



## Proposed Precipitation Gage Relocation Program

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### River Measurement

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The Chehalis River Basin Flood Authority operates and maintains a basin-wide flood warning system that now includes approximately 260 hydrometeorological sensors. The Flood Authority owns and maintains approximately 35 sensors located at 15 physical locations. The remaining sensors are operated and maintained by other agencies in the region.

WEST Consultants installed the 10 real-time precipitation gages for the Flood Authority in 2011 and 2012. These gages, placed in areas previously lacking high quality, real-time data, provide important precipitation and temperature data used to improve river forecasts at National Weather Service (NWS) forecast points and inform residents of the Chehalis River Basin of developing flood threats. The original gage locations were selected in consultation with the NWS to fill gage network gaps identified during post-event reviews of the 2007 and 2009 floods. Timber growth over the past decade at several gage locations has reached a point where precipitation data collection will soon be impacted.

Locations adequate for measuring precipitation at critical locations are somewhat limited in the Chehalis River Basin due to rugged terrain and high percentage of land being owned and used by the timber industry. By necessity, seven of the ten precipitation gages are installed on or near timber company property (e.g. Weyerhaeuser and Green Diamond). Timber management is intended to promote fast growing trees. Unfortunately, timber growth eventually impacts precipitation gage data collection.

WEST discussed the issue with Weyerhaeuser and it is their practice to relocate precipitation gages on a set interval of approximately 10 years. Due to land use and timber management practices in the basin, it will be necessary for the Flood Authority to follow a similar approach to maintain high quality data collection.

WEST has monitored each of the existing sites during routine maintenance visits and has determined when each gage should be relocated. The anticipated relocation schedule is shown in Table 1. All of the 15 locations collecting data are listed in Table 1, but not all of the locations are subject to relocation.

**Table 1: Gage Relocation Plan Schedule**

Site Name	PARAMETERS	ID	Elevation	Latitude	Longitude	Property	Year Installed	Anticipated Year of Relocation
BROOKLYN	Precip, Air Temp	D150635E	1041	46.728083	-123.54525	Weyerhaeuser	2012	2020
HAYWIRE	Precip, Air Temp	D1500688	1792	47.3213083	-123.5955889	Green Diamond	2011	2020
ROCK	Precip, Air Temp	D15093DA	1416	46.527972	-123.3990560	Weyerhaeuser	2012	2021
SKOOKUMCHUCK	Precip, Air Temp	D15056C4	1784	46.752756	-122.5459940	Weyerhaeuser	2012	2021
CHEHALIS BLW THRASH	Precip, Air Temp, Stage, Barometric Pressure, Solar Radiation, Wind Speed and Direction, Relative Humidity	D15080AC	689	46.478544	-123.297167	Weyerhaeuser	2012	2022
NEWAUKUM	Precip, Air Temp	D1507028	1594	46.670258	-122.612658	Weyerhaeuser	2012	2022
BEEVILLE	Precip, Air Temp	D15015CE	579	47.2815667	-123.4408222	Mason County FD	2011	2030
CEDAR CREEK	Precip, Air Temp	D1503322	710	46.885292	-123.141147	DNR	2012	N/A - No trees nearby
WEST FORK SATSOP	Precip, Air Temp, Stage	D1502054	225	47.1797222	-123.5594444	Private	2011	N/A - No trees nearby
RIVERSIDE	Precip, Air Temp	D15045B2	203	46.7791306	-123.3076917	RFA	2011	N/A - No trees nearby
CHEHALIS RIVER AT CENTRALIA	Stage	D1501B1C/CENW1	183	46.711721	-122.978476	City of Centralia	2017	N/A - Not affected
SKOOKUMCHUCK RIVER AT CENTRALIA	Stage	D150086A/CTAW1	189	46.730654	-122.953795	WSDOT	2017	In late 2018, WSDOT confirmed the bridge is scheduled for replacement, but at that time WSDOT did not know construction dates.
MONTENSANO WWTP WEBCAM	Images	WYNR	20	46.967936	-123.607817	City of Montesano	2019	N/A - Not affected
MELLEN STREET WEBCAM	Images	CENW1	176	46.712222	-122.977811	City of Centralia	2019	N/A - Not affected
SATSOP RIVER WEBCAM	Images	SATW1	40	47.001357	-123.494734	Grays Harbor County	2019	N/A - Not affected

As part of the relocation effort, the following tasks are required:

- Coordinate relocation of gages to a suitable site that is in the best interests of primary data users (Flood Authority, NWS)
- Conduct a field visit to potential new locations prior to installation. (Sites with the potential for longest service will be prioritized.)
- Coordinate with property owners and Flood Authority to secure access and permits to install and maintain gages.
- If timberland is a desired relocation site, a plot of land will be picked that has recently (within 1 or 2 years) been harvested to provide maximum time between relocation efforts.
- Remove precipitation gage components at existing sites, including cutting off mounting posts at or below ground level and removing any sharp objects.
- Reinstall precipitation components at new locations, reusing as many existing components as possible.
- Work with NWS to update the Hydrometeorological Automated Data System (HADS) for the relocated sites.
- Update Flood Authority website as needed to add/remove gage locations.

It is assumed that the Flood Authority will provide assistance with the following:

- Secure permits with landowner to install and maintain gage

Note: The Chehalis below Thrash Creek precipitation gage is co-located with an important water level sensor in the upper Chehalis River Basin. The precipitation sensor will eventually need to be relocated, but the stream gage is anticipated to remain in place. This precipitation sensor can be redeployed to a new location where there is an identified need for additional precipitation data. At that time, additional components such as data logger with GOES telemetry, solar panel, battery, gage house and satellite antenna would need to be purchased to facilitate the relocation.

A budget plan to support the gage relocation program is shown in Table 2.

**Table 2: Gage Relocation Budget**

**Chehalis River Basin Flood Authority**  
**Budget Plan for Relocation of Precipitation Gages**  
 March 9, 2020

Prepared by:

Prepared for:



			Senior Hydrologist	Hydrologist						Total Task Hours	COST
Hourly Rate			\$151.00	\$120.00							
<b>A. LABOR COSTS</b>											
TASK	SUB-TASK	DESCRIPTION									
1		2020 Gage Relocations (Haywire, Brooklyn)	38	24						62	\$8,618.00
2		2021 Gage Relocations (Rock, Schookumchuck), 2% increase	38	24						62	\$8,790.36
3		2022 Gage Relocations (Newaukum, Chehalis Thrash Precip), 2% increase	38	24						62	\$8,966.17
4		2030 Gage Relocation (Beeville)	23	14						37	\$6,281.48
<b>TOTAL HOURS</b>			<b>137</b>	<b>86</b>						<b>223</b>	
<b>TOTAL LABOR COST:</b>											<b>\$32,656.01</b>

<b>B. DIRECT COSTS</b>			COST
Task	Item		
1	2020 Materials & Expenses	New support pipes, minor hardware/fastener replacements. \$300 per gage. Hotel, food, mileage \$1100	\$1,700.00
2	2021 Materials & Expenses	New support pipes, minor hardware/fastener replacements. \$300 per gage. Hotel, food, mileage \$1100	\$1,700.00
3	2022 Materials & Expenses	New support pipes, minor hardware/fastener replacements. \$300 per gage. New GOES data logger, battery, solar panel, GOES antenna, shelter all for Thrash precip gage if it is relocated. \$5500. Hotel, food, mileage \$1100	\$7,200.00
4	2030 Materials & Expenses	New support pipes, minor hardware/fastener replacements. \$375 per gage. Hotel, food, mileage \$712	\$1,087.00
Taxes			8.40%
<b>TOTAL DIRECT COSTS</b>			<b>\$12,668.71</b>
<b>TOTAL FOR ALL TASKS &amp; DIRECT COSTS</b>			<b>\$45,324.71</b>