

Unique Ecology Well ID

Tag No. CPT 1Property Owner CITY OF CHEHALISSite Address 850 NW LOUISIANA AVECity CHEHALISCounty LEWISLocation NE 1/4-1/4 NW 1/4 Sec 31 Twn 14 R 2Select One ☒ EWM☐ WWM

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print)WARREN MCCANNDriller/Engineer/Trainee Signature WarrenDriller or Trainee License No. 2460

Lat/Long (s, t, r still REQUIRED)

Lat Deg _____

Lat Min/Sec _____

Long Deg _____

Long Min/Sec _____

Tax Parcel No. _____

Cased or Uncased Diameter 2Static Level N/AWork/Decommission Start Date 7/18/03Work/Decommission Completed Date 7/18/03

If trainee, licensed driller's _____

Signature and License No. 2460

Construction/Design

Well Data

Formation Description

BACKFILLED WITH BENTONITE
GROUT FROM 45 FEET TO 0 FEET

SILTY SAND TO CLAYEY SILT

SAND TO SILTY SAND

TERMINATED AT 45 FEET

RECEIVED

MAR 22 2007

DEPARTMENT OF ECOLOGY

SCALE: 1"= 20PAGE 1 OF 1

ECY 050-12 (Rev. 2/03)

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RESOURCE PROTECTION WELL REPORTCURRENT Notice of Intent No. A67858

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission (select one)

☐ Construction☒ Decommission ORIGINAL INSTALLATION Noticeof Intent Number S22358Consulting Firm SQUIER

Unique Ecology Well ID

Tag No. CPT 2

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) WARREN MCCANNDriller/Engineer/Trainee Signature WaDriller or Trainee License No. 2460

If trainee, licensed driller's

Signature and License No. 2460

Type of Well (select one)

☐ Resource Protection☒ Geotech Soil BoringProperty Owner CITY OF CHEHALISSite Address 850 NW LOUISIANA AVECity CHEHALIS County LEWISLocation NE 1/4-1/4 NW 1/4 Sec 31 Twn 14 R 2Select One ☒ EWM☐ WWMLat/Long (s, t, r
still REQUIRED)

Lat Deg _____ Lat Min/Sec _____

Long Deg _____ Long Min/Sec _____

Tax Parcel No. _____

Cased or Uncased Diameter 2 Static Level N/AWork/Decommission Start Date 7/18/03Work/Decommission Completed Date 7/18/03

Construction/Design

Well Data

Formation Description

BACKFILLED WITH BENTONITE
GROUT FROM 45 FEET TO 0 FEET

SILTY SAND TO CLAYEY SILT

SAND TO SILTY SAND

TERMINATED AT 45 FEET

RECEIVED

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DEPARTMENT OF ECOLOGY

SCALE: 1"= 20PAGE 1 OF 1

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RESOURCE PROTECTION WELL REPORTCURRENT Notice of Intent No. A67858

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission (select one)

☐ Construction☒ Decommission ORIGINAL INSTALLATION Notice
of Intent Number S22358Consulting Firm SQUIER

Unique Ecology Well ID

Tag No. CPT 3

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) WARREN MCCANNDriller/Engineer/Trainee Signature Warren McCannDriller or Trainee License No. 2460

If trainee, licensed driller's

Signature and License No. 2460

Type of Well (select one)

☐ Resource Protection☒ Geotech Soil BoringProperty Owner CITY OF CHEHALISSite Address 850 NW LOUISIANA AVECity CHEHALIS County LEWISLocation NE 1/4-1/4 NW 1/4 Sec 31 Twn 14 R 2Select One ☒ EWM☐ WWMLat/Long (s, t, r
still REQUIRED)

Lat Deg _____ Lat Min/Sec _____

Long Deg _____ Long Min/Sec _____

Tax Parcel No. _____

Cased or Uncased Diameter 2 Static Level N/AWork/Decommission Start Date 7/18/03Work/Decommission Completed Date 7/18/03

Construction/Design

Well Data

Formation Description

BACKFILLED WITH BENTONITE
GROUT FROM 45 FEET TO 0 FEET

SILTY SAND TO CLAYEY SILT

SAND TO SILTY SAND

TERMINATED AT 45 FEET

RECEIVED

MAR 22 2007

DEPARTMENT OF ECOLOGY

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. A67858

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission (select one)

☐ Construction

☒ Decommission ORIGINAL INSTALLATION Notice
of Intent Number S22358

Type of Well (select one)

☐ Resource Protection

☒ Geotech Soil Boring

Consulting Firm SQUIER

Unique Ecology Well ID

Tag No. CPT 4

Property Owner CITY OF CHEHALIS

Site Address 850 NW LOUISIANA AVE

City CHEHALIS

County LEWIS

Location NE 1/4-1/4 NW 1/4 Sec 31 Twn 14 R 2

Select One ☒ EWM
☐ WWM

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Lat/Long (s, t, r
still REQUIRED)

Lat Deg _____

Lat Min/Sec _____

Long Deg _____

Long Min/Sec _____

Tax Parcel No. _____

Cased or Uncased Diameter 2

Static Level N/A

Work/Decommission Start Date 7/18/03

Work/Decommission Completed Date 7/18/03

☒ Driller ☐ Engineer ☐ Trainee Name (Print) WARREN MCCANN

Driller/Engineer/Trainee Signature Warren McCann

Driller or Trainee License No. 2460

If trainee, licensed driller's

Signature and License No. 2460

Construction/Design

Well Data

Formation Description

BACKFILLED WITH BENTONITE
GROUT FROM 45 FEET TO 0 FEET

SILTY SAND TO CLAYEY SILT

SAND TO SILTY SAND

TERMINATED AT 45 FEET

RECEIVED

MAR 22 2007

DEPARTMENT OF ECOLOGY

RESOURCE PROTECTION WELL REPORTCURRENT Notice of Intent No. A67858

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission (select one)

☐ Construction☒ Decommission ORIGINAL INSTALLATION Notice
of Intent Number S22358256905

Type of Well (select one)

☐ Resource Protection☒ Geotech Soil BoringConsulting Firm SQUIER

Unique Ecology Well ID

Tag No. CPT 5Property Owner CITY OF CHEHALISSite Address 850 NW LOUISIANA AVECity CHEHALISCounty LEWISLocation NE 1/4-1/4 NW 1/4 Sec 31 Twn 14 R 2Select One ☒ EWM☐ WWMWELL CONSTRUCTION CERTIFICATION: I constructed and/or
accept responsibility for construction of this well, and its compliance with all
Washington well construction standards. Materials used and the information reported
above are true to my best knowledge and belief.Lat/Long (s, t, r
still REQUIRED)

Lat Deg _____

Lat Min/Sec _____

Long Deg _____

Long Min/Sec _____

Tax Parcel No. _____

Cased or Uncased Diameter 2 Static Level N/AWork/Decommission Start Date 7/18/03Work/Decommission Completed Date 7/18/03☒ Driller ☐ Engineer ☐ Trainee Name (Print)WARREN MCCANNDriller/Engineer /Trainee Signature WarrenDriller or Trainee License No. 2460

If trainee, licensed driller's _____

Signature and License No. 2460

Construction/Design

Well Data

Formation Description

BACKFILLED WITH BENTONITE
GROUT FROM 45 FEET TO 0 FEET

SILTY SAND TO CLAYEY SILT

SAND TO SILTY SAND

TERMINATED AT 45 FEET

RECEIVED

MAR 22 2007

DEPARTMENT OF ECOLOGY

RESOURCE PROTECTION WELL REPORTCURRENT Notice of Intent No. A67858

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission (select one)

☐ Construction☒ Decommission ORIGINAL INSTALLATION Notice
of Intent Number S22358Consulting Firm SQUIER

Unique Ecology Well ID

Tag No. CPT 6WELL CONSTRUCTION CERTIFICATION: I constructed and/or
accept responsibility for construction of this well, and its compliance with all
Washington well construction standards. Materials used and the information reported
above are true to my best knowledge and belief.☒ Driller ☐ Engineer ☐ Trainee Name (Print) WARREN MCCANNDriller/Engineer/Trainee Signature Warren McCannDriller or Trainee License No. 2460

If trainee, licensed driller's

Signature and License No. 2460

Type of Well (select one)

☐ Resource Protection☒ Geotech Soil BoringProperty Owner CITY OF CHEHALISSite Address 850 NW LOUISIANA AVECity CHEHALISCounty LEWISLocation NE 1/4-1/4 NW 1/4 Sec 31 Twn 14 R 2Select One ☒ EWM☐ WWMLat/Long (s, t, r
still REQUIRED)

Lat Deg _____

Lat Min/Sec _____

Long Deg _____

Long Min/Sec _____

Tax Parcel No. _____

Cased or Uncased Diameter 2 Static Level N/AWork/Decommission Start Date 7/18/03Work/Decommission Completed Date 7/18/03

Construction/Design

Well Data

Formation Description

BACKFILLED WITH BENTONITE
GROUT FROM 45 FEET TO 0 FEET

SILTY SAND TO CLAYEY SILT

SAND TO SILTY SAND

TERMINATED AT 45 FEET

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DEPARTMENT OF ECOLOGY

SCALE: 1"= 20PAGE 1 OF 1

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LOG OF TEST BORING



Washington State
Department of Transportation

Hole No. H-23-97
Project Station 0+250
Equipment Wink
Method of Drilling WET ROTARY
Start Date 20-May-97
Location Rush Rd. to Thurston County Line H.O.V..
Offset 10 m Rt.
Casing BX x 61.0
NE 1/4 NW 1/4 Sec. 31
Start Card No. A-19019
County Lewis
Driller Scott Tunison
Company Salisbury
Inspector David A. Nelson
Twn. 14N R. 2 W. WM
Job No. 0L-2579
S.R. 5
C.S. 2104
Ground Elv. 94 m
W.T. dry
Sheet 1 of 4
Completion Date 20-May-97

Depth (ft.)	Profile	(N)	SPT Blows 6"	Sample Type	Sample No.	Description of Material	Ground Water	Instrument
0.0						0.0 to 1.0 overburden		
1.0								
2.0		CR	100%		C-1	[1.0 to 6.0] Sandstone ,brownish-gray, fine grained,slightly weathered slightly fractured		
3.0		RQD	66%					
4.0		FF	3					
5.0								
6.0								
7.0		CR	100%		C-2	[6.0 to 11.0] Sandstone ,brownish-gray, fine grained,slightly weathered slightly fractured		
8.0		RQD	50%					
9.0		FF	3					
10.0								
11.0								
12.0		CR	100%		C-3	[11.0 to 16.0] Sandstone ,gray, fine grained fresh slightly fractured		
13.0		RQD	46%					
14.0		FF	2					
15.0								
16.0								
17.0		CR	100%		C-4	[16.0 to 21.0] Sandstone ,gray, fine grained fresh slightly fractured		
18.0		RQD	66%					
19.0		FF	1					
20.0								

LEAFMAN & ASSOCIATES
S.W. INTERNATIONAL OFFICE

97 MAY 28 49:12

CEILING LOG

1020

SAND

CEMENT

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Job No. 0L-2579
Sheet 2 of 4

Depth (ft.)	Profile	(N)	SPT Blows 6 "	Sample Type	Sample No.	Description of Material	Ground Water	Instrument
20.0								
21.0								C
		CR	100%		C-5	[21.0 to 26.0] Sandstone ,gray, fine grained fresh		O
22.0		RQD	18%			highly fractured		L
		FF	4					O
23.0								R
								A
24.0								D
								O
25.0								1020
26.0								S
		CR	100%		C-6	[26.0 to 31.0] Sandstone ,gray, fine grained fresh		A
27.0		RQD	20%			highly fractured		N
		FF	4					D
28.0								
29.0								
30.0								
31.0								
		CR	100%		C-7	[31.0 to 36.0] Sandstone ,gray, fine grained fresh		
32.0		RQD	0%			highly fractured		
		FF	6					
33.0								
34.0								
35.0								
36.0								
		CR	100%		C-8	[36.0 to 41.0] Sandstone ,gray, fine grained fresh		
37.0		RQD	50%			moderately fractured		
		FF	3					
38.0								
39.0								
40.0								

LOG OF TEST BORING



**Washington State
Department of Transportation**

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Hole No. Project	H-23-97 Rush Rd. to Thurston County Line H.O.V.					Job No. Sheet	3	0L-2579 of	4
Depth (ft.)	Profile	(N)	SPT Blows 6 "	Sample Type	Sample No.	Description of Material	Ground Water	Instrument	
40.0								C	
								O	
41.0								L	
		CR	100%		C-9	[41.0 to 46.0] Sandstone ,gray, fine grained fresh		O	
42.0		RQD	40%			highly fractured		R	
		FF	4					A	
43.0								D	
								O	
44.0									
45.0								1020	
46.0								S	
		CR	100%		C-10	[46.0 to 51.0] Sandstone ,gray, fine grained fresh		A	
47.0		RQD	15%			highly fractured		N	
		FF	5					D	
48.0									
49.0									
50.0									
51.0									
		CR	100%		C-11	[51.0 to 56.0] Sandstone ,gray, fine grained fresh		W	
52.0		RQD	15%			highly fractured		E	
		FF	5					L	
53.0									
54.0									
55.0								S	
								C	
56.0								R	
		CR	100%		C-12	[56.0 to 61.0] Sandstone ,gray, fine grained fresh		E	
57.0		RQD	18%			highly fractured		N	
		FF	6						
58.0									
59.0									
60.0									

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LOG OF TEST BORING



Washington State
Department of Transportation

Hole No. Project	H-23-97 Rush Rd. to Thurston County Line H.O.V.					Job No. Sheet	4	0L-2579 of	4
Depth (ft.)	Profile	(N)	SPT Blows 6 "	Sample Type	Sample No.	Description of Material	Ground Water	Instrument	
60.0						Stopped Test Boring at 61.0 Installed Piezo to 61.0 with a 10.0 well screen to 51.0 backed fill with sand to 10.0, hole plug to 2.0,cement, monument			
61.0									
62.0									
63.0									
64.0									
65.0									
66.0									
67.0									
68.0									
69.0									
70.0									
71.0									
72.0									
73.0									
74.0									
75.0									
76.0									
77.0									
78.0									
79.0									
80.0									

LOG OF TEST BORING

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JUN 30 1997



Washington State
Department of Transportation

DEPARTMENT OF
WELL DRILLING UNIT

Start Card No.

County

Driller

Company

Inspector

A-19019 / R 17255

Lewis

Scott Tunison

Salisbury

David A. Nelson

1678

Twn. 14N

R. 2 W.WM

Job No. 0L-2579

S.R. 5

C.S. 2104

Ground Elv. 94 m

W.T. dry

Sheet 1 of 4

Hole No. H-23-97
Project Rush Rd. to Thurston County Line H.O.V..
Station 0+250 Offset 10 m Rt.
Equipment Winki Casing BX x 61.0
Method of Drilling WET ROTARY
Start Date 20-May-97 Completion Date 20-May-97

Depth (ft.)	Profile	(N)	SPT Blows 6 "	Sample Type	Sample No.	Description of Material	Ground Water	Instrument
0.0						0.0 to 1.0 overburden		C E M E N T
1.0								
2.0		CR	100%		C-1	[1.0 to 6.0] Sandstone ,brownish-gray, fine grained,slightly weathered		
		RQD	66%			slightly fractured		
		FF	3					
3.0								
4.0								
5.0								
6.0								
		CR	100%		C-2	[6.0 to 11.0] Sandstone ,brownish-gray, fine grained,slightly weathered		
7.0		RQD	50%			slightly fractured		
		FF	3					
8.0								
9.0								
10.0								
11.0								C
		CR	100%		C-3	[11.0 to 16.0] Sandstone ,gray, fine grained fresh		O
12.0		RQD	46%			slightly fractured		L
		FF	2					O
13.0								R
								A
14.0								D
								O
15.0								1020
16.0								S
		CR	100%		C-4	[16.0 to 21.0] Sandstone ,gray, fine grained fresh		A
17.0		RQD	66%			slightly fractured		N
		FF	1					D
18.0								
19.0								
20.0								

LOG OF TEST BORING



Washington State
Department of Transportation

Hole No. H-23-97
Project Rush Rd. to Thurston County Line H.O.V.

Job No. 0L-2579
Sheet 2 of 4

Depth (ft.)	Profile	(N)	SPT Blows 6 "	Sample Type	Sample No.	Description of Material	Ground Water	Instrument
20.0								
21.0		CR	100%	✓	C-5	[21.0 to 26.0] Sandstone ,gray, fine grained fresh highly fractured		C
22.0		RQD	18%					O
		FF	4					L
23.0								O
								R
24.0								A
								D
25.0								O
								1020
26.0		CR	100%	✓	C-6	[26.0 to 31.0] Sandstone ,gray, fine grained fresh highly fractured		S
27.0		RQD	20%					A
		FF	4					N
28.0								D
29.0								
30.0								
31.0		CR	100%	✓	C-7	[31.0 to 36.0] Sandstone ,gray, fine grained fresh highly fractured		
32.0		RQD	0%					
		FF	6					
33.0								
34.0								
35.0								
36.0		CR	100%	✓	C-8	[36.0 to 41.0] Sandstone ,gray, fine grained fresh moderately fractured		
37.0		RQD	50%					
		FF	3					
38.0								
39.0								
40.0								

LOG OF TEST BORING



Washington State
Department of Transportation

Hole No. Project	H-23-97 Rush Rd. to Thurston County Line H.O.V.					Job No. Sheet	3	of	4
Depth (ft.)	Profile	(N)	SPT Blows 6 "	Sample Type	Sample No.	Description of Material	Ground Water	Instrument	
40.0								C	W E L L S C R E E N
								O	
41.0				✓				L	
		CR	100%	✓	C-9	[41.0 to 46.0] Sandstone ,gray, fine grained fresh		O	
42.0		RQD	40%			highly fractured		R	
		FF	4					A	
43.0								D	
								O	
44.0									
								1020	
45.0									
								S	
46.0				✓				A	
		CR	100%	✓	C-10	[46.0 to 51.0] Sandstone ,gray, fine grained fresh		N	
47.0		RQD	15%			highly fractured		D	
		FF	5						
48.0									
49.0									
50.0									
51.0				✓					
		CR	100%	✓	C-11	[51.0 to 56.0] Sandstone ,gray, fine grained fresh			
52.0		RQD	15%			highly fractured			
		FF	5						
53.0									
54.0									
55.0									
56.0				✓					
		CR	100%	✓	C-12	[56.0 to 61.0] Sandstone ,gray, fine grained fresh			
57.0		RQD	18%			highly fractured			
		FF	6						
58.0									
59.0									
60.0									

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The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

LOG OF TEST BORING



Washington State
Department of Transportation

Hole No.
Project

H-23-97
Rush Rd. to Thurston County Line H.O.V.

Job No.
Sheet

0L-2579
4 of 4

Depth (ft.)	Profile	(N)	SPT Blows 6 "	Sample Type	Sample No.	Description of Material	Ground Water	Instrument
60.0						Stopped Test Boring at 61.0 Installed Piezo to 61.0 with a 10.0 well screen to 51.0 backed fill with sand to 10.0, hole plug to 2.0, cement, monument		
61.0				✓				
62.0								
63.0								
64.0								
65.0								
66.0								
67.0								
68.0								
69.0								
70.0								
71.0								
72.0								
73.0								
74.0								
75.0								
76.0								
77.0								
78.0								
79.0								
80.0								

RESOURCE PROTECTION WELL REPORT

Job No.: XL-3224
Project: I-5 Blakeslee Jct. to Grand Mound
Hole#: H-23P-97 Well ID#: NONE
Method: Wet Rotary
Driller: Robert Shepherd Lic #: 2710
Company: _____
Signature: [Signature]

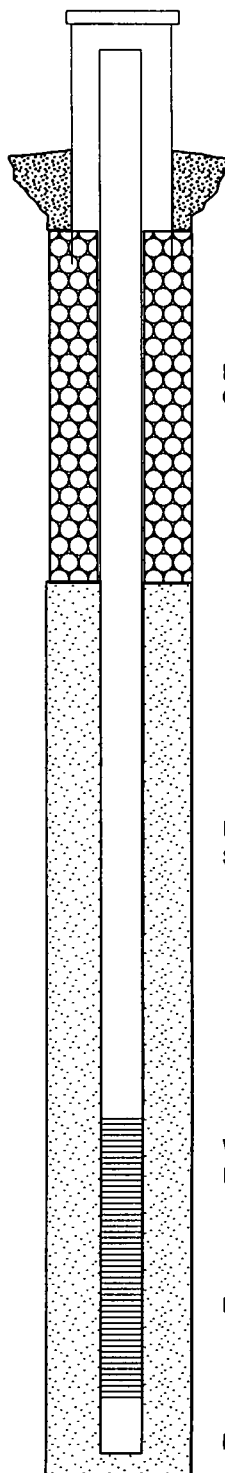
Decommission card #: A-136728

County: Lewis
Location: NE 1/4 of NW 1/4 Sec: 31 Twn: 14 Range: 2 WWM
Street Address of Well: Vicinity of MP85.3 I-5 Northbound
Water Table Depth: 23.3'
Ground Surface Elevation: 266.3
Installed: 5/20/1997 Decommissioned: April 13, 2010
Cased Hole: 1"

372209

Casing BX to 61'

Filled pipe with Bentonite slurry.
Cut of 2ft below ground and sealed top of hole.



Protective Casing,
Stick-up 2ft

Instrument Pipe'
stick-up 1 1/2ft

Ground Surface

Cement Surface Seal
from 0.0 ft. to 2.0 ft.

Instrument Pipe in
Granular Bentonite, from ft. to ft.

Instrument Pipe in
SAND, from 10.0 ft. to 51.0 ft.

RECEIVED

APR 29 2010

WA State Department
of Ecology (SWRO)

Well Screen
In Clean Sand, from 51.0 ft. to 61.0 ft

Bottom Seal, from ft. to ft

Bottom of Hole 61.0 ft.

Section E

Soil Information

Project Name: Chehalis Flood Storage Master Plan – Phase 1

Project No.: 15070-12

Date: 6/21/17

By: J. Sauer

Sheet: Soil Types

Page 1

Of

3

The area of interest is bounded to the North by NW River St, to the East by Interstate 5, to the South by the Chehalis River and to the West by State Route 6 and the Chehalis River. The soils that make up this area are: Newberg fine sandy loam (Hydrologic Soil Group A, see Table 1), Chehalis silty clay (Hydrologic Group B), Colquato silt loam (Hydrologic Group B), Reed silty clay loam, channeled (Hydrologic Group C & D), Alvor silty clay loam (Hydrologic Group C) and Reed silty clay loam (Hydrologic Group D).

Approximately 55% of the area is made up of **Chehalis silty clay** with minor components of Alvor (5%) and Reed (5%). This soil is silty clay from 0 to 17 inches, silty clay loam from 17 to 44 inches and stratified fine sandy loam to silty clay loam from 44 to 60 inches. The soil is well drained with depth to water table more than 80 inches. The frequency of flooding is occasional with no ponding. The water storage available for this soil is high at about 11.2 inches.

Newberg fine sandy loam with minor components of Alvor (5%), Puget (5%) and Reed (5%) make up approximately **15%** of the soil. This soil's profile consists of fine sandy loam from 0 to 17 inches and loamy very fine sand from 17 to 60 inches. The soil is well drained with depth to the water table more than 80 inches. The frequency of flooding is occasional with no ponding. The soil has moderate water storage of about 7.1 inches.

Colquato silt loam makes up approximately **15%** of the soil with minor components of Alvor (5%), Puget (5%) and Reed (5%). This soil is silt loam from 0 to 60 inches. It is well drained with depth to water table more than 80 inches. With frequency of flooding is occasional with no ponding. The available water storage is very high at approximately 12.1 inches.

Reed silty clay loam, channeled with minor components of Alvor (5%) and Chehalis (5%) make up about **5%** of the soil. The soil is silty clay loam from 0 to 14 inches and clay from 14 to 60 inches. This soil is

HYDROLOGIC GROUP	TYPE OF SOIL	DESCRIPTION
A	<i>Sand, loamy sand, or sandy loam</i>	Consists mainly of well drained sands or gravels. The soil has high runoff potential and high infiltration rates.
B	<i>Silt loam or loam</i>	Consists of moderate to well drained soils with medium fine to medium coarse textures. Infiltration rate is moderate.
C	<i>Clay loam</i>	Consists of medium to fine structure. Infiltration rate is low.
D	<i>Clay loam, silty clay loam, sandy clay or clay</i>	High runoff potential. Low infiltration rates. High swelling potential. This soil has a permanent high water table.



Project Name:	Chehalis Flood Storage Master Plan – Phase 1				
Project No.:	15070-12				
Date:	6/21/17	By:	J. Sauer		
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poorly drained with depth to water table of 0 inches. The frequency of flooding is frequent with frequent ponding. The available water storage is high at 10.1 inches.

Alvor silty clay loam with minor components of Reed (5%) and Chehalis (5%) makes up about **5%** of the soil. This soil is silty clay loam from 0 to 25 inches and silty clay from 25 to 60 inches. The soil is poorly drained with depth to water table about 24 to 48 inches. The frequency of flooding is frequent with no ponding. The available water storage is high at about 10.2 inches.

Reed silty clay loam with minor components of Chehalis (4%) and Alvor (1%) makes up about **5%** of the soil. The soil is silty clay loam from 0 to 14 inches and silty clay from 14 to 60 inches. The soil is well drained with depth to water table more than 80 inches. The frequency of flooding is none with no frequency of ponding.



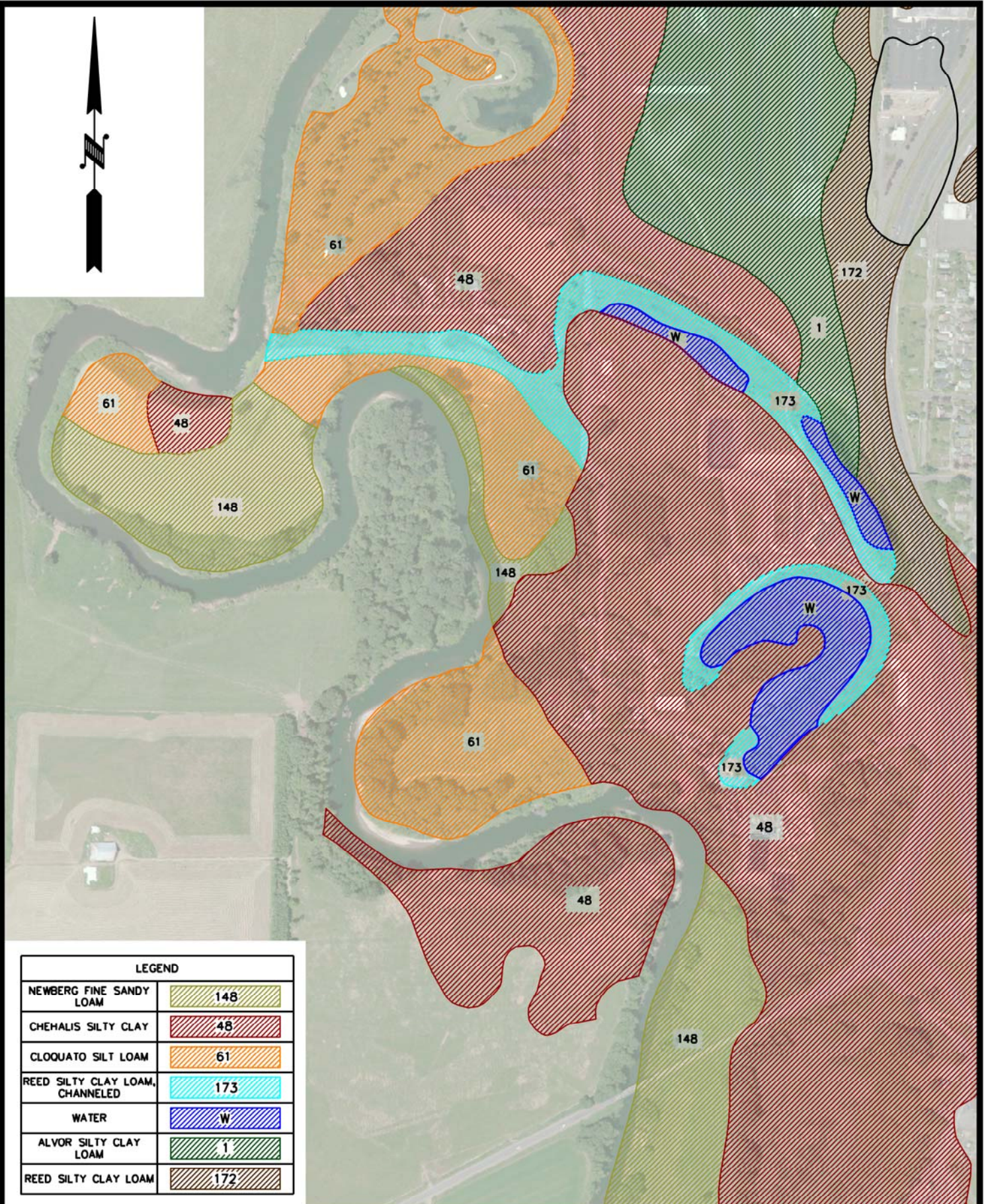
Project Name:	Chehalis Flood Storage Master Plan – Phase 1		
Project No.:	15070-12		
Date:	6/21/17	By:	J. Sauer
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<https://engineering.purdue.edu/mapserve/LTHIA7/documentation/hsg.html>

DRAFT



LEGEND	
NEWBERG FINE SANDY LOAM	148
CHEHALIS SILTY CLAY	48
CLOQUATO SILT LOAM	61
REED SILTY CLAY LOAM, CHanneled	173
WATER	W
ALVOR SILTY CLAY LOAM	1
REED SILTY CLAY LOAM	172



EXISTING SOIL TYPES



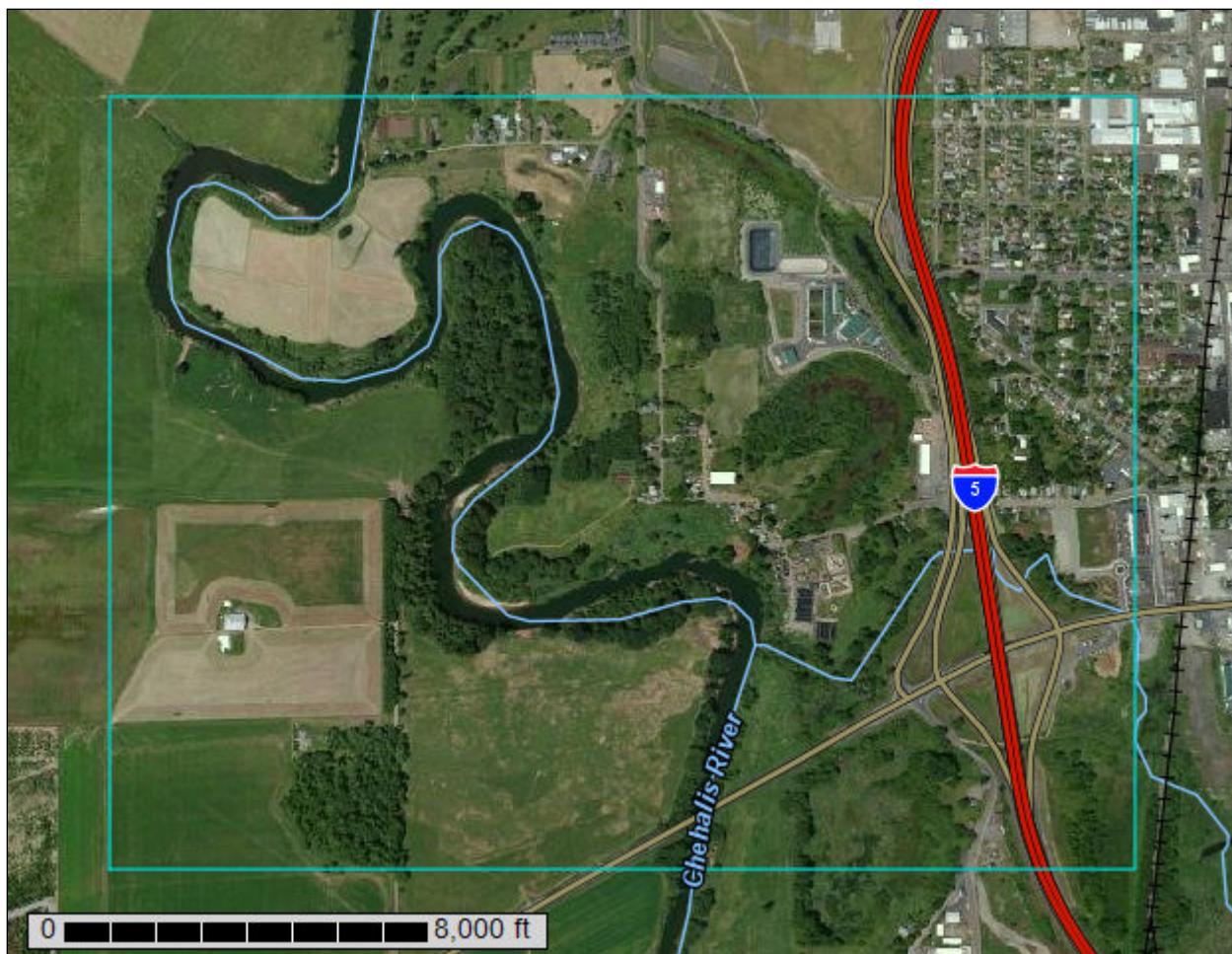
United States
Department of
Agriculture

NRCS

Natural
Resources
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Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for **Lewis County Area, Washington**



June 16, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Custom Soil Resource Report


MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot


 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails


 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lewis County Area, Washington

Survey Area Data: Version 14, Sep 9, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Jul 9, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Lewis County Area, Washington (WA641)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Alvor silty clay loam	19.5	3.1%
48	Chehalis silty clay	316.9	50.3%
61	Cloquato silt loam	40.6	6.4%
118	Lacamas silt loam, 0 to 3 percent slopes	1.4	0.2%
148	Newberg fine sandy loam	78.8	12.5%
172	Reed silty clay loam	31.7	5.0%
173	Reed silty clay loam, channeled	31.7	5.0%
187	Salkum silty clay loam, 0 to 5 percent slopes	51.2	8.1%
247	Xerorthents, spoils	5.6	0.9%
W	Water	52.1	8.3%
Totals for Area of Interest		629.5	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit

descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Lewis County Area, Washington

1—Alvor silty clay loam

Map Unit Setting

National map unit symbol: 2h7x

Elevation: 100 to 350 feet

Mean annual precipitation: 40 to 60 inches

Mean annual air temperature: 50 to 54 degrees F

Frost-free period: 150 to 200 days

Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Alvor, drained, and similar soils: 80 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alvor, Drained

Setting

Landform: Terraces, flood plains

Parent material: Alluvium

Typical profile

H1 - 0 to 7 inches: silty clay loam

H2 - 7 to 25 inches: silty clay loam

H3 - 25 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: About 24 to 48 inches

Frequency of flooding: Frequent

Frequency of ponding: None

Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4w

Hydrologic Soil Group: C

Other vegetative classification: Seasonally Wet Soils (G002XV202WA)

Hydric soil rating: Yes

Minor Components

Reed

Percent of map unit: 5 percent

Landform: Flood plains

Hydric soil rating: Yes

Chehalis

Percent of map unit: 5 percent

Hydric soil rating: No

48—Chehalis silty clay

Map Unit Setting

National map unit symbol: 2hgb

Elevation: 30 to 600 feet

Mean annual precipitation: 40 to 60 inches

Mean annual air temperature: 50 to 54 degrees F

Frost-free period: 150 to 210 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Chehalis and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chehalis

Setting

Landform: Flood plains, terraces

Parent material: Alluvium

Typical profile

H1 - 0 to 17 inches: silty clay

H2 - 17 to 44 inches: silty clay loam

H3 - 44 to 60 inches: stratified fine sandy loam to silty clay loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Available water storage in profile: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): 3w

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: B

Other vegetative classification: Soils with Few Limitations (G002XV502WA)

Hydric soil rating: No

Minor Components

Alvor

Percent of map unit: 5 percent

Landform: Terraces

Hydric soil rating: Yes

Reed

Percent of map unit: 5 percent

Landform: Flood plains

Hydric soil rating: Yes

61—Cloquato silt loam

Map Unit Setting

National map unit symbol: 2hgt

Elevation: 30 to 800 feet

Mean annual precipitation: 38 to 60 inches

Mean annual air temperature: 50 to 54 degrees F

Frost-free period: 150 to 240 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Cloquato and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cloquato

Setting

Landform: Flood plains, terraces

Typical profile

H1 - 0 to 9 inches: silt loam

H2 - 9 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Available water storage in profile: Very high (about 12.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: B

Other vegetative classification: Seasonally Wet Soils (G002XV202WA)

Hydric soil rating: No

Minor Components

Alvor

Percent of map unit: 5 percent

Landform: Terraces

Hydric soil rating: Yes

Puget

Percent of map unit: 5 percent

Landform: Flood plains

Hydric soil rating: Yes

Reed

Percent of map unit: 5 percent

Landform: Flood plains

Hydric soil rating: Yes

118—Lacamas silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2h8l

Elevation: 250 to 1,200 feet

Mean annual precipitation: 40 to 70 inches

Mean annual air temperature: 48 to 50 degrees F

Frost-free period: 125 to 200 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Lacamas, drained, and similar soils: 60 percent

Lacamas, undrained, and similar soils: 30 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lacamas, Drained

Setting

Landform: Flood plains, terraces

Typical profile

H1 - 0 to 7 inches: silt loam

H2 - 7 to 17 inches: silt loam

H3 - 17 to 27 inches: silty clay

H4 - 27 to 60 inches: clay

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)

Depth to water table: About 12 to 18 inches

Frequency of flooding: None

Custom Soil Resource Report

Frequency of ponding: None

Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4w

Hydrologic Soil Group: C/D

Other vegetative classification: Seasonally Wet Soils (G002XV202WA)

Hydric soil rating: Yes

Description of Lacamas, Undrained

Setting

Landform: Flood plains, terraces

Typical profile

H1 - 0 to 7 inches: silt loam

H2 - 7 to 17 inches: silt loam

H3 - 17 to 27 inches: silty clay

H4 - 27 to 60 inches: clay

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Very poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: C/D

Other vegetative classification: Seasonally Wet Soils (G002XV202WA)

Hydric soil rating: Yes

Minor Components

Klaber

Percent of map unit: 5 percent

Landform: Depressions

Hydric soil rating: Yes

Prather

Percent of map unit: 3 percent

Hydric soil rating: No

Scamman

Percent of map unit: 2 percent

Landform: Terraces

Hydric soil rating: Yes

148—Newberg fine sandy loam

Map Unit Setting

National map unit symbol: 2h9p

Elevation: 10 to 1,500 feet

Mean annual precipitation: 18 to 60 inches

Mean annual air temperature: 50 to 54 degrees F

Frost-free period: 165 to 210 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Newberg and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Newberg

Setting

Landform: Flood plains, terraces

Typical profile

H1 - 0 to 7 inches: fine sandy loam

H2 - 7 to 17 inches: fine sandy loam

H3 - 17 to 60 inches: loamy very fine sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: A

Other vegetative classification: Soils with Few Limitations (G002XV502WA)

Hydric soil rating: No

Minor Components

Alvor

Percent of map unit: 5 percent

Landform: Terraces

Hydric soil rating: Yes

Puget

Percent of map unit: 5 percent

Landform: Flood plains

Hydric soil rating: Yes

Reed

Percent of map unit: 5 percent

Landform: Flood plains

Hydric soil rating: Yes

172—Reed silty clay loam

Map Unit Setting

National map unit symbol: 2hbk

Elevation: 30 to 500 feet

Mean annual precipitation: 40 to 80 inches

Mean annual air temperature: 50 to 54 degrees F

Frost-free period: 150 to 200 days

Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Reed, drained, and similar soils: 95 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reed, Drained

Setting

Landform: Flood plains, terraces

Typical profile

H1 - 0 to 6 inches: silty clay loam

H2 - 6 to 14 inches: silty clay loam

H3 - 14 to 60 inches: clay

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 18 to 36 inches

Frequency of flooding: Frequent

Frequency of ponding: None

Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: D

Custom Soil Resource Report

Other vegetative classification: Wet Soils (G002XV102WA)
Hydric soil rating: Yes

Minor Components

Chehalis

Percent of map unit: 4 percent
Hydric soil rating: No

Alvor

Percent of map unit: 1 percent
Landform: Terraces
Hydric soil rating: Yes

173—Reed silty clay loam, channeled

Map Unit Setting

National map unit symbol: 2hbl
Elevation: 30 to 500 feet
Mean annual precipitation: 40 to 80 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Reed and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reed

Setting

Landform: Flood plains, terraces

Typical profile

H1 - 0 to 6 inches: silty clay loam
H2 - 6 to 14 inches: silty clay loam
H3 - 14 to 60 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: C/D

Other vegetative classification: Wet Soils (G002XV102WA)

Hydric soil rating: Yes

Minor Components

Alvor

Percent of map unit: 5 percent

Landform: Terraces

Hydric soil rating: Yes

Chehalis

Percent of map unit: 5 percent

Hydric soil rating: No

187—Salkum silty clay loam, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2hc2

Elevation: 200 to 1,000 feet

Mean annual precipitation: 40 to 70 inches

Mean annual air temperature: 48 to 50 degrees F

Frost-free period: 150 to 210 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Salkum and similar soils: 90 percent

Minor components: 4 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Salkum

Setting

Landform: Terraces

Parent material: Glacial drift

Typical profile

H1 - 0 to 14 inches: silty clay loam

H2 - 14 to 52 inches: silty clay

H3 - 52 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 5 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: More than 80 inches

Custom Soil Resource Report

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C

Other vegetative classification: Soils with Few Limitations (G002XV502WA)

Hydric soil rating: No

Minor Components

Lacamas

Percent of map unit: 3 percent

Landform: Terraces

Hydric soil rating: Yes

Scamman

Percent of map unit: 1 percent

Landform: Terraces

Hydric soil rating: Yes

247—Xerorthents, spoils

Map Unit Setting

National map unit symbol: 2hf7

Elevation: 100 to 690 feet

Mean annual precipitation: 40 to 60 inches

Mean annual air temperature: 50 degrees F

Frost-free period: 150 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Xerorthents and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Xerorthents

Setting

Landform: Hills

Typical profile

H1 - 0 to 6 inches: silty clay loam

H2 - 6 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 20 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)

Custom Soil Resource Report

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Hydric soil rating: No

W—Water

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting

Landform: Alluvial cones

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Custom Soil Resource Report

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Section F

Critical Areas Information



WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

PRIORITY HABITATS AND SPECIES REPORT

SOURCE DATASET: PHSPublic
REPORT DATE: 06/19/2017 3.41

Query ID: P170619154058

Common Name	Site Name	Priority Area	Accuracy	Federal Status	Sensitive Data	Source Entity
Scientific Name	Source Dataset	Occurrence Type		State Status	Resolution	Geometry Type
Notes	Source Record	More Information (URL)		PHS Listing Status		
Notes	Source Date	Mgmt Recommendations				
Cavity-nesting Ducks	CHEHALIS RIVER & PHSREGION	Breeding Area	1/4 mile (Quarter	N/A	N	WA Dept. of Fish and Wildlife
	905309	Breeding occurrence		N/A	AS MAPPED	Polygons
		http://wdfw.wa.gov/publications/pub.php?		PHS LISTED		
Chinook	Chehalis River	Occurrence	NA	Not Warranted	N	WDFW Fish Program
Oncorhynchus tshawytscha	SASI	Occurrence		N/A	AS MAPPED	Lines
	1435	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm		PHS Listed		
		http://wdfw.wa.gov/publications/pub.php?				
Chinook	Chehalis River	Occurrence	NA	Not Warranted	N	WDFW Fish Program
Oncorhynchus tshawytscha	SASI	Occurrence		N/A	AS MAPPED	Lines
	1432	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm		PHS Listed		
		http://wdfw.wa.gov/publications/pub.php?				
Coho	Dillenbaugh Creek	Occurrence/Migration	NA	N/A	N	
Oncorhynchus kisutch	SWIFD	Occurrence/migration		N/A	AS MAPPED	Lines
	56269	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm		PHS LISTED		
		http://wdfw.wa.gov/publications/pub.php?				
Coho	Chehalis River	Occurrence/Migration	NA	N/A	N	
Oncorhynchus kisutch	SWIFD	Occurrence/migration		N/A	AS MAPPED	Lines
	63843	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm		PHS LISTED		
		http://wdfw.wa.gov/publications/pub.php?				
Coho	Dillenbaugh Creek	Occurrence	NA	Candidate	N	WDFW Fish Program
Oncorhynchus kisutch	SASI	Occurrence		N/A	AS MAPPED	Lines
	3605	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm		PHS Listed		
		http://wdfw.wa.gov/publications/pub.php?				
Coho	Chehalis River	Occurrence	NA	Candidate	N	WDFW Fish Program
Oncorhynchus kisutch	SASI	Occurrence		N/A	AS MAPPED	Lines
	3605	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm		PHS Listed		
		http://wdfw.wa.gov/publications/pub.php?				

Common Name Scientific Name Notes	Site Name Source Dataset Source Record Source Date	Priority Area Occurrence Type More Information (URL) Mgmt Recommendations	Accuracy	Federal Status State Status PHS Listing Status	Sensitive Data Resolution	Source Entity Geometry Type
Cutthroat Oncorhynchus clarki	Dillenbaugh Creek SASI 7580	Occurrence Occurrence http://wdfw.wa.gov/wlm/diversty/soc/soc.htm http://wdfw.wa.gov/publications/pub.php?	NA	Candidate N/A PHS Listed	N AS MAPPED	WDFW Fish Program Lines
Cutthroat Oncorhynchus clarki	Chehalis River SASI 7580	Occurrence Occurrence http://wdfw.wa.gov/wlm/diversty/soc/soc.htm http://wdfw.wa.gov/publications/pub.php?	NA	Candidate N/A PHS Listed	N AS MAPPED	WDFW Fish Program Lines
Fall Chinook Oncorhynchus tshawytscha	Chehalis River SWIFD 63833	Occurrence/Migration Occurrence/migration http://wdfw.wa.gov/wlm/diversty/soc/soc.htm http://wdfw.wa.gov/publications/pub.php?	NA	N/A N/A PHS LISTED	N AS MAPPED	Lines
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons

Common Name Scientific Name Notes	Site Name Source Dataset Source Record Source Date	Priority Area Occurrence Type More Information (URL) Mgmt Recommendations	Accuracy	Federal Status State Status PHS Listing Status	Sensitive Data Resolution	Source Entity Geometry Type
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons

Common Name Scientific Name Notes	Site Name Source Dataset Source Record Source Date	Priority Area Occurrence Type More Information (URL) Mgmt Recommendations	Accuracy	Federal Status State Status PHS Listing Status	Sensitive Data Resolution	Source Entity Geometry Type
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons

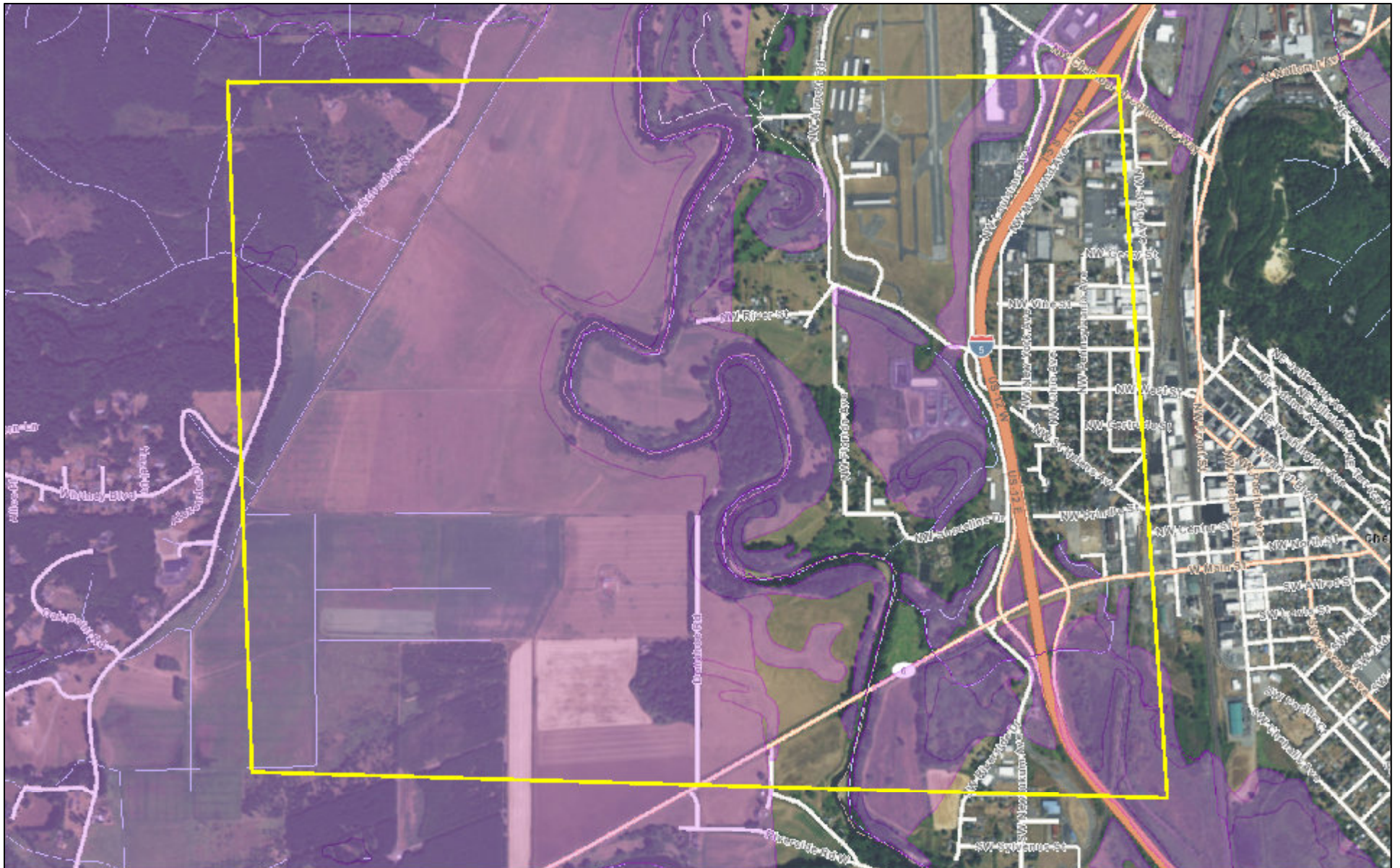
Common Name Scientific Name Notes	Site Name Source Dataset Source Record Source Date	Priority Area Occurrence Type More Information (URL) Mgmt Recommendations	Accuracy	Federal Status State Status PHS Listing Status	Sensitive Data Resolution	Source Entity Geometry Type
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.gov	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons

Common Name Scientific Name Notes	Site Name Source Dataset Source Record Source Date	Priority Area Occurrence Type More Information (URL) Mgmt Recommendations	Accuracy	Federal Status State Status PHS Listing Status	Sensitive Data Resolution	Source Entity Geometry Type
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Pond	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Pond	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Pond	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Resident Coastal Cutthroat Oncorhynchus clarki	Dillenbaugh Creek SWIFD 56268	Occurrence/Migration Occurrence/migration http://wdfw.wa.gov/wlm/diversty/soc/soc.htm http://wdfw.wa.gov/publications/pub.php?	NA	N/A N/A PHS LISTED	N AS MAPPED	Lines
Resident Coastal Cutthroat Oncorhynchus clarki	Chehalis River SWIFD 63831	Occurrence/Migration Occurrence/migration http://wdfw.wa.gov/wlm/diversty/soc/soc.htm http://wdfw.wa.gov/publications/pub.php?	NA	N/A N/A PHS LISTED	N AS MAPPED	Lines
Riverine	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons

Common Name Scientific Name Notes	Site Name Source Dataset Source Record Source Date	Priority Area Occurrence Type More Information (URL) Mgmt Recommendations	Accuracy	Federal Status State Status PHS Listing Status	Sensitive Data Resolution	Source Entity Geometry Type
Roosevelt elk Cervus elaphus roosevelti	PHSREGION 918523	Regular Concentration Regular concentration http://wdfw.wa.gov/publications/pub.php?	General locality	N/A N/A PHS LISTED	N AS MAPPED	WA Dept. of Fish and Wildlife Polygons
Spring Chinook Oncorhynchus tshawytscha	Chehalis River SWIFD 63838	Occurrence/Migration Occurrence/migration http://wdfw.wa.gov/wlm/diversty/soc/soc.htm http://wdfw.wa.gov/publications/pub.php?	NA	N/A N/A PHS LISTED	N AS MAPPED	Lines
Steelhead Oncorhynchus mykiss	Chehalis River SASI 6574	Occurrence Occurrence http://wdfw.wa.gov/wlm/diversty/soc/soc.htm	NA	Not Warranted N/A PHS Listed	N AS MAPPED	WDFW Fish Program Lines
Steelhead Oncorhynchus mykiss	Chehalis River SASI 6609	Occurrence Occurrence http://wdfw.wa.gov/wlm/diversty/soc/soc.htm	NA	Not Warranted N/A PHS Listed	N AS MAPPED	WDFW Fish Program Lines
Waterfowl Concentrations	CHEHALIS WETLANDS PHSREGION 902195	Regular Concentration Regular concentration http://wdfw.wa.gov/publications/pub.php?	1/4 mile (Quarter	N/A N/A PHS LISTED	N AS MAPPED	WA Dept. of Fish and Wildlife Polygons
Winter Steelhead Oncorhynchus mykiss	Chehalis River SWIFD 63850	Occurrence/Migration Occurrence/migration http://wdfw.wa.gov/wlm/diversty/soc/soc.htm	NA	N/A N/A PHS LISTED	N AS MAPPED	Lines

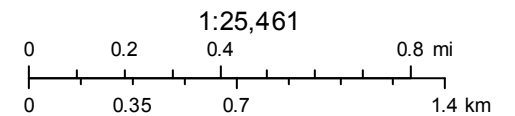
DISCLAIMER. This report includes information that the Washington Department of Fish and Wildlife (WDFW) maintains in a central computer database. It is not an attempt to provide you with an official agency response as to the impacts of your project on fish and wildlife. This information only documents the location of fish and wildlife resources to the best of our knowledge. It is not a complete inventory and it is important to note that fish and wildlife resources may occur in areas not currently known to WDFW biologists, or in areas for which comprehensive surveys have not been conducted. Site specific surveys are frequently necessary to rule out the presence of priority resources. Locations of fish and wildlife resources are subject to variation caused by disturbance, changes in season and weather, and other factors. WDFW does not recommend using reports more than six months old.

WDFW Test Map



June 19, 2017

- | | | |
|--|---|---|
| PHS Report Clip Area | POLY | QTR-TWP |
| • PT | AS MAPPED | TOWNSHIP |
| — LN | SECTION | |



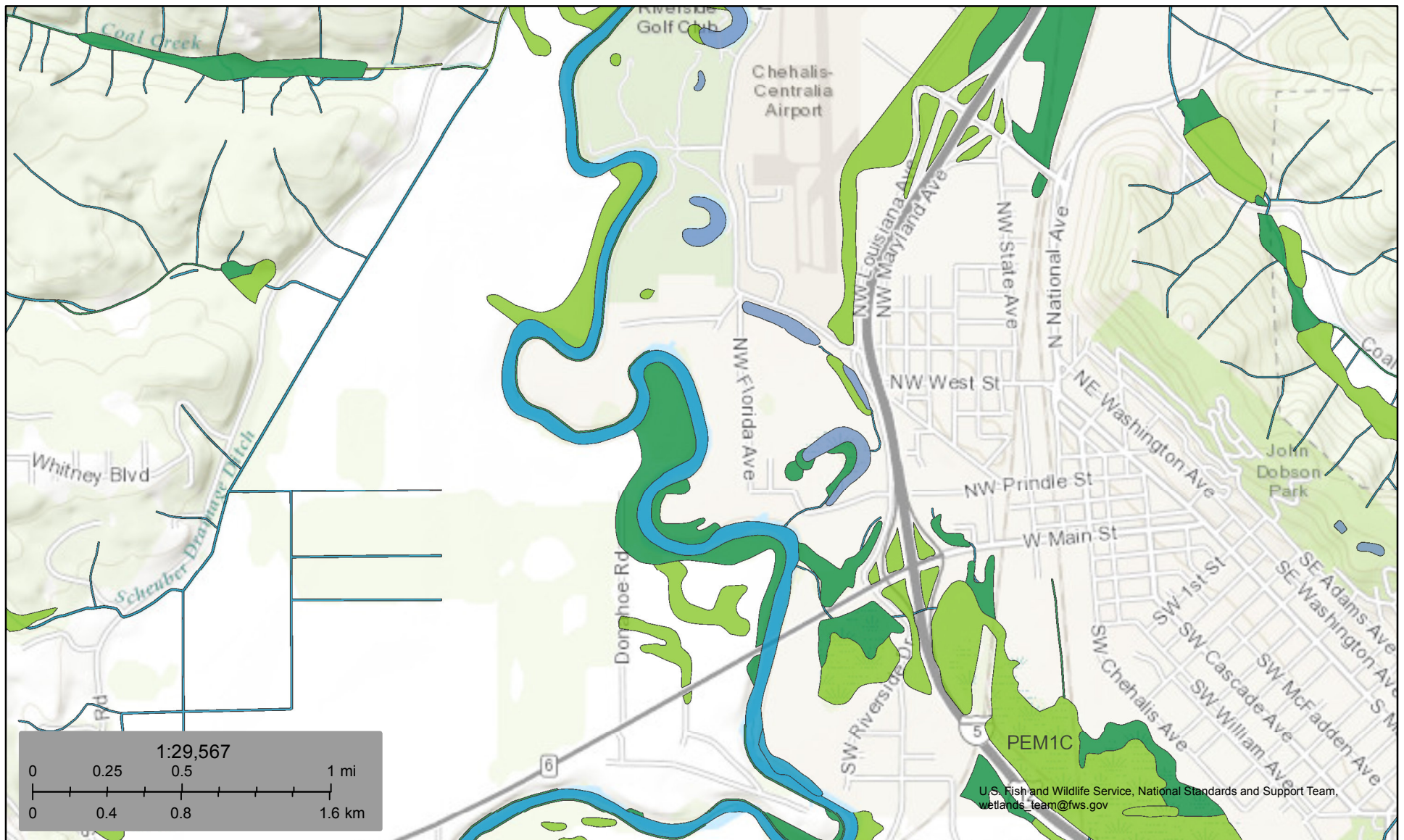
Washington Fish and Wildlife
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus



U.S. Fish and Wildlife Service

National Wetlands Inventory

Wetland- Chehalis

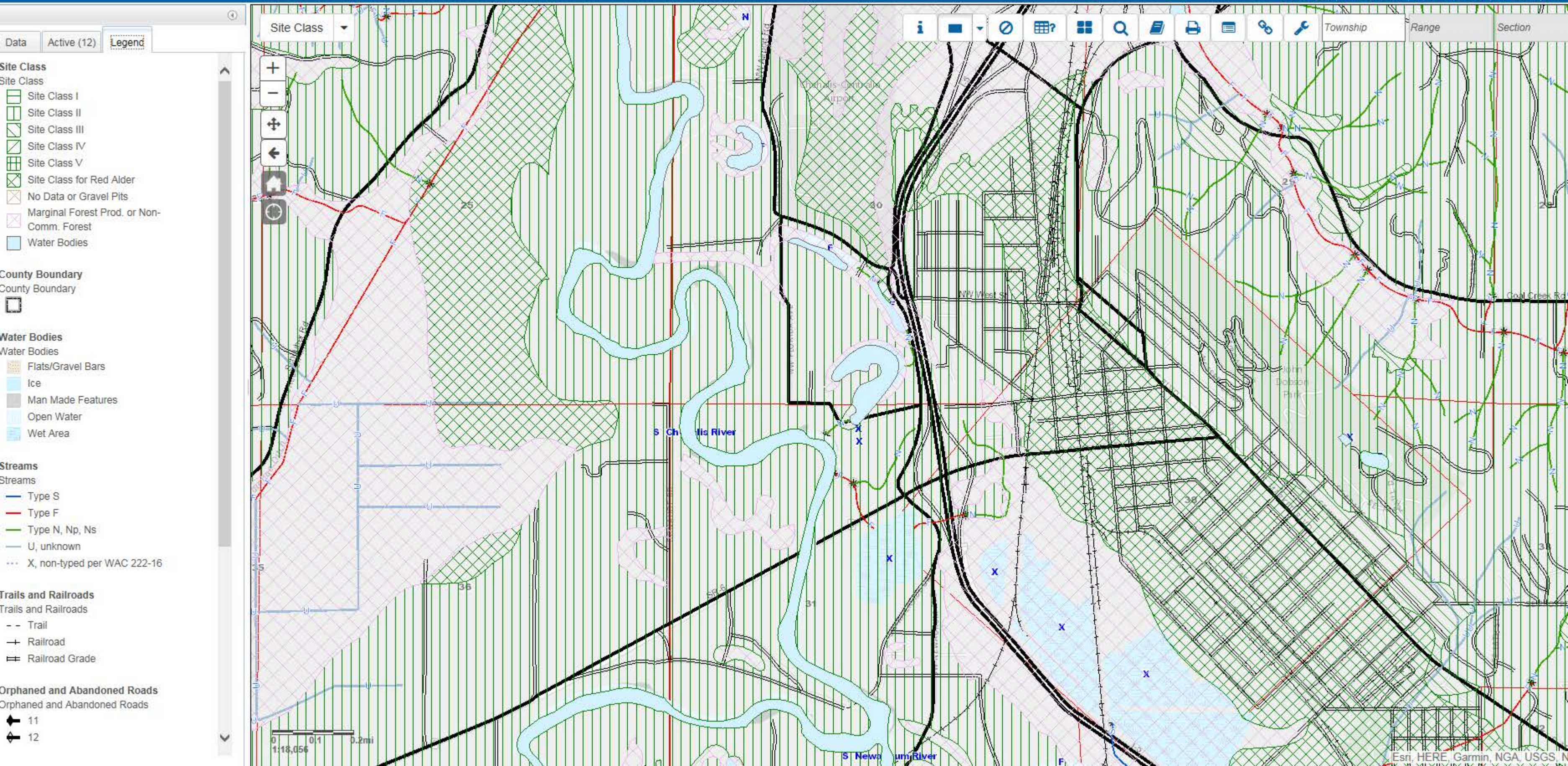


June 19, 2017

Wetlands

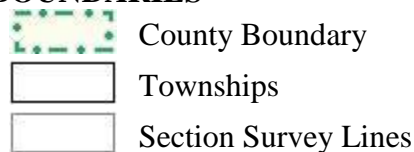
- | | | |
|--------------------------------|-----------------------------------|----------|
| Estuarine and Marine Deepwater | Freshwater Emergent Wetland | Lake |
| Estuarine and Marine Wetland | Freshwater Forested/Shrub Wetland | Other |
| | Freshwater Pond | Riverine |

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.



FPARS MAPS LEGEND

BOUNDARIES



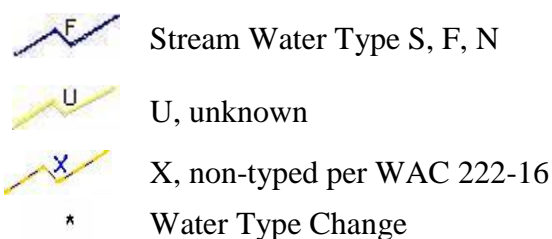
WATER BODIES



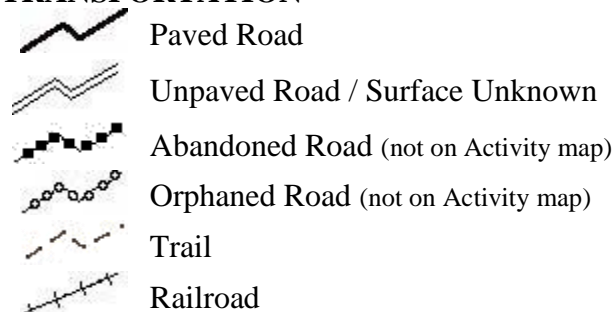
ELEVATION



STREAMS



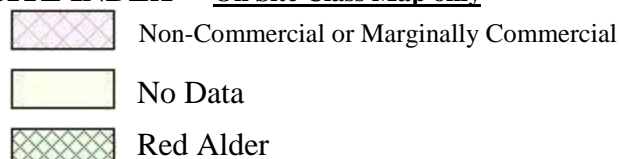
TRANSPORTATION



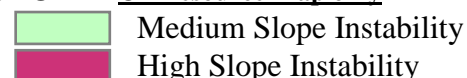
SITE CLASS – On Site Class Map only



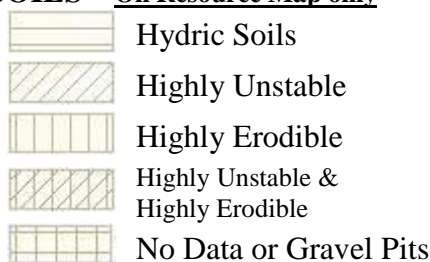
SITE INDEX – On Site Class Map only



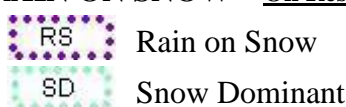
SLOPE– On Resource Map only



SOILS – On Resource Map only



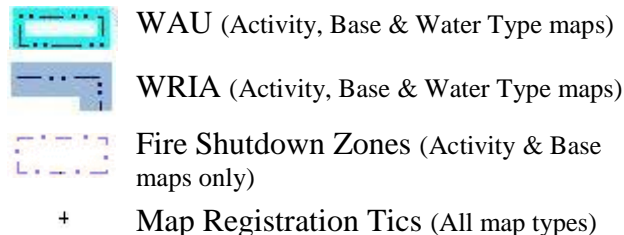
RAIN ON SNOW – On Resource Map only



WETLANDS – Resource & Water Type Maps only



OTHER



Notes to Applicant or other user:

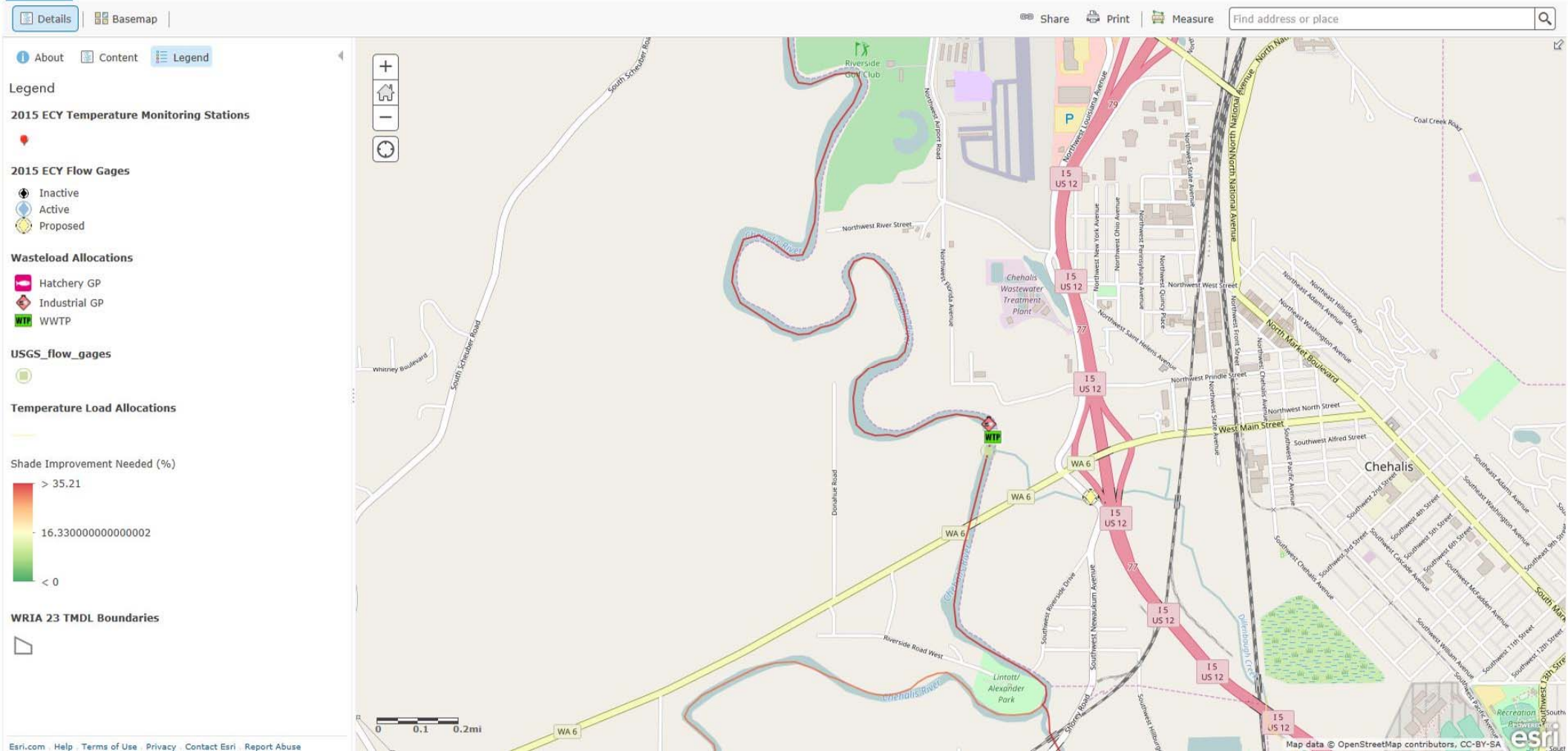
See the FPA/N instructions for Activity Map standards.

Site indices are based on the WA-DNR State Soil Survey. If the site index does not exist or indicates red alder, noncommercial, or marginally commercial species, the following apply:

- If red alder is indicated and the whole RMZ width is within that site index, then use site class V. If red alder is indicated for only a portion of the RMZ width, or there is on-site evidence that the site has historically supported conifer, then use the site class for conifer in the most physiographically similar adjacent soil polygon.
- In Western Washington, if there is no site index information, use the site class for conifer in the most physiographically similar adjacent soil polygon.
- In Eastern Washington, if there is no site index information, assume site class III, unless site specific information indicates otherwise.
- If the soil polygon indicates noncommercial or marginally commercial, then use site class V.

See Forest Practices Rules WAC 222-16-010 for a more complete definition of site class.

Disclaimer: Features shown on Forest Practices Application Review System (FPARS) maps represent data stored in the Washington State Department of Natural Resources (DNR) Geographic Information Systems database. As some of the data sets rely on outside sources of information, the DNR cannot accept responsibility for errors or omissions, and therefore there are no warranties that accompany this material.




<http://www.ecy.wa.gov>

[Water Quality Improvement Projects](#) > [Chehalis Watershed Area Projects](#) > Chehalis River Multi-parameter Projects

Water Quality Improvement Projects Chehalis River Area: Multi-parameter

Introduction

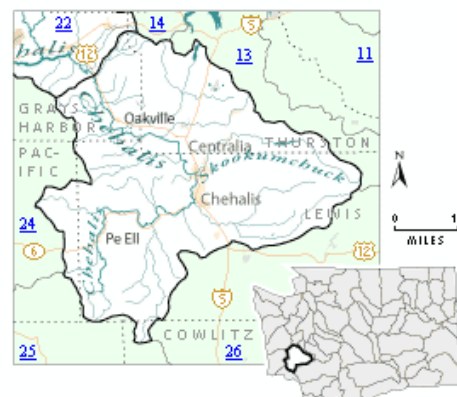
The Chehalis River and its tributaries cover more than 3300 surface miles and span two watershed resource inventory areas (WRIAs 22 and 23). The upper watershed (from Porter to the Chehalis River headwaters) has been the subject of several water quality studies and total maximum daily load (TMDL) plans since 1990. The TMDL plans cover all of the upper watershed in WRIA 23 and address 303(d) listings for dissolved oxygen (DO), fecal coliform bacteria, and temperature (T) impairments. These TMDL plans are described together here since these pollutants are inter-related, as are the implementation activities needed to achieve water quality standards. The [Grays Harbor Bacteria TMDL](#) covers the Chehalis River watershed from Porter to the harbor at Aberdeen.



Water quality issues

The Chehalis River and many of its largest tributaries have a history of not meeting water quality standards for instream temperature, dissolved oxygen, and fecal coliform, while many waterbodies in the upper watershed also have difficulties meeting pH, total phosphorus, and turbidity criteria on occasion. A fish kill on the Black River in 1989 (see [report](#)) and other problems with dissolved oxygen on the Chehalis River spurred the water quality studies that led to the Upper Chehalis Dissolved Oxygen TMDL, which incorporated the Black River water quality studies.

Sufficient levels of dissolved oxygen (DO) in healthy water is vital for fish and aquatic life to survive. If DO levels are too low, then fish and other aquatic life will suffocate. Oxygen is also necessary to help decompose organic matter in the water and bottom sediments, as well as for other biological and chemical processes. Pollutants that affect DO include nitrogen in several forms (ammonia, nitrate, and nitrite) and phosphorus. Both nutrients are needed to fuel primary productivity, which is the process whereby energy is converted to



Map of Upper Chehalis River Watershed TMDLs

PROJECT INFO

Location:

WRIA(s):

[#22 \(Lower Chehalis\)](#)

[#23 \(Upper Chehalis\)](#)

County: [Grays Harbor](#)

Water-body Name:

Upper Chehalis River

Parameters:

Ammonia-N/BOD

Dissolved Oxygen

Fecal Coliform Bacteria

Temperature

of TMDLs:

Ammonia-N/BOD: 34

Dissolved Oxygen: 3

Temperature: 11

Status:

Approved by EPA

Contact Info:

Brett Raunig

Phone: 360-690-4660

Email: Brett.Raunig@ecy.wa.gov

Southwest Region

Department of Ecology

P.O. Box 47775

Olympia, WA 98504 - 7775

organic substances through photosynthesis. Primary productivity can increase DO during the day as the plants photosynthesize, but DO decreases at night as a result of respiration. High concentrations of decomposing organic matter can lower DO, and high stream temperatures can lower the DO saturation point which also results in lower DO.

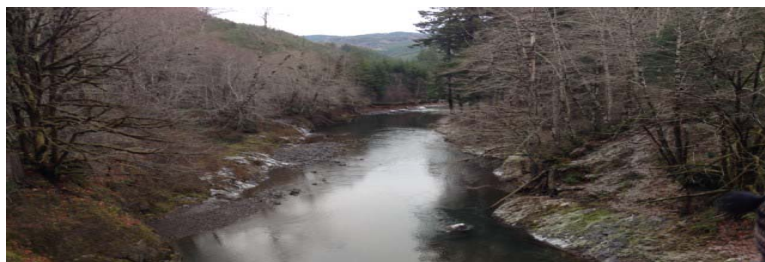
The Dissolved Oxygen TMDL report (2000) identified the section of the Chehalis River, called the Twin Cities Reach (which is from the confluence with the Newaukum River to the confluence with Skookumchuck River), as very sensitive to nutrient inputs due in large part to the very slow streamflow within this reach. This prompted a significant investment of money for improvements and operational changes to the city of Chehalis' and the city of Centralia's wastewater treatment plants in the mid-2000s. The TMDL set limits on point and nonpoint sources of ammonia and biological oxygen demand (BOD) as surrogates for improving DO in the Chehalis River watershed.

A plan to reduce instream temperatures was developed with the [stream temperature TMDL](#) (1999), which established targets for riparian restoration and improvements along the mainstem Chehalis River and several of its significant tributaries like the Newaukum River. Both juvenile and adult salmonids need cool temperatures to survive. Cooler temperatures can be achieved by restoring and protecting riparian shade which blocks solar radiation from directly warming a waterbody, and also by increasing channel complexity and restoring hydrologic functions that increase the amount of inter-gravel and hyporheic flow of cooler groundwater into the surface water to provide cold-water refugia for salmonids. Properly functioning riparian areas have the added benefit of reducing streambank erosion, and can filter stormwater runoff to remove bacteria and nutrients before they get into rivers and streams. Cooler streams also results in a higher DO saturation point which means the stream can hold higher concentrations of DO.

Fecal coliform is a group of bacteria common in human and animal waste and includes pathogens that can make people sick and cause the closure of shellfish harvesting beds when concentrations are higher than limits established by the National Sanitation and Shellfish Program (NSSP) and regulated through the Washington Department of Health (WDOH). Bacteria can get into our waters from untreated or partially treated wastewater treatment plant discharges, improperly functioning septic systems, improperly managed manure, direct access from livestock, pets and wildlife. The [fecal coliform bacteria TMDL](#) (2004) set multiple targets for the reduction of fecal coliform bacteria in areas all throughout the upper Chehalis Watershed.

A study conducted during 2006-2009, in partnership with the Grays Harbor Community College, the Chehalis Tribes, and the Chehalis Basin Partnership, found that bacteria levels in many places around the upper watershed had decreased to levels that did not exceed water quality criteria for bacteria. The Category 4a impaired bacteria listings from those improved areas are on the proposed 2014 Water Quality Assessment list for re-categorization to Category 1 (meets criteria).

TMDL implementation: getting to clean water





To address the fishery resource concerns the [Chehalis Salmon Recovery Lead Entity](#) coordinates salmon recovery funding and projects sponsored by various organizations to protect and enhance the riparian corridor (see the [Partners](#) webpage). Funding opportunities are made available through Ecology, the Governor's Salmon Recovery Office, Natural Resource Conservation Service (NRCS), the US Fish and Wildlife Service, and other public and private entities. Landowners, the local conservation districts, the Confederated Tribes of the Chehalis Indian Reservation, cities, volunteer groups including students, land trusts, and local fishery support groups provide labor and plant materials for stabilizing the stream banks and to increase riparian shade.

In addition to preserving current riparian areas, restoring riparian shade is one of the most important implementation activities to directly lower stream temperatures. Where livestock are present, landowners should install fencing to keep livestock out of rivers, streams, and away from eroding river banks, as well as fixing denuded riparian areas to increase shade. The fence and vegetative "buffers" reduce animal waste and other pollutants washed off adjacent lands from getting into the river or stream. A functioning riparian area prevents or reduces transport of nutrient and BOD materials into the river to help improve DO conditions too.

Ecology (along with WDFW, WDNR, the salmon recovery Lead Entity, and others) is engaged with the Chehalis Flood Strategy efforts to reduce flood damage and restore aquatic species habitat throughout the Chehalis River basin. Solutions to reduce flooding and restore natural functions and aquatic habitat can also have benefits for the improvement of water quality and to meet TMDL objectives.

Current Monitoring

[Ecology's Streamflow Gaging and WQ Monitoring Network](#) for the Chehalis Flood Strategy Workgroup can be found on the [web](#). In addition, Ecology has maintained two long-term ambient water quality monitoring stations with data going back to the '80s and later (available on the [web](#)).

In addition to Ecology's monitoring, Thurston County also collects water quality data within the county's part of the upper Chehalis Basin (parts of the Scatter Creek and Black River watersheds). The county's data is available on the [web](#). The Chehalis Tribe also collects surface water quality data.

Technical information

TMDL reports are submitted to the U.S. EPA for approval. These documents are also called WQ Improvement Reports (WQIRs). Sometimes the study on which these reports are based is published separately as a TMDL study, or technical report, that describes the results and analysis of the study. The precursor to a study is a Quality Assurance Project Plan (QAPP). The QAPP describes the study design, data collection and data quality objectives. Important follow-up studies to a TMDL are also included in the following table. Unless otherwise specified the following documents are Ecology publications.

Document Type	Pollutant	Title	Publication #
TMDL Reports	Temperature	Upper Chehalis River Basin Temperature Total Maximum	99-52

		Daily Load Submittal	
	Dissolved Oxygen	Revised -- Upper Chehalis River Basin Dissolved Oxygen Total Maximum Daily Load Submittal Report	00-10-018
	Fecal Coliform Bacteria	Upper Chehalis River Fecal Coliform Bacteria Total Maximum Daily Load: Submittal Report	04-10-041
TMDL Implementation Plan	Fecal Coliform Bacteria	The Chehalis/Grays Harbor Watershed Dissolved Oxygen,	
	Temperature	Temperature, and Fecal Coliform Bacteria TMDL: Detailed Implementation (Cleanup) Plan	04-10-065
	Dissolved Oxygen		
	Dissolved Oxygen	Black River Dissolved Oxygen and Phosphorus Total Maximum Daily Load Study	94-106
TMDL Studies		Black River Wet Season Nonpoint Source Total Maximum Daily Load Study	94-104 94-126 04-03-004
	Fecal Coliform Bacteria	Upper Chehalis River Dry Season Total Maximum Daily Load Study	
		Upper Chehalis River Fecal Coliform Bacteria Total Maximum Daily Load Recommendations	
Follow-up Studies	Fecal Coliform Bacteria	Upper Chehalis River Watershed Multi-Parameter Total Maximum Daily Load: Water Quality Data Review	10-03-057

Partners

Related information

WRIA 22 23 Watershed Information (Water web site)

www.ecy.wa.gov/water/wria/22.html

www.ecy.wa.gov/water/wria/23.html

[Back to top of page](#)

Last updated October 2016

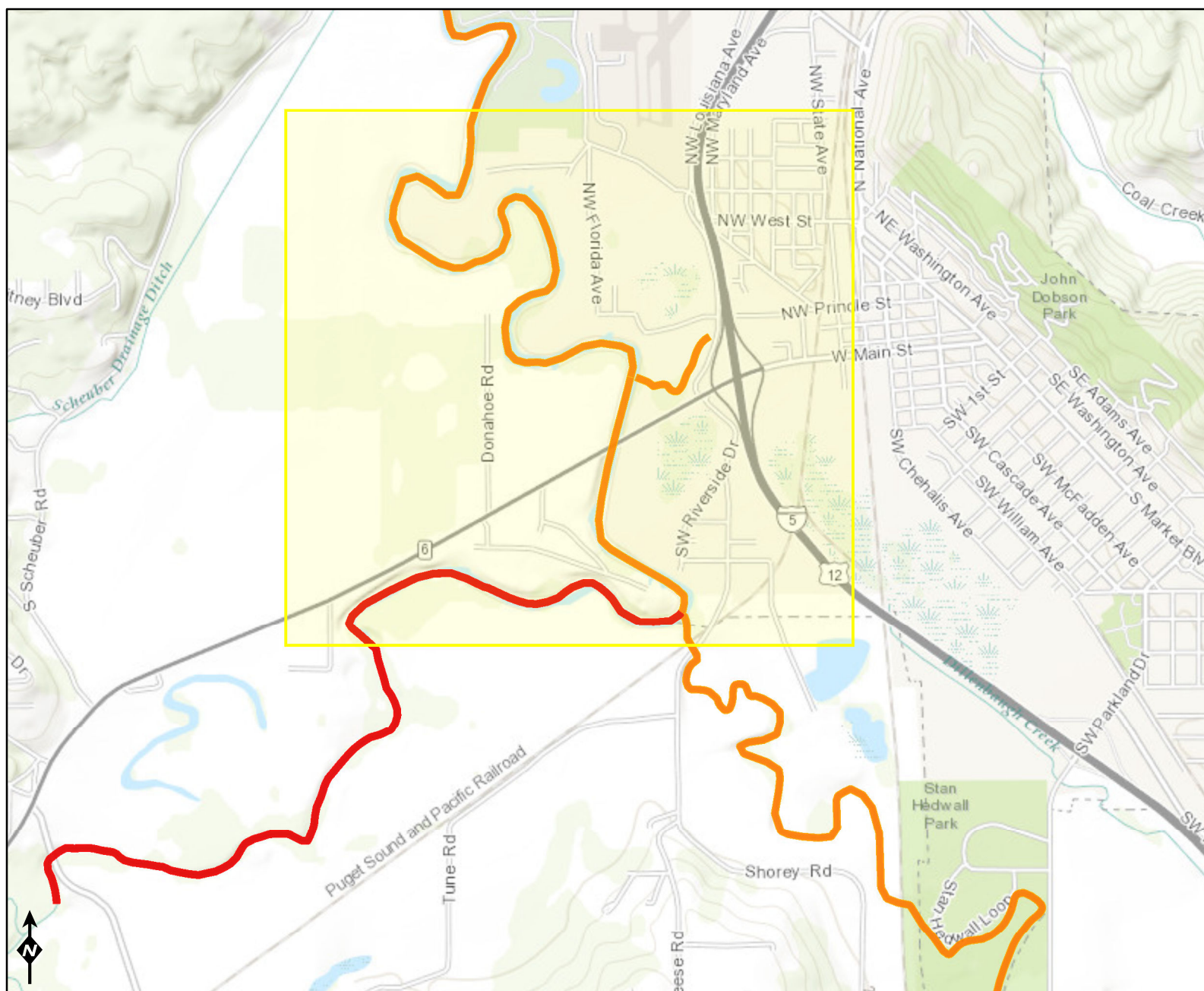
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Water Quality Atlas- WA Dept of Ecology

303D

Listing ID	Category	Medium	Parameter	Assessment Unit ID	Waterbody Name	WATS Link
10411		2 Water	Bacteria	17100103000086	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=10411
5871	4A	Water	Temperature	17100103000086	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=5871
5878	4A	Water	Dissolved Oxygen	17100103000086	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=5878
7770	4A	Water	Temperature	17100103000226	NEWAUKUM RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=7770
35939	4A	Water	Temperature	17100103000087	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=35939
5868	4A	Water	Dissolved Oxygen	17100103000088	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=5868
10685	4A	Water	Temperature	17100103000088	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=10685
10417		1 Water	Bacteria	17100103000087	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=10417
16752		1 Water	Bacteria	17100103000088	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=16752
11003	4A	Water	Dissolved Oxygen	17100103000226	NEWAUKUM RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=11003
7754	4A	Water	Dissolved Oxygen	17100103027313	DILLENBAUGH CREEK	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=7754
15915		5 Water	Turbidity	17100103000088	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=15915
16758	4A	Water	Bacteria	17100103000226	NEWAUKUM RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=16758
6669	4A	Water	Bacteria	17100103027313	DILLENBAUGH CREEK	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=6669
5867	4A	Water	Dissolved Oxygen	17100103000087	CHEHALIS RIVER	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=5867
7755	4A	Water	Temperature	17100103027313	DILLENBAUGH CREEK	https://fortress.wa.gov/ecy/approvedwqa/ApprovedSearch.aspx?LISTING_ID=7755

303D



Assessed Waters/Sediment

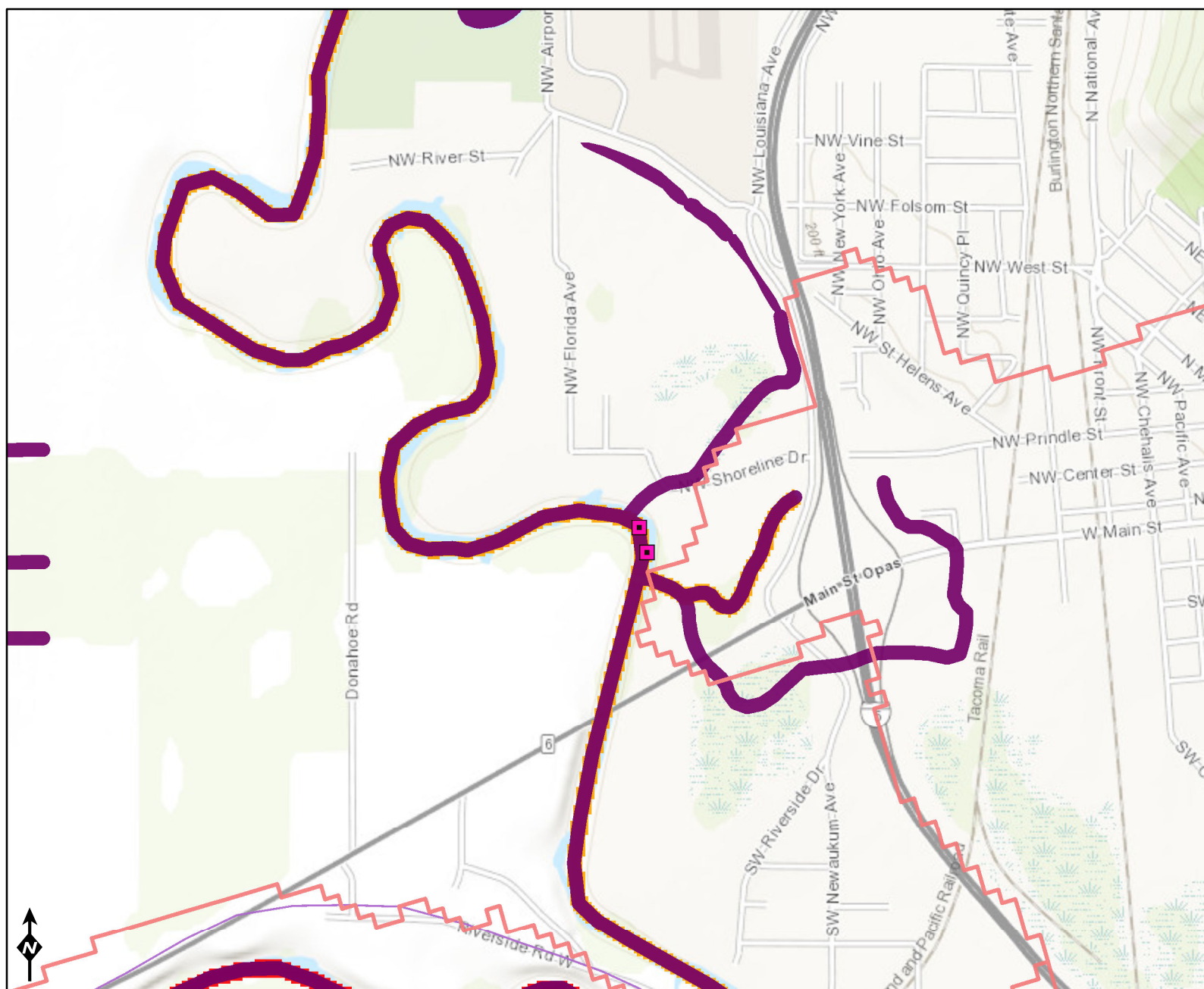
Water

- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

Sediment

- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

303D- 2

**Assessed Waters/Sediment****Water**

- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

Sediment

- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

Shade Allocation**Shade deficit**

- up to 5%
- 5.1% to 25%
- 25.1% to 50%
- 50.1% to 75%
- 75.1% to 100%


WQ Standards

Sediment Superfund Sites

Wasteload Allocation

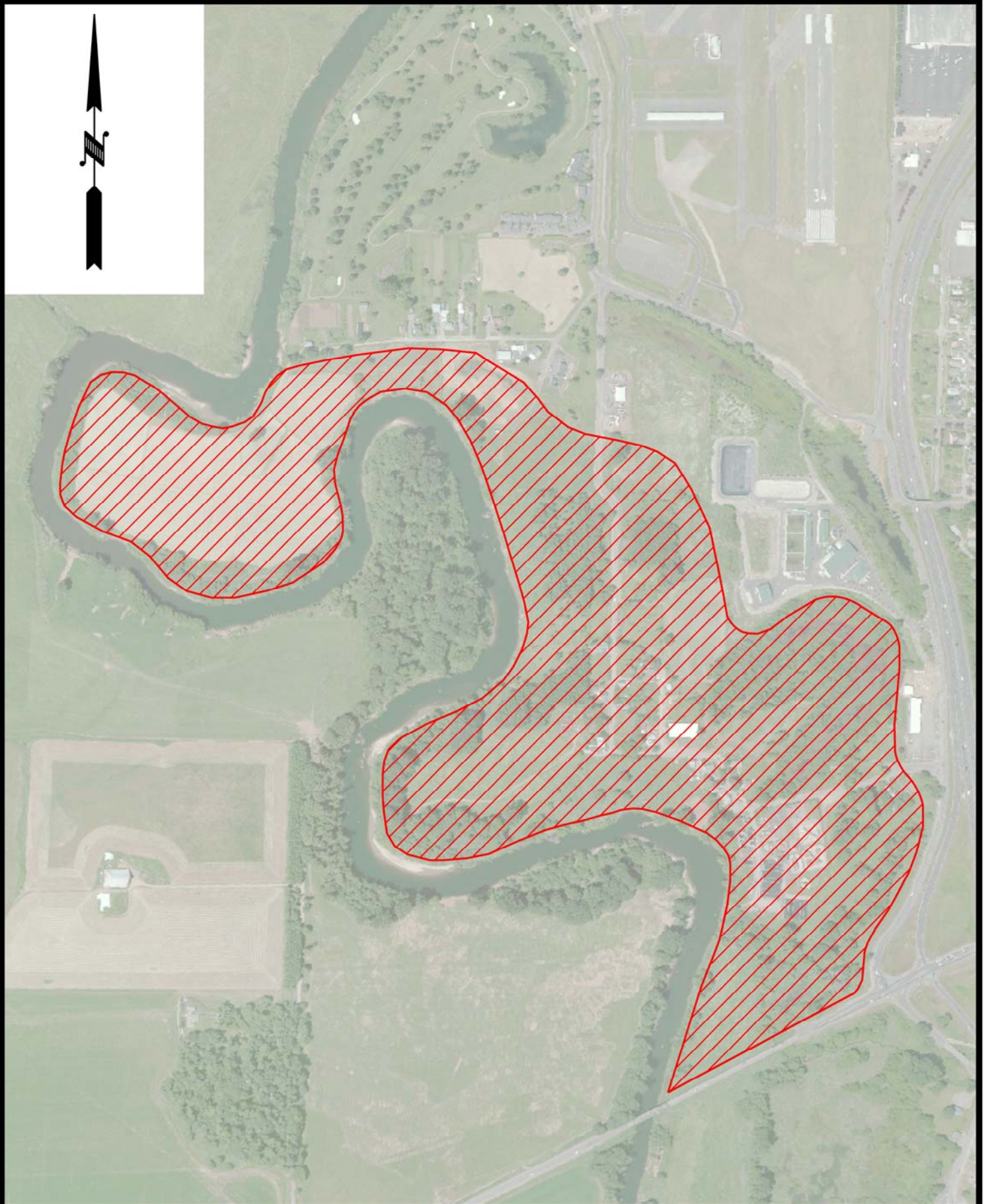
Load Allocation Compliance Areas

303D- 2 Legend Continued

 Sub-Watershed (12 digit HUC)

Section G

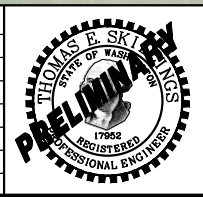
Exhibits



PROJECT AREA



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Plotted By: Kate Hoffer on 6/5/2017				
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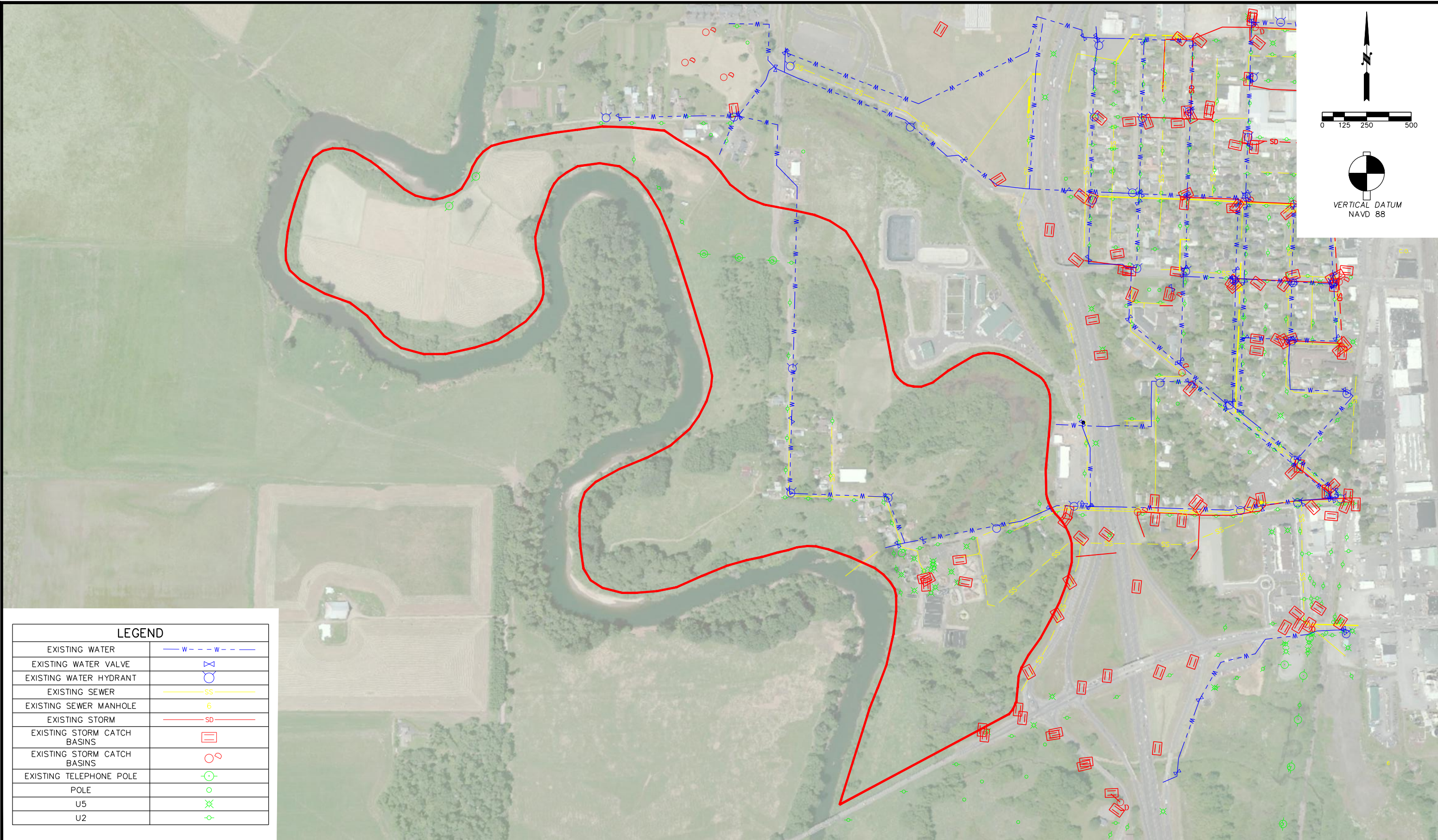


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CITY OF CHEHALIS

CHEHALIS FLOOD STORAGE MASTER PLAN		JOB NUMBER 15070-12
EXISTING TOPOGRAPHY		SHEET EX-A1



LEGEND	
EXISTING WATER	
EXISTING WATER VALVE	
EXISTING WATER HYDRANT	
EXISTING SEWER	
EXISTING SEWER MANHOLE	
EXISTING STORM	
EXISTING STORM CATCH BASINS	
EXISTING STORM CATCH BASINS	
EXISTING TELEPHONE POLE	
POLE	
U5	
U2	

DESIGNED BY: K. HOFFER		DATE	REVISIONS	
ENTERED BY: J. SAUER		6/14/17	NO.	DATE
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PROJ. ENGR.: T. SKILLINGS				
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CITY OF CHEHALIS

CHEHALIS FLOOD STORAGE MASTER PLAN

EXISTING UTILITIES

JOB NUMBER
15070-12

SHEET
EX-A4



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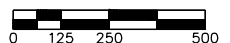
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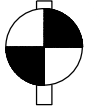
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CITY OF CHEHALIS

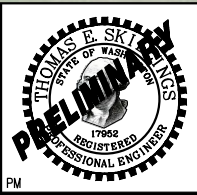
CHEHALIS FLOOD STORAGE MASTER PLAN	JOB NUMBER 15070-12
FLOOD STORAGE AREA - LAYOUT OPTION 1	SHEET EX-A2.1




VERTICAL DATUM
NAVD 88

DESIGNED BY: K. HOFFER		DATE	REVISIONS	
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PROJ. ENGR.: T. SKILLINGS				
Plotted By: Kate Hoffer on 6/5/2017				
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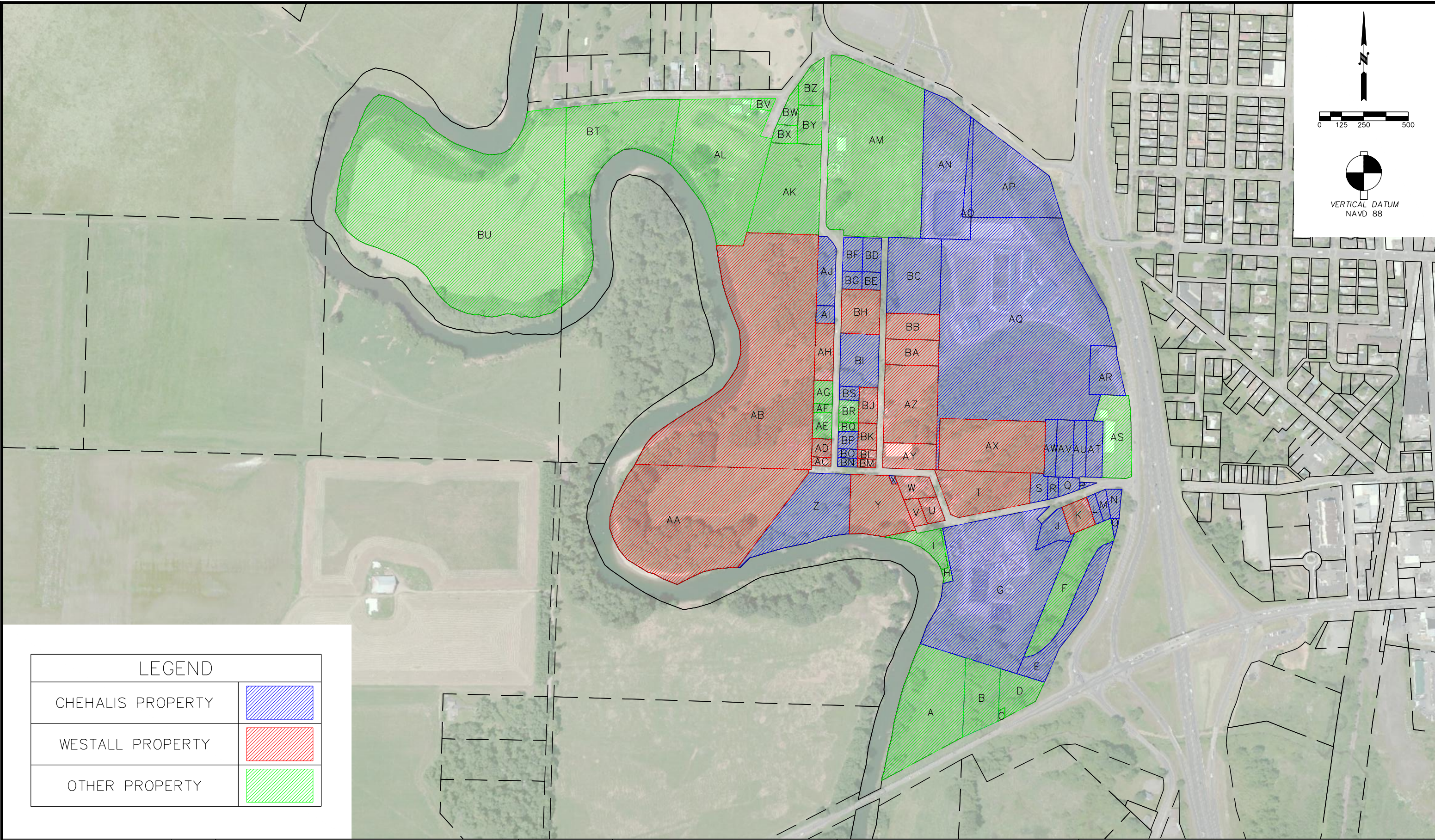
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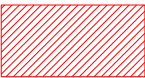
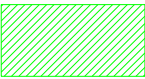
CITY OF CHEHALIS

CHEHALIS FLOOD STORAGE MASTER PLAN	JOB NUMBER 15070-12
FLOOD STORAGE AREA - LAYOUT OPTION 2	SHEET EX-A2.2

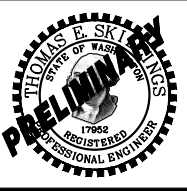
Section H

Property Information



LEGEND	
CHEHALIS PROPERTY	
WESTALL PROPERTY	
OTHER PROPERTY	

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Plotted By: Kate Hoffer on 6/5/2017				
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CITY OF CHEHALIS

CHEHALIS FLOOD STORAGE MASTER PLAN

PROPERTY OWNER INFORMATION

JOB NUMBER
15070-12

SHEET
EX-A3

Parcel Information

Parcel #	Acreage	Map Location	Owner	Physical Address	Mailing Address	City	State	Zip	Land Value	Imp. Value	Total Value	% Take Land	% Take Imp.	Total Take Value
5825-0-0	16.06	A	Coffey Family Trust DTD 11/24/92	0 State Highway 6	37 Post Shadow Estate Dr	Spring	TX	77389	\$ 41,600.00	\$ -	\$ 41,600.00	35%	0%	\$ 14,560.00
N/A	1.47	B	WSDOT HWY 6 ROW	N/A	N/A	Chehalis	WA	98532						
5823-1-0	1.04	D	Amondson-Muller, Linda C, Et Al	0 State Highway 6	102 Pine Drive	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5823-2-0	0.06	C	Amondson-Muller, Linda	0 State Highway 6	102 Pine Drive	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5794-1-0	9.29	G	City of Chehalis	1191 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 391,000.00	\$ 7,900,000.00	\$ 8,291,000.00	0%	0%	\$ -
5784-4-0	2.12	E	City of Chehalis	0 NW Louisiana Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 2,500.00	\$ -	\$ 2,500.00	100%	0%	\$ 2,500.00
5784-5-0	2.43	F	Vanderkolk, Dan & Nailla	0 NW Louisiana Avenue	1212 F Street	Centralia	WA	98531	\$ 23,400.00	\$ -	\$ 23,400.00	100%	0%	\$ 23,400.00
5795-0-0	0.13	H	Consolidated Dairy Products Co.	0 NW Shoreline Drive	PO Box 34377	Seattle	WA	98124	\$ 3,900.00	\$ -	\$ 3,900.00	100%	0%	\$ 3,900.00
5796-0-0	0.77	I	Callison & Sons Inc	1199 NW Shoreline Drive	2400 Callison Rd NE	Lacey	WA	98516	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5790-1-0	0.69	J	City of Chehalis	1165 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 29,300.00	\$ -	\$ 29,300.00	100%	0%	\$ 29,300.00
4784-4-0	0.55	K	Westall, John C & Donna I	1129 NW Shoreline Drive	325 NW Georgia Ave	Chehalis	WA	98532	\$ 23,400.00	\$ 83,300.00	\$ 106,700.00	100%	100%	\$ 106,700.00
4785-0-0	0.19	L	City of Chehalis	1127 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 17,600.00	\$ -	\$ 17,600.00	100%	0%	\$ 17,600.00
4786-0-0	0.22	M	City of Chehalis	1121 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 17,600.00	\$ -	\$ 17,600.00	100%	0%	\$ 17,600.00
4787-0-0	0.35	N	City of Chehalis	1117 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 17,600.00	\$ -	\$ 17,600.00	100%	0%	\$ 17,600.00
5787-0-0	0.50	O	City of Chehalis	0 NW Louisiana Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5788-0-0	0.05	P	City of Chehalis	0 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5822-0-0	0.22	Q	City of Chehalis	1148 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 17,600.00	\$ -	\$ 17,600.00	100%	0%	\$ 17,600.00
5821-0-0	0.15	R	City of Chehalis	1152 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 7,000.00	\$ -	\$ 7,000.00	100%	0%	\$ 7,000.00
5499-0-0	0.26	S	City of Chehalis	1182 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 8,000.00	\$ -	\$ 8,000.00	100%	0%	\$ 8,000.00
5498-0-0	2.04	T	Westall, John C & Donna I	1190 NW Cedar Street	325 NW Georgia Ave	Chehalis	WA	98532	\$ 39,800.00	\$ 60,600.00	\$ 100,400.00	100%	100%	\$ 100,400.00
5368-0-0	0.57	W	Westall, John C & Donna I	1131 NW Cedar Street	325 NW Georgia Ave	Chehalis	WA	98532	\$ 16,400.00	\$ 86,300.00	\$ 102,700.00	100%	100%	\$ 102,700.00
5369-0-0	0.30	U	Westall, John C & Donna I	1202 NW Cedar Street	325 NW Georgia Ave	Chehalis	WA	98532	\$ 16,400.00	\$ 115,500.00	\$ 131,900.00	100%	100%	\$ 131,900.00
5370-0-0	0.25	V	Westall, John C & Donna I	0 NW Shoreline Drive	325 NW Georgia Ave	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5371-2-0	0.04	X	City of Chehalis	0 NW Brace Street	1321 S Market Blvd	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5371-1-0	2.80	Y	Westall, John C & Donna I	0 NW Brace Street	325 NW Georgia Ave	Chehalis	WA	98532	\$ 3,000.00	\$ -	\$ 3,000.00	100%	0%	\$ 3,000.00
5372-0-0	3.55	Z	City of Chehalis	0 NW Brace Street	1321 S Market Blvd	Chehalis	WA	98532	\$ 11,700.00	\$ -	\$ 11,700.00	100%	0%	\$ 11,700.00
5373-0-0	11.84	AA	Westall, John C & Donna I	0 NW Brace Street	325 NW Georgia Ave	Chehalis	WA	98532	\$ 14,100.00	\$ -	\$ 14,100.00	100%	0%	\$ 14,100.00
5685-0-0	17.51	AB	Westall, John C & Donna I	0 NW Florida Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 28,100.00	\$ -	\$ 28,100.00	100%	0%	\$ 28,100.00
5348-0-0	0.13	AC	Westall, John C & Donna I	305 NW Florida Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 16,400.00	\$ 50,900.00	\$ 67,300.00	100%	100%	\$ 67,300.00
5347-0-0	0.26	AD	Westall, John C & Donna I	0 NW Florida Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 8,200.00	\$ -	\$ 8,200.00	100%	0%	\$ 8,200.00
5346-0-0	0.39	AE	Suarez, Isaias F & Flores, Yolanda M	347 NW Florida Avenue	347 NW Florida Ave	Chehalis	WA	98532	\$ 16,400.00	\$ 57,000.00	\$ 73,400.00	100%	100%	\$ 73,400.00
5345-1-0	0.13	AF	Suarez, Isaias F & Flores, Yolanda M	0 NW Florida Avenue	347 NW Florida Ave	Chehalis	WA	98532	\$ 4,100.00	\$ -	\$ 4,100.00	100%	0%	\$ 4,100.00
5345-2-0	0.33	AG	Fields, Kevin A	0 NW Florida Avenue	342 NW Florida Ave	Chehalis	WA	98532	\$ 8,200.00	\$ -	\$ 8,200.00	100%	0%	\$ 8,200.00
5344-0-0	0.82	AH	Westall, John C & Donna I	389 NW Florida Ave	325 NW Georgia Ave	Chehalis	WA	98532	\$ 16,400.00	\$ 75,800.00	\$ 92,200.00	100%	100%	\$ 92,200.00
5343-0-0	0.26	AI	City of Chehalis	0 NW Florida Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 8,200.00	\$ -	\$ 8,200.00	100%	0%	\$ 8,200.00
5338-1-0	1.00	AJ	City of Chehalis	0 NW Florida Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 11,700.00	\$ -	\$ 11,700.00	100%	0%	\$ 11,700.00
5680-1-0	3.84	AK	Waring, Rose	0 NW Florida Avenue	1380 NW Arizona Ave	Chehalis	WA	98532	\$ 6,500.00	\$ -	\$ 6,500.00	100%	0%	\$ 6,500.00
5682-1-0	7.68	AL	Waring, Rose	1380 NW Arizona Avenue	1380 NW Arizona Ave	Chehalis	WA	98532	\$ 64,500.00	\$ 39,000.00	\$ 103,500.00	80%	0%	\$ 51,600.00
4066-1-0	1.90	AS	Whittington, Donald R	388 NW Louisiana Avenue	388 NW Louisiana Ave	Chehalis	WA	98532	\$ 220,800.00	\$ 335,000.00	\$ 555,800.00	0%	0%	\$ -
5710-1-0	0.67	AT	City of Chehalis	1124 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 58,300.00	\$ -	\$ 58,300.00	100%	0%	\$ 58,300.00
5710-0-0	0.54	AU	City of Chehalis	1132 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 23,500.00	\$ -	\$ 23,500.00	100%	0%	\$ 23,500.00
5708-0-0	0.72	AV	City of Chehalis	1140 NW Shorelline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 35,000.00	\$ -	\$ 35,000.00	100%	0%	\$ 35,000.00
5709-0-0	0.48	AW	City of Chehalis	0 NW Shoreline Drive	1321 S Market Blvd	Chehalis	WA	98532	\$ 500.00	\$ -	\$ 500.00	100%	0%	\$ 500.00
5687-0-0	4.00	AX	Westall, John C & Donna I	0 NW Brace Street	325 NW Georgia Ave	Chehalis	WA	98532	\$ 2,800.00	\$ -	\$ 2,800.00	100%	0%	\$ 2,800.00
4065-0-0	1.10	AR	City of Chehalis	0 NW Snow St	1321 S Market Blvd	Chehalis	WA	98532	\$ 95,800.00	\$ -	\$ 95,800.00	50%	0%	\$ 47,900.00
5676-2-0	22.32	AQ	City of Chehalis	420 NW Louisiana Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 664,300.00	\$ 3,100,000.00	\$ 3,764,300.00	50%	0%	\$ 332,150.00
5676-3-0	4.01	AP	City of Chehalis	625 NW St Helens Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 35,000.00	\$ -	\$ 35,000.00	0%	0%	\$ -
5677-2-0	0.39	AO	City of Chehalis	0 NW St Helens Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 17,000.00	\$ -	\$ 17,000.00	0%	0%	\$ -
5677-1-0	4.61	AN	City of Chehalis	0 NW St Helens Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 86,900.00	\$ -	\$ 86,900.00	0%	0%	\$ -
5679-1-0	11.65	AM	Hamilton, Ricky C	542 NW Floriday Avenue	1316 NW River St	Chehalis	WA	98532	\$ 90,000.00	\$ 25,000.00	\$ 115,000.00	20%	0%	\$ 18,000.00
5493-0-0	3.00	BC	City of Chehalis	0 NW Georgia Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 83,700.00	\$ -	\$ 83,700.00	100%	0%	\$ 83,700.00
5494-0-0	1.00	BB	Westall, John C & Donna I	0 NW Georgia Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 2,800.00	\$ -	\$ 2,800.00	100%	0%	\$ 2,800.00
5495-0-0	1.00	BA	Westall, John C & Donna I	0 NW Georgia Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 2,800.00	\$ -	\$ 2,800.00	100%	0%	\$ 2,800.00
5496-0-0	3.00	AZ	Westall, John C & Donna I	0 NW Georgia Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 9,500.00	\$ -	\$ 9,500.00	100%	0%	\$ 9,500.00
5496-1-0	1.00	AY	Westall, John C & Donna I	0 NW Georgia Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 8,200.00	\$ 35,300.00	\$ 43,500.00	100%	100%	\$ 43,500.00
5361-1-0	0.12	BM	Westall, John C & Donna I	307 NW Georgia Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 16,400.00	\$ 44,600.00	\$ 61,000.00	100%	100%	\$ 61,000.00
5681-0-0	0.31	BV	Rose Waring	1380 NW Arizona Avenue	1380 NW Arizona Ave	Chehalis	WA	98532	\$ 23,400.00	\$ 83,400.00	\$ 106,800.00	0%	0%	\$ -
5680-3-0	0.32	BW	Daniel & Cheryl Brown	0 NW Arizona Avenue	1385 NW Arizoona Ave	Chehalis	WA	98532	\$ 1,800.00	\$ -	\$ 1,800.00	0%	0%	\$ -
5680-2-0	0.30	BX	Daniel & Cheryl Brown	1385 NW Arizona Avenue	1385 NW Arizoona Ave	Chehalis	WA	98532	\$ 5,900.00	\$ 84,600.00	\$ 90,500.00	0%	0%	\$ -
5680-5-0	0.72	BY	Daniel & Cheryl Brown	0 NW Florida Avenue	1385 NW Arlzoona Ave	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	0%	0%	\$ -
5680-4-0	0.66	BZ	Daniel & Cheryl Brown	0 NW Arizona Avenue	1385 NW Arizoona Ave	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	0%	0%	\$ -
5360-0-0	0.13	BN	City of Chehalis	1206 NW Brace Street	1321 S Market Blvd	Chehalis	WA	98532	\$ 8,200.00	\$ -	\$ 8,200.00	100%	0%	\$ 8,200.00
5361-2-0	0.12	BL	Westall, John C & Donna I	315 NW Georgia Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 16,400.00	\$ 42,100.00	\$ 58,500.00	100%	100%	\$ 58,500.00
5359-0-0	0.13	BO	City of Chehalis	0 NW Florida Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5361-3-0	0.36	BK	Westall, John C & Donna I	0 NW Georgia Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5358-0-0	0.26	BP	City of Chehalis	366 NW Florida Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 8,200.00	\$ -	\$ 8,200.00	100%	0%	\$ 8,200.00
5357-0-0	0.13	BQ	Fields, Kevin A	342 NW Florida Avenue	342 NW Florida Ave	Chehalis	WA	98532	\$ 16,400.00	\$ 37,800.00	\$ 54,200.00	100%	100%	\$ 54,200.00
5362-0-0	0.48	BJ	Westall, John C & Donna I	325 NW Georgia Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 16,400.00	\$ 101,800.00	\$ 118,200.00	100%	100%	\$ 118,200.00
5356-0-0	0.32	BR	Robinson, Alden & Tammra	354 NW Florida Avenue	2301 E "Q" Street	Tacoma	WA	98421	\$ 16,400.00	\$ 65,100.00	\$ 81,500.00	100%	100%	\$ 81,500.00
5355-0-0	0.19	BS	City of Chehalis	358 NW Florida Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 8,200.00	\$ -	\$ 8,200.00	100%	0%	\$ 8,200.00
5354-1-0	1.48	BI	City of Chehalis	370 NW Florida Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 25,800.00	\$ -	\$ 25,800.00	100%	0%	\$ 25,800.00
5351-1-0	1.24	BH	Westall, John C & Donna I	0 NW Florida Avenue	325 NW Georgia Ave	Chehalis	WA	98532	\$ 3,700.00	\$ -	\$ 3,700.00	100%	0%	\$ 3,700.00
5366-0-0	0.24	BE	City of Chehalis	0 NW Georgia Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5350-0-0	0.26	BG	City of Chehalis	0 NW Florida Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5367-0-0	0.45	BD	City of Chehalis	0 NW Georgia Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
5683-0-0	7.67	BT	Steven Emrich	0 NW River St	1358 NW River Street	Chehalis	WA	98532	\$ 64,500.00	\$ -	\$ 64,500.00	100%	0%	\$ 64,500.00
5872-0-0	18.00	BU	Steven Emrich	0 NW River St	1358 NW River Street	Chehalis	WA	98532	\$ 77,200.00	\$ -	\$ 77,200.00	100%	0%	\$ 77,200.00
5349-0-0	0.48	BF	City of Chehalis	448 NW Florida Avenue	1321 S Market Blvd	Chehalis	WA	98532	\$ 1,900.00	\$ -	\$ 1,900.00	100%	0%	\$ 1,900.00
N/A	8.13		Chehalis ROW						\$ 71,200.00	\$ 1,480,000.00	\$ 1,551,200.00	100%	100%	\$ 1,551,200.00
Totals:	194.18					</								

MEMORANDUM

To: Trent Lougheed, PE – City of Chehalis
From: Tom Skillings, PE – Skillings Connolly
Kate Hoffer, EIT – Skillings Connolly
Subject: Chehalis Flood Storage Master Plan – Preliminary Phase 1 Work
Date: June 30, 2017

1.0 Background Information

The City of Chehalis has retained Skillings Connolly to provide professional services to assist in the preparation of a Flood Storage Master Plan for that area of the City between the Chehalis River and Louisiana Avenue, south of Airport Road and north of Highway 6, an area of approximately 150 acres. The proposed project site is located along the right (east) bank of the Chehalis River, between Highway 6 and the Chehalis-Centralia Airport (see Section G of this report).

The proposed project site comprises both City owned property and privately owned property. The City's abandoned waste water treatment plant (WWTP) is located at the south end of the site. In the spring of 2017, the City evaluated the hydraulic impacts of removing the treatment plant. The City retained Watershed Science & Engineering (WSE) to complete the hydraulic modeling, and Skillings Connolly to complete the storage area layout and the earthwork volume calculations. The City was considering modifications to the treatment plant property to increase the available flood storage, provide additional fish and wildlife habitat, and to enhance recreational use of the site. The preliminary plans included removing the existing buildings within the project limits and excavating in-situ material for use off site, to increase the available on-site flood storage and potentially lower the water elevation during flood events.

As the City owns a large percentage of the properties around the WWTP site, the City has decided to expand the scope of the project, to include a much larger project area; the proposed project site is approximately 150 acres. This expanded project area has the potential to provide significantly greater flood mitigation benefits. As a secondary benefit, this project will provide a flood mitigation bank that will help projects within the flood plain meet the City's "zero-rise" ordinance.

This report details the work completed in the first phase of the project. Additional work will be completed in subsequent phases of the project to complete a full Master Plan Report. The information from this report will be used for preliminary planning purposes only. The existing grade was modeled based on LiDAR information from the Puget Sound LiDAR Consortium website. Soil data was obtained

from the Natural Resources Conservation Survey (NRCS) website; no field test holes or borings were completed for this phase. Wetlands and critical areas for the project site were estimated per field reconnaissance and observations from aerial photography, exact field locations were not delineated.

2.0 Phase 1 Work

The full Master Plan will ultimately include the evaluation of the potential flood storage volume within the project area to determine the resultant reduction of the flood stage nearby, estimate storage volumes, estimate cost to construct, determine required permitting, and determine environmental impacts and mitigation. Schematic plans will also be provided, along with method of controlling flood waters entering and exiting the flood storage facility. Due to funding constraints, the Master Plan will be developed in phases. This first phase is limited to data gathering, preliminary conceptual layouts, rough order of magnitude earthwork volumes, rough order of magnitude storage volumes, and preliminary environmental investigation.

2.1 Preliminary Earthwork/Storage Volumes

Two alternatives were modeled to compare preliminary earthwork/storage volumes that could potentially be available. Option 1 included a berm that is set at elevation 184.5 feet (approximately 1.5 feet above the highest 100 year flood elevation on the site), has a bottom elevation of 160 ft (NAVD 88), with 3:1 side slopes. Option 2 includes a berm that is set at elevation 179 feet (approximately 1.5 feet above the highest 2-year flood elevation on the site), has a bottom elevation of 160 ft (NAVD 88), with 3:1 side slopes. Option 1 produces approximately two million cubic yards of excavated material, and 2.3 acre-ft of storage. Option 2 produces approximately 2.5 million cubic yards of excavated material, and 1.6 acre-ft of storage. It is important to note that these storage volumes do not account for groundwater within the project area. Based on the limited groundwater information available (see 2.3 below), it is very likely that the amount of storage that can be obtained by excavating within the project area will be less due to high groundwater in this area. More investigation will be needed in future phases. For more information on earthwork and storage volume calculations, see Section 2. See Section G for an exhibit showing the preliminary flood storage area layout (Options 1 and 2).

2.2 Flood Elevations

Information for the 2-year and 100-year flood elevations within the project area were compiled from the FEMA flood maps, charts from the Flood Insurance Study for the City of Chehalis, and modeling completed by WSE for the WWTP removal project. The elevation of the 100-year flood varies across the project site from approximately 182 feet to approximately 183 feet (NAVD 88). The elevation of the 2-year flood varies across the project site from approximately 175 feet to approximately 177.5 feet (NAVD 88). For more information on flood elevations within the project area, see Section C.

2.3 Groundwater Information

Groundwater information for this site was obtained from the Washington State Department of Ecology well logs. Multiple wells are located within or immediately outside of the project boundaries. The water table level in and around the project area varies from 4 feet below the existing ground surface to 28 feet below the existing ground surface. High groundwater in this area will limit the amount of flood storage

that can be obtained by excavating within the project area. For more information on groundwater within the project area, see Section D.

2.4 Soils Information

Soil data was obtained from the Natural Resources Conservation Survey (NRCS) website; no field testholes or borings were completed for this phase. The soils within the project area are as follows:

- Approximately 15% Newberg fine sandy loam (Hydrologic Soil Group A)
- Approximately 55% Chehalis silty clay (Hydrologic Group B)
- Approximately 15% Cloquato silt loam (Hydrologic Group B)
- Approximately 5% Reed silty clay loam, channeled (Hydrologic Group C & D)
- Approximately 5% Alvor silty clay loam (Hydrologic Group C)
- Approximately 5% Reed silty clay loam (Hydrologic Group D)

For more information on soils within the project area, see Section E.

2.5 Critical Areas

2.5.1 Streams

The Chehalis River main-stem originates at the confluence of the East Fork Chehalis River and the West Fork Chehalis River at river mile 118.9. The main-stem has numerous tributaries with headwaters originating in the Olympic Mountains, Willapa Hills, Bald Hills, Black Hills, and a spur of the Cascade Mountains. It flows near several towns and cities including Pe Ell, Chehalis, Centralia, Oakville, Elma, and Montesano before it eventually drains into the Grays Harbor Estuary at Aberdeen¹.

The upper main-stem is confined to a low-to-moderate gradient with a land use dominated by forestry. As it nears the Newaukum River confluence, the floodplain broadens and the main land use is agriculture. The reach flowing near Centralia and Chehalis is incised and primarily developed for urban and industrial land uses. Downstream of Centralia, the main-stem again borders agricultural land. From Montesano to the mouth of the main-stem, the river is tidally influenced and contains several sloughs (Smith Wenger 2001)¹.

Major Tributaries: Wynoochee River, Satsop River, Black River, Scatter Creek, Skookumchuck River, Newaukum River, South Fork Chehalis River, Elk Creek, Lincoln Creek, and Bunker Creek

Land Uses: Forestry, Agriculture, Urban and Industrial

Anadromous Fish Stocks: Fall Chinook*, spring Chinook, summer Chinook*, coho, fall chum, cutthroat, winter steelhead*, summer steelhead, and bull trout* (*denotes priority stock)

¹ Grays Harbor County Lead Entity Habitat Work Group. The Chehalis Basin Salmon Habitat Restoration and Preservation Strategy for WRIA 22 and 23

The Chehalis River (23-0190²) is designated as a Shoreline of the State (Type S), as denoted by the Washington State Department of Natural Resources (DNR) Forest Practices Application Review System (FPARS) Water Type Mapping. The “Catalog of Washington Streams”, Volume 2, also indicates that Dillenbaugh Creek’s (23-0880²) confluence with the Chehalis River is within the southern portion of the study area. DNR Water Type Mapping shows that Dillenbaugh Creek is fish-bearing (Type F). A small non-fish bearing (Type N) tributary discharges to Dillenbaugh Creek immediately upstream of its confluence with the Chehalis River. DNR also documents the presence of a Type N stream that connects two small ponds to the remnant oxbow, and the remnant oxbow to the Chehalis River.

2.5.2 Wetlands

The United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) mapping indicates the presence of multiple wetlands within the study area. The majority of wetlands are riparian wetlands, associated with the Chehalis River, Dillenbaugh Creek and the unnamed tributaries that are within the study area. The remainders of wetlands within the study area are depressional in nature. NWI mapping indicates the presence of Palustrine Scrub-shrub (PSS)³ and Palustrine Forested (PFO) wetlands. Palustrine wetlands are described as including all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. PSS wetland systems are palustrine systems that are dominated by a shrub species, while the PFO wetlands are dominated by forested conditions. The PSS wetlands are mapped as seasonally flooded (PSSC), as is the PFO wetland adjacent to an historic oxbow (PFOC). The forested wetland adjacent to the Chehalis River is mapped as being temporarily flooded (PFOA). The historic oxbow is designated as a Palustrine Aquatic Bed wetland that is permanently flooded (PABH). The Chehalis River is designated a Riverine, upper perennial system with an unconsolidated bottom that is permanently flooded (R3UBH).

Wetlands will need to be formally delineated and characterized prior to permit application. This is necessary in order to quantify potential impacts to aquatic resources and to develop compensatory mitigation, which can be part of the site restoration strategy.

2.5.3 Regulatory permitting

The Chehalis River is designated as a Shoreline of State, which is managed, in part, under the Shoreline Management Act (SMA). Proposed improvements that occur within 200 feet shoreward of the Chehalis River will require a Shoreline Substantial Development Permit (SSDP) from the City of Chehalis. In addition, SMA jurisdiction extends to any wetlands associated with the Chehalis River and to the 100-foot floodplain.

² Washington Department of Fisheries. 1975. A Catalog of Washington Streams and Salmon Utilization, Volume 3 Coastal Region.

³ Federal Geographic Data Committee. 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, DC.

Work within the 100-year floodplain that has the potential to affect the base flood elevation must be reviewed and approved by the United States Army Corps of Engineers (COE). In addition, the placement or discharge of material into site wetlands (including dredging or excavation) and any changes to site streams will require a permit from COE under Section 404 of the Clean Water Act. An Individual Section 404 permit will likely be required due to the magnitude of the proposed project. In addition to the Section 404 permit, the project will require approval under Section 401 of the Clean Water Act. Section 401 is managed by the Department of Ecology (ECY) as a Water Quality Certification Permit. Application for both the Section 401 and 404 permits will be through the Joint Aquatic Resource Permit Application (JARPA).

Due to proposed work along the Chehalis River, Dillenbaugh Creek and the un-named tributaries, a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife (WDFW) will be required. The HPA can be applied for using WDFW's APPS online permit portal.

2.5.4 Priority Habitat and Species (PHS)

WDFW documents multiple priority species and associated habitat within and in the vicinity of the subject area. Anadromous fish species, including Chinook, Coho, and steelhead utilize the Chehalis River and its tributaries. In addition, resident cutthroat and coastal cutthroat utilize the river system. Freshwater emergent, shrub, and forested wetlands are priority habitats that concentrations of waterfowl and cavity-nesting ducks utilize.

2.5.5 303(d) List

A review of the 303(d) list of impaired waterbodies indicates that within the project area, the Chehalis River and Dillenbaugh Creek are listed as Category 4A waters. Category 4A waters are polluted waters that do not require a Total Maximum Daily Loading (TMDL), but have an approved TMDL in place and are actively being implemented. Category 5 waters are considered listed on the 303(d) list as impaired and require a TMDL.

2.6 Base Map

The existing grade was modeled based on LiDAR information from the Puget Sound LiDAR Consortium website. The LiDAR information was determined to be sufficiently accurate for the planning level calculations needed for the Master Plan Report. See Section G for an exhibit showing the existing topography of the project area.

2.7 Property Listing

The proposed project site comprises both City owned property and privately owned property; the City owns 34 parcels, and the remaining 44 parcels are owned by others. See Section H for an exhibit showing the parcels within the project area.

2.8 Existing Utilities

The following utilities existing within the project area:

- Sanitary Sewer
- Storm Drainage
- Telephone
- Water

The existing utilities information that was used for the first phase of this project appears to be incomplete, and further investigation will be needed in the subsequent phases.

See Section G for an exhibit showing the existing utilities within the project area.

3.0 Next Steps

The first step following the completion of Phase 1 of this project is to develop a scope and budget to complete the full Master Plan report.

In the next phase of the development of the Master Plan, additional hydrologic modeling will need to be completed. WSE will complete the modeling to determine the flood mitigation impacts in a process similar to the one used for the WWTP Removal Project. Skillings Connolly will create several layout alternatives, and will coordinate with WSE to determine the potential flood mitigation benefits created by each option. Once this has been determined, the team will have enough information to complete a preliminary inlet/outlet design, and develop a conceptual plan for how the flood storage area will function during different flood events. For the Phase 1 work, the base elevation of the storage area was set at an assumed elevation of 160 feet (NAVD 88), and this will also need to be refined during subsequent phases of the project.

The City has also expressed an interest in phasing construction of this project as grant funding becomes available. At this time, we do not have sufficient information to provide any details on the phasing process. During the next phase of the Master Planning process, we will need to determine how the storage area could potentially function as the construction progresses (i.e. where the inlet and outlet will be set, which areas to excavate first, etc.).

The next phase of the Master Planning process will also include preliminary park design and preliminary habitat restoration design.

A preliminary environmental screening was completed as part of Phase 1 (see 2.5 above), but additional investigation will be needed as part of the next phase. In the following phases, additional work will be completed to identify permits that will be needed for the project, review the documentation for ESA issues, prepare a detailed environmental screening report, and meet with the USCOE to review the project.

Once a conceptual design has been developed, rough order of magnitude cost estimates will be prepared that includes, but is not limited to:

- Purchase of properties
- Permits
- Habitat restoration features
- Park features
- Abandonment of existing utilities
- Demolition of buildings and roads
- Excavation
- Berms and flood controls