

## **WTS 4 Appendix 1**

---

*Indicators of Hydrologic Alteration*

**Table WTS A-1. Mean monthly flow data for Lewis River at Cougar, 1925-1958. Flow in cfs.**

Year	October	November	December	January	February	March	April	May	June	July	August	September
1925	1,247	5,010	3,743	4,691	6,836	2,638	4,021	4,234	2,603	1,283	904	739
1926	661	1,086	3,622	2,374	4,753	2,968	2,346	2,059	1,154	793	671	736
1927	2,430	3,729	3,702	4,065	4,428	2,708	3,101	4,894	4,374	1,778	976	1,217
1928	2,504	6,587	3,497	4,119	2,354	5,651	4,449	5,068	2,122	1,359	905	714
1929	1,180	2,160	2,436	1,666	998	2,323	3,493	4,809	3,415	1,315	846	673
1930	581	523	2,124	1,460	5,749	2,689	3,454	2,476	1,549	873	705	608
1931	650	856	1,105	2,697	2,937	4,325	5,024	2,997	1,481	1,045	715	657
1932	1,141	2,492	2,689	3,274	2,734	6,180	5,502	5,636	4,634	2,239	1,126	857
1933	1,010	5,834	3,622	3,747	1,631	3,387	3,929	5,585	7,584	3,571	1,512	1,464
1934	2,761	3,243	13,390	8,541	3,431	4,632	3,217	1,885	1,161	931	761	693
1935	2,257	6,793	4,840	3,813	3,689	2,866	3,173	5,128	3,852	1,631	949	809
1936	739	944	1,826	5,256	1,933	3,092	3,814	5,521	3,770	1,585	984	827
1937	671	596	2,603	1,259	1,275	3,180	5,536	5,019	5,245	1,970	1,023	820
1938	859	5,636	5,655	4,643	2,153	3,007	5,037	4,868	2,962	1,319	876	709
1939	860	1,630	3,104	3,704	2,389	2,779	3,720	3,570	2,135	1,179	853	766
1940	765	809	5,073	3,058	5,389	5,291	3,495	2,955	1,253	872	731	679
1941	842	1,795	3,276	3,169	2,315	2,042	1,993	2,378	1,367	911	764	1,236
1942	1,713	2,520	6,099	1,898	2,688	2,026	2,817	2,545	2,550	1,272	861	706
1943	706	5,042	4,357	2,629	2,808	3,456	6,612	4,150	3,731	1,899	1,050	826
1944	1,205	1,731	2,388	2,284	2,563	1,970	2,791	2,919	1,743	869	681	654
1945	637	1,824	1,955	4,086	4,441	3,004	2,940	5,581	2,589	1,180	791	898
1946	784	2,985	4,882	3,935	2,653	3,488	3,938	5,729	4,828	2,993	1,200	886
1947	1,336	4,343	8,258	2,936	4,688	3,466	3,789	2,636	1,774	1,133	875	989
1948	4,290	4,346	3,427	4,487	3,119	2,766	3,590	5,512	4,396	1,685	1,093	991
1949	1,364	2,940	2,979	1,183	2,825	3,764	4,722	7,093	4,004	1,990	1,082	954
1950	1,156	4,257	3,442	3,317	4,637	5,889	4,970	5,569	6,287	3,166	1,427	1,053
1951	3,122	6,077	7,710	4,056	6,515	2,323	4,560	5,115	2,898	1,459	997	923
1952	3,658	3,420	4,101	1,611	4,079	2,216	4,742	5,141	3,097	1,574	960	779
1953	648	648	1,319	1,456	5,392	2,535	3,179	4,934	3,805	2,300	1,172	882
1954	1,154	3,404	6,477	3,774	5,029	3,623	4,718	5,166	4,742	2,958	1,364	1,048
1955	1,310	3,451	2,951	2,500	2,971	1,593	3,062	4,335	6,106	2,945	1,315	1,092
1956	3,753	7,078	7,115	5,106	2,236	3,847	5,457	7,205	5,887	3,519	1,625	1,038
1957	1,843	2,836	4,935	1,805	2,715	4,715	4,213	4,687	2,077	1,122	905	733
1958	885	1,740	3,948	4,478	6,820	2,610	4,934	4,104	2,287	1,222	906	788

**Table WTS A-2. Minima and maxima flow data for the Lewis River at Cougar, 1925-1958. Flow in cfs**

Year	1-day min	3-day min	7-day min	30-day min	90-day min	1-day max	3-day max	7-day max	30-day max	90-day max
1925	598	585	588	584	572	7,200	6,450	6,076	5,064	4,036
1926	490	495	502	516	638	9,460	8,433	7,169	5,544	3,899
1927	550	553	577	564	668	16,100	13,533	9,529	6,415	4,384
1928	464	464	477	794	990	13,100	11,900	8,856	6,717	6,091
1929	708	715	728	995	1,567	15,300	12,533	11,029	8,008	6,435
1930	625	625	630	641	723	45,000	38,267	26,700	14,815	8,873
1931	577	585	599	741	788	19,200	17,700	12,940	6,816	5,183
1932	614	622	637	676	675	10,600	10,367	8,110	5,684	4,423
1933	550	556	562	590	883	17,200	14,367	10,199	6,015	5,278
1934	614	614	628	677	803	22,200	18,400	12,124	6,427	5,481
1935	622	625	665	726	777	9,120	8,417	6,373	4,015	3,485
1936	630	630	630	661	712	18,500	16,200	11,554	6,450	5,073
1937	597	601	629	740	945	9,720	6,750	5,174	3,583	3,444
1938	644	648	643	623	731	18,600	14,217	10,074	6,213	3,817
1939	578	592	594	630	944	23,000	16,240	11,950	7,791	5,349
1940	586	590	598	635	655	7,760	6,500	4,729	3,105	2,671
1941	570	570	575	632	810	20,600	14,867	9,970	5,644	4,027
1942	659	671	674	770	1,085	17,500	14,500	9,586	5,776	5,066
1943	745	752	761	839	987	29,300	26,033	20,237	10,372	5,890
1944	862	862	881	942	1,148	13,000	12,267	9,683	5,885	4,820
1945	825	805	816	937	1,027	11,500	10,090	9,351	7,398	5,510
1946	780	788	893	1,033	1,482	21,600	14,200	10,157	7,181	5,690
1947	798	800	811	857	1,100	23,400	19,600	14,660	8,300	6,734
1948	704	697	685	645	684	16,100	12,193	9,490	5,381	4,445
1949	552	556	573	628	860	20,800	19,567	15,800	12,444	6,165
1950	915	917	912	1,008	1,194	14,700	12,967	9,776	7,368	5,158
1951	892	902	913	1,060	1,580	11,600	10,693	9,396	6,339	5,972
1952	934	939	949	956	1,412	18,400	15,267	11,567	8,499	6,640
1953	685	685	690	728	813	14,300	10,700	9,247	5,675	4,893
1954	342	478	648	788	964	14,000	12,200	10,046	6,936	5,142
1955	598	585	588	584	572	7,200	6,450	6,076	5,064	4,036
1956	490	495	502	516	638	9,460	8,433	7,169	5,544	3,899
1957	550	553	577	564	668	16,100	13,533	9,529	6,415	4,384
1958	464	464	477	794	990	13,100	11,900	8,856	6,717	6,091

**Table WTS A-3. IHA-generated data for Lewis River at Cougar, 1924-1958**

Year	Zero days	Base flow (cfs)	Day of min flow*	Day of max flow*	Lo pulse length	#Lo pulses per year	Hi pulse length	#Hi pulses per year	LRise rate	Fall rate (cfs/day)	Reversals (number)
1924	0	0.28	274	345	15.5	2	4.0	2	368	-155	77
1925	0	0.27	342	39	65.0	2	5.7	3	442	-195	89
1926	0	0.28	278	92	18.8	5	4.4	5	484	-207	78
1927	0	0.15	293	57	11.5	2	6.6	8	865	-327	70
1928	0	0.2	284	161	5.0	2	8.1	7	677	-320	89
1929	0	0.17	271	357	25.0	2	8.3	8	1,657	-598	85
1930	0	0.18	292	312	15.0	2	6.8	5	655	-312	73
1931	0	0.25	308	12	15.7	3	5.2	5	432	-194	88
1932	0	0.23	335	105	26.0	3	4.0	6	612	-213	81
1933	0	0.2	287	364	11.8	4	6.4	7	819	-338	76
1934	0	0.3	282	2	13.3	3	3.0	3	415	-212	85
1935	0	0.25	263	351	13.0	6	7.2	5	803	-329	73
1936	0	0.34	282	334	7.7	6	2.5	2	384	-161	85
1937	0	0.28	273	354	13.5	2	5.3	3	630	-214	69
1938	0	0.19	299	328	11.7	3	6.3	6	848	-329	74
1939	0	0.33	255	338	19.8	4	4.0	1	383	-144	81
1940	0	0.23	300	39	11.2	5	4.3	6	680	-251	70
1941	0	0.21	292	363	12.0	2	6.4	5	593	-308	93
1942	0	0.25	292	348	7.0	1	6.8	5	939	-432	79
1943	0	0.27	275	293	0.0	0	5.7	7	759	-333	85
1944	0	0.28	257	123	0.0	0	8.2	5	519	-231	72
1945	0	0.24	277	332	0.0	0	12.7	6	1,057	-392	68
1946	0	0.21	266	42	0.0	0	8.6	8	934	-429	69
1947	0	0.23	273	336	8.0	2	6.2	5	573	-262	95
1948	0	0.18	334	18	21.3	3	13.7	3	706	-303	77
1949	0	0.25	274	345	0.0	0	7.7	7	743	-324	96
1950	0	0.33	280	324	0.0	0	5.0	5	528	-229	82
1951	0	0.21	268	332	0.0	0	14.9	7	1,065	-451	73
1952	0	0.25	266	57	10.0	3	9.0	4	551	-216	92
1953	0	0.23	273	111	8.0	3	9.8	4	527	-261	91
1954	0	0.28	274	345	15.5	2	4.0	2	368	-155	77
1955	0	0.27	342	39	65.0	2	5.7	3	442	-195	89
1956	0	0.28	278	92	18.8	5	4.4	5	484	-207	78
1957	0	0.15	293	57	11.5	2	6.6	8	865	-327	70
1958	0	0.2	284	161	5.0	2	8.1	7	677	-320	89

\* Julian day

Note: The "base flow" is the 7-day annual minimum flow divided by the mean annual flow. Low pulse threshold = 90% exceedance value; High Pulse threshold = 10% exceedance value

**Table WTS A-4. IHA-generated data for Lewis River at Cougar – Summary Statistics.**

Statistic	October	November	December	January	February	March	April	May	June	July	August	September
1-day min	581	523	1,105	1,183	998	1,593	1,993	1,885	1,154	793	671	608
- 1 S.D.	483	1,237	1,816	1,696	1,990	2,166	2,977	3,083	1,677	898	748	673
Mean	1,492	3,187	4,196	3,591	3,564	3,325	4,010	4,456	3,337	1,704	988	866
+ 1 S.D.	2,501	5,138	6,575	5,485	5,137	4,484	5,043	5,829	4,997	2,510	1,229	1,058
1-day max	4,290	7,078	13,390	10,456	6,836	6,180	6,612	7,205	7,584	3,571	1,625	1,464

Statistic	1-day min	3-day min	7-day min	30-day min	90-day min	1-day max	3-day max	7-day max	30-day max	90-day max
1-day min	342	464	477	516	572	7,200	6,450	4,729	3,105	2,671
- 1 S.D.	524	539	557	600	664	9,709	8,194	6,621	4,541	3,886
Mean	658	666	684	752	938	16,993	14,212	10,833	6,829	5,071
+ 1 S.D.	792	793	810	905	1,211	24,277	20,230	15,045	9,117	6,256
1-day max	934	939	949	1,060	1,580	45,000	38,267	26,700	14,815	8,873

Statistic	Zero days	Base flow (cfs)	Day of min flow*	Day of max flow*	Lo pulse length	#Lo pulses per year	Hi pulse length	#Hi pulses per year	LRise rate	Fall rate (cfs/day)	Reversals (number)
1-day min	0	0.15	255	2	0	0	2.5	1	368	-598	57
- 1 S.D.	0	0.2	267	242	0	0.53	4.0	3.30	427	-390	71
Mean	0	0.24	283	325	12	2.44	6.8	5.12	690	-291	80
+ 1 S.D.	0	0.29	299	407	24	4.35	9.7	6.94	952	-193	90
1-day max	0	0.34	342	364	65	7	14.9	8	1,657	-144	96