

HYDROLOGY AVERAGING COMPARISON:

30-Year Rolling Average versus Full Historic Record Average



November 14, 2001

The attached tables and graphs compare inflow averages developed using a 30-year rolling average and the average of the full historic record as per the request by Commissioner Whalen on October 12, 2001. In reviewing the attached, please note the following:

Methodology

Inflow information was developed in a manner consistent with that done in response to requests for information IC-195 and NP-204. As with NP-204, no reductions were made for spill or fisheries compensation, as developing and applying these quantities to historical data is tedious and offers little benefit, since the changes are common to the two alternatives being compared. As well, contributions by Paradise River, Snook's Arm, Venam's Bight, and the Roddickton min-hydro were omitted due to their relatively small contribution to overall production capability.

Energy inflow data was calculated by multiplying each year's inflow (in millions of cubic metres, or MCM) by a fixed conversion factor (as quoted in NP-44, page 4 of 4). This yielded a series of annual energy inflow quantities for each major reservoir and plant, which vary in duration in accordance with the length of record available. The individual plant equivalent annual energy inflows are shown in Table 2 along with the total.

Table 3 provides the rolling 30-year averages and the full record averages for each plant. A second full record average column is provided to reflect a reduced data set for Cat Arm and Hinds Lake so as to match that of Bay d'Espoir and Upper Salmon. The second reduced full record average is being provided to be consistent with Commissioner Whalen's request for comparison to the 50-year average.

The sum of the individual plant energies for a given year provides the combined inflows in equivalent energy for that year as shown in Table 4 under the column "Actual Total". This data is limited to the 51 years of record for Bay d'Espoir. Based on these totals, Table 4 provides a 30-year rolling average and the reduced data set average, which starts in 1950. Table 4 also has the average for the full data set, which is consistent with what was used by Hydro in developing its average hydraulic production.

It should be noted in reviewing the "Actual Total" column in Table 4 that it is comparable to that provided in IC-195, the table provided in NP-204, the data in LBB-4 under the column "Inflows (GWh)" and the data in E-NP-003 under the column "Total", which were based upon water-to-energy conversion factors

prior to the 2000 update. The data in Table 4 under the column “Actual Total” are based upon the updated conversion factors, as set forth in NP-44. This gives rise to a slight difference from the data in the above noted filed information by 4 to 5 GWh per year.

2001 Estimate

For comparative purposes, the inflows for 2001 were estimated. The projections are done using actual inflows to October 31, 2001 and estimates for the remaining two months of the year. The estimates are developed using the same assumptions as noted above. For the 30-year rolling average approach, the inflows for November and December for the most recent 30 years are averaged, while for the full historic average approach, the November and December information for all available years are averaged. The following table provides the detail for the estimates.

Table 1. 2001 Estimates

Reservoir	Year-to-Date Inflows (MCM)	Estimated Inflows for Nov-Dec (MCM)		Estimated Annual Equivalent Energy Inflows (GWh)	
		30-Year Avg	Full Average	30-Year Avg	Full Average
Victoria	689.22	228.63	229.53	516.38	516.89
Meelpaeg ¹	1617.3	472.97	478.67	1,175.99	1,179.19
Upper Salmon	438.3	163.90	180.15	338.80	347.94
Long Pond	1016.85	311.58	349.56	575.21	591.66
Cat Arm	592.43	105.27	108.75	625.98	629.10
Hinds Lake	464.23	109.18	111.27	307.92	309.04
Total				3,540.28	3,573.82

¹: Inflows represent combined Burnt Pond, Granite Lake, and Meelpaeg Lake inflows.

Results

Figures 1 through to 4 compare by plant the averages produced by using the two methodologies, along with actual inflows for each year of record available. These figures use the data for the full available record as provided in Tables 2 and 3.

Figures 5 and 6 are provided to compare the results of the two methodologies for Cat Arm and Hinds Lake assuming that the data set is restricted to the period available for Bay d'Espoir, discarding all previous data.

Figure 7 shows the Total Actual Energy Inflows of Table 4 for the period 1950-2000 inclusive, along with the 30-year, full historic averages and the reduced data set averages from Table 4. Figure 7 provides the graph of data as requested by Commissioner Whalen.

Table 2. Comparison of Actual Annual Reservoir Inflows

Year Ending	Inflows (GWh)				
	Bay d'Espoir	Upper Salmon	Cat Arm	Hinds Lake	Total
1927	-	-	-	433	433
1928	-	-	-	321	321
1929	-	-	-	371	371
1930	-	-	925	355	1,280
1931	-	-	726	329	1,056
1932	-	-	819	351	1,170
1933	-	-	1,160	449	1,609
1934	-	-	881	359	1,240
1935	-	-	932	413	1,345
1936	-	-	785	321	1,106
1937	-	-	771	297	1,067
1938	-	-	619	273	892
1939	-	-	1,010	370	1,379
1940	-	-	766	306	1,072
1941	-	-	909	383	1,293
1942	-	-	875	368	1,243
1943	-	-	734	300	1,034
1944	-	-	879	426	1,305
1945	-	-	977	389	1,366
1946	-	-	771	266	1,037
1947	-	-	758	303	1,061
1948	-	-	705	296	1,001
1949	-	-	898	425	1,323
1950	1,987	438	700	264	3,388
1951	2,609	552	742	356	4,259
1952	2,716	563	798	349	4,426
1953	2,485	525	661	319	3,989
1954	2,901	607	687	364	4,559
1955	2,294	483	493	322	3,591
1956	2,715	566	649	352	4,281
1957	2,382	517	658	310	3,867
1958	2,717	586	563	336	4,202
1959	2,067	442	619	285	3,413
1960	1,881	404	601	269	3,155
1961	1,814	392	595	264	3,065
1962	2,992	617	747	372	4,728
1963	3,057	631	755	349	4,792

Year Ending	Inflows (GWh)				
	Bay d'Espoir	Upper Salmon	Cat Arm	Hinds Lake	Total
1964	2,678	555	755	338	4,327
1965	2,486	515	660	320	3,981
1966	2,123	448	702	259	3,533
1967	2,638	557	639	311	4,145
1968	2,719	578	647	338	4,283
1969	3,065	661	912	408	5,046
1970	2,243	432	556	337	3,568
1971	3,026	660	796	391	4,873
1972	3,004	680	772	412	4,868
1973	2,710	613	775	398	4,496
1974	2,505	578	599	334	4,016
1975	2,291	518	679	332	3,821
1976	2,961	670	764	372	4,767
1977	3,243	763	1,040	447	5,493
1978	2,179	517	700	294	3,690
1979	2,393	552	923	323	4,190
1980	2,803	606	921	383	4,713
1981	3,232	731	868	416	5,247
1982	2,539	570	844	382	4,335
1983	3,286	712	521	395	4,914
1984	2,977	634	732	354	4,696
1985	1,966	427	645	265	3,303
1986	2,340	508	602	288	3,738
1987	2,230	491	694	298	3,713
1988	2,666	588	768	363	4,384
1989	2,047	453	622	263	3,385
1990	2,759	595	726	355	4,435
1991	2,480	547	703	331	4,061
1992	2,649	585	633	329	4,196
1993	3,460	741	751	409	5,362
1994	2,772	606	850	422	4,649
1995	2,893	607	766	408	4,675
1996	2,808	603	751	382	4,544
1997	2,748	597	683	387	4,415
1998	2,889	620	761	453	4,723
1999	3,281	708	847	372	5,209
2000	3,300	700	851	398	5,250

Table 3. Comparison of Average Annual Inflows (GWh)

Year Ending	Bay d'Espoir			Upper Salmon			Cat Arm			Hinds Lake		
	30-Year Average	Full Average	Reduced Full Average	30-Year Average	Full Average	Reduced Full Average	30-Year Average	Full Average	Reduced Full Average	30-Year Average	Full Average	Reduced Full Average
1927	-	-	-	-	-	-	-	-	-	-	433	-
1928	-	-	-	-	-	-	-	-	-	-	377	-
1929	-	-	-	-	-	-	-	-	-	-	375	-
1930	-	-	-	-	-	-	-	925	-	-	370	-
1931	-	-	-	-	-	-	-	826	-	-	362	-
1932	-	-	-	-	-	-	-	823	-	-	360	-
1933	-	-	-	-	-	-	-	908	-	-	373	-
1934	-	-	-	-	-	-	-	902	-	-	371	-
1935	-	-	-	-	-	-	-	907	-	-	376	-
1936	-	-	-	-	-	-	-	890	-	-	370	-
1937	-	-	-	-	-	-	-	875	-	-	364	-
1938	-	-	-	-	-	-	-	846	-	-	356	-
1939	-	-	-	-	-	-	-	863	-	-	357	-
1940	-	-	-	-	-	-	-	854	-	-	354	-
1941	-	-	-	-	-	-	-	859	-	-	356	-
1942	-	-	-	-	-	-	-	860	-	-	356	-
1943	-	-	-	-	-	-	-	851	-	-	353	-
1944	-	-	-	-	-	-	-	853	-	-	357	-
1945	-	-	-	-	-	-	-	860	-	-	359	-
1946	-	-	-	-	-	-	-	855	-	-	354	-
1947	-	-	-	-	-	-	-	850	-	-	352	-
1948	-	-	-	-	-	-	-	842	-	-	349	-
1949	-	-	-	-	-	-	-	845	-	-	352	-
1950	-	1,987	1,987	-	438	438	-	838	700	-	349	264
1951	-	2,298	2,298	-	495	495	-	834	721	-	349	310
1952	-	2,437	2,437	-	518	518	-	832	747	-	349	323
1953	-	2,449	2,449	-	519	519	-	825	725	-	348	322
1954	-	2,539	2,539	-	537	537	-	819	718	-	348	330
1955	-	2,499	2,499	-	528	528	-	807	680	-	348	329
1956	-	2,529	2,529	-	533	533	-	801	676	348	348	332
1957	-	2,511	2,511	-	531	531	-	796	673	344	346	329
1958	-	2,534	2,534	-	537	537	-	788	661	344	346	330
1959	-	2,487	2,487	-	528	528	782	782	657	341	344	325
1960	-	2,432	2,432	-	517	517	771	776	652	338	342	320
1961	-	2,381	2,381	-	506	506	767	771	647	336	340	316
1962	-	2,428	2,428	-	515	515	765	770	655	337	341	320
1963	-	2,473	2,473	-	523	523	751	770	662	333	341	322

Table 3 (Cont'd). Comparison of Average Annual Inflows (GWh)

Year Ending	Bay d'Espoir			Upper Salmon			Cat Arm			Hinds Lake		
	30-Year Average	Full Average	Reduced Full Average	30-Year Average	Full Average	Reduced Full Average	30-Year Average	Full Average	Reduced Full Average	30-Year Average	Full Average	Reduced Full Average
1964	-	2,486	2,486	-	525	525	747	769	668	333	341	323
1965	-	2,486	2,486	-	525	525	738	766	668	330	340	323
1966	-	2,465	2,465	-	520	520	735	764	670	328	338	319
1967	-	2,475	2,475	-	522	522	731	761	668	328	338	319
1968	-	2,487	2,487	-	525	525	732	758	667	330	338	320
1969	-	2,516	2,516	-	532	532	728	762	679	332	339	324
1970	-	2,503	2,503	-	527	527	721	757	673	333	339	325
1971	-	2,527	2,527	-	533	533	718	758	679	333	340	328
1972	-	2,548	2,548	-	540	540	714	758	683	334	342	331
1973	-	2,555	2,555	-	543	543	716	759	687	338	343	334
1974	-	2,553	2,553	-	544	544	706	755	683	334	343	334
1975	-	2,543	2,543	-	543	543	696	753	683	333	343	334
1976	-	2,558	2,558	-	548	548	696	754	686	336	343	336
1977	-	2,582	2,582	-	555	555	706	760	699	341	345	340
1978	-	2,569	2,569	-	554	554	705	758	699	341	344	338
1979	2,563	2,563	2,563	554	554	554	706	762	706	337	344	337
1980	2,590	2,570	2,570	560	556	556	714	765	713	341	345	339
1981	2,611	2,591	2,591	566	561	561	718	767	718	343	346	341
1982	2,605	2,590	2,590	566	561	561	719	768	722	345	347	343
1983	2,631	2,610	2,610	572	566	566	715	764	716	347	347	344
1984	2,634	2,621	2,621	573	568	568	716	763	716	347	348	344
1985	2,623	2,602	2,602	571	564	564	721	761	714	345	346	342
1986	2,611	2,595	2,595	569	562	562	720	758	711	343	345	341
1987	2,606	2,586	2,586	568	560	560	721	757	711	342	344	340
1988	2,604	2,588	2,588	568	561	561	728	757	712	343	345	340
1989	2,603	2,574	2,574	569	558	558	728	755	710	342	343	338
1990	2,632	2,579	2,579	575	559	559	732	755	710	345	344	339
1991	2,655	2,576	2,576	580	559	559	736	754	710	348	343	338
1992	2,643	2,578	2,578	579	560	560	732	752	709	346	343	338
1993	2,657	2,598	2,598	583	564	564	732	752	709	348	344	340
1994	2,660	2,602	2,602	585	565	565	735	753	713	351	345	342
1995	2,673	2,608	2,608	588	566	566	738	753	714	354	346	343
1996	2,696	2,612	2,612	593	566	566	740	753	715	358	347	344
1997	2,700	2,615	2,615	594	567	567	741	752	714	361	347	345
1998	2,705	2,621	2,621	596	568	568	745	753	715	364	349	347
1999	2,713	2,634	2,634	597	571	571	743	754	718	363	349	348
2000	2,748	2,647	2,647	606	574	574	753	755	720	365	350	349

Table 4. Combined Annual Average Inflows (GWh): 1950-2000 Data Only

(Bay d'Espoir, Upper Salmon, Cat Arm, and Hinds Lake)

Year Ending	Annual Inflows					Combined		
	Bay d'Espoir	Upper Salmon	Cat Arm	Hinds Lake	Actual Total	30-Year Average	Reduced Full Average	Full Average
1950	1,987	438	700	264	3,388	-	3,388	3,612
1951	2,609	552	742	356	4,259	-	3,823	3,976
1952	2,716	563	798	349	4,426	-	4,024	4,136
1953	2,485	525	661	319	3,989	-	4,016	4,141
1954	2,901	607	687	364	4,559	-	4,124	4,245
1955	2,294	483	493	322	3,591	-	4,035	4,181
1956	2,715	566	649	352	4,281	-	4,070	4,212
1957	2,382	517	658	310	3,867	-	4,045	4,185
1958	2,717	586	563	336	4,202	-	4,062	4,205
1959	2,067	442	619	285	3,413	-	3,998	4,142
1960	1,881	404	601	269	3,155	-	3,921	4,067
1961	1,814	392	595	264	3,065	-	3,850	3,997
1962	2,992	617	747	372	4,728	-	3,917	4,053
1963	3,057	631	755	349	4,792	-	3,980	4,106
1964	2,678	555	755	338	4,327	-	4,003	4,122
1965	2,486	515	660	320	3,981	-	4,001	4,117
1966	2,123	448	702	259	3,533	-	3,974	4,088
1967	2,638	557	639	311	4,145	-	3,983	4,095
1968	2,719	578	647	338	4,283	-	3,999	4,108
1969	3,065	661	912	408	5,046	-	4,051	4,150
1970	2,243	432	556	337	3,568	-	4,028	4,127
1971	3,026	660	796	391	4,873	-	4,067	4,159
1972	3,004	680	772	412	4,868	-	4,102	4,188
1973	2,710	613	775	398	4,496	-	4,118	4,199
1974	2,505	578	599	334	4,016	-	4,114	4,195
1975	2,291	518	679	332	3,821	-	4,103	4,182
1976	2,961	670	764	372	4,767	-	4,127	4,203
1977	3,243	763	1,040	447	5,493	-	4,176	4,243
1978	2,179	517	700	294	3,690	-	4,159	4,225
1979	2,393	552	923	323	4,190	4,160	4,160	4,222
1980	2,803	606	921	383	4,713	4,205	4,178	4,236
1981	3,232	731	868	416	5,247	4,237	4,212	4,265
1982	2,539	570	844	382	4,335	4,234	4,215	4,266
1983	3,286	712	521	395	4,914	4,265	4,236	4,287
1984	2,977	634	732	354	4,696	4,270	4,249	4,299
1985	1,966	427	645	265	3,303	4,260	4,223	4,273
1986	2,340	508	602	288	3,738	4,242	4,210	4,261
1987	2,230	491	694	298	3,713	4,237	4,197	4,248
1988	2,666	588	768	363	4,384	4,243	4,201	4,251
1989	2,047	453	622	263	3,385	4,242	4,181	4,231
1990	2,759	595	726	355	4,435	4,285	4,187	4,236
1991	2,480	547	703	331	4,061	4,318	4,184	4,233
1992	2,649	585	633	329	4,196	4,300	4,184	4,233
1993	3,460	741	751	409	5,362	4,319	4,211	4,258
1994	2,772	606	850	422	4,649	4,330	4,221	4,265
1995	2,893	607	766	408	4,675	4,353	4,231	4,274
1996	2,808	603	751	382	4,544	4,387	4,237	4,279
1997	2,748	597	683	387	4,415	4,396	4,241	4,282
1998	2,889	620	761	453	4,723	4,411	4,251	4,290
1999	3,281	708	847	372	5,209	4,416	4,270	4,308
2000	3,300	700	851	398	5,250	4,472	4,289	4,326

Figure 1: Hydrology Calculation Comparison: Cat Arm

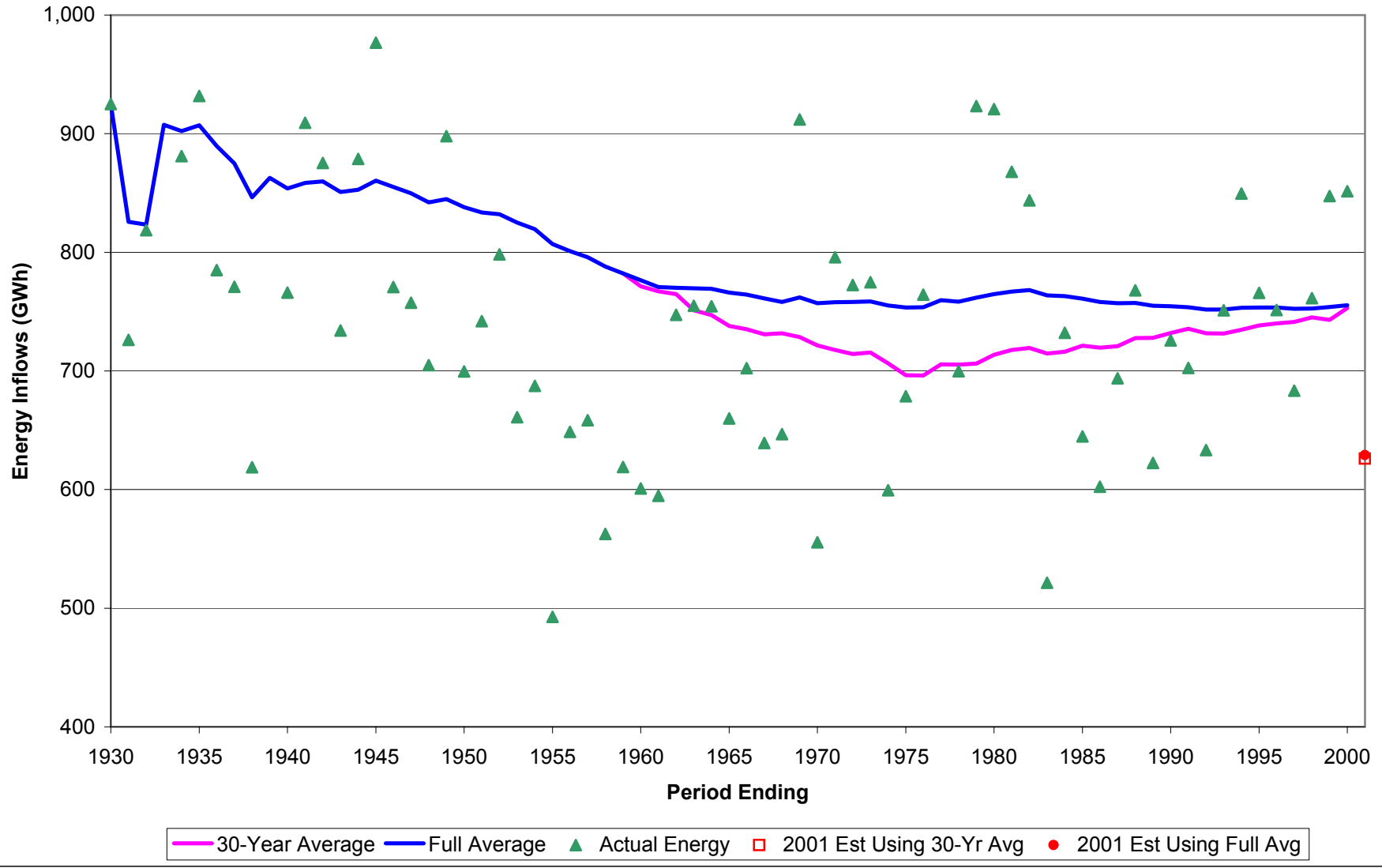


Figure 2: Hydrology Calculation Comparison: Hinds Lake

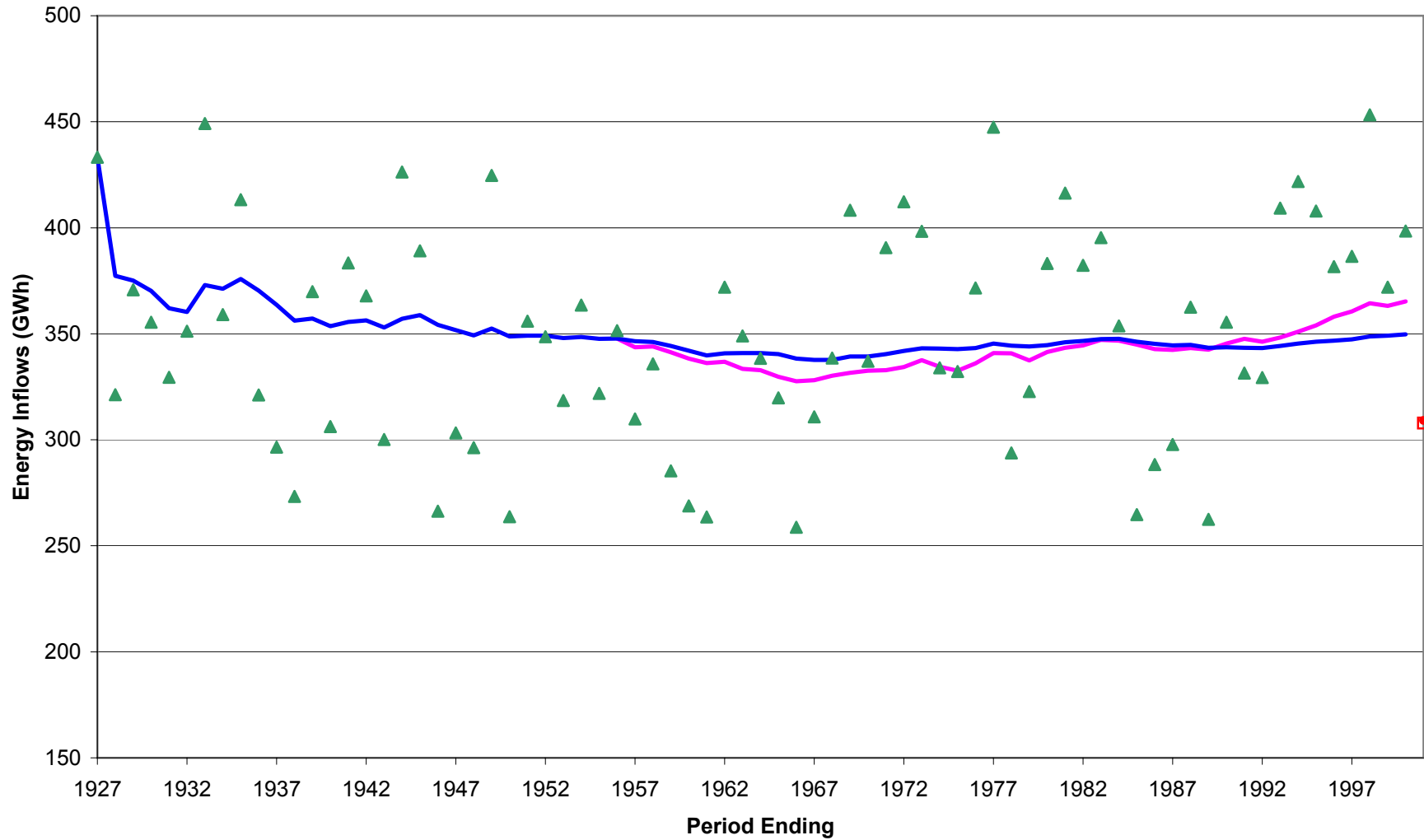


Figure 3: Hydrology Calculation Comparison: Upper Salmon

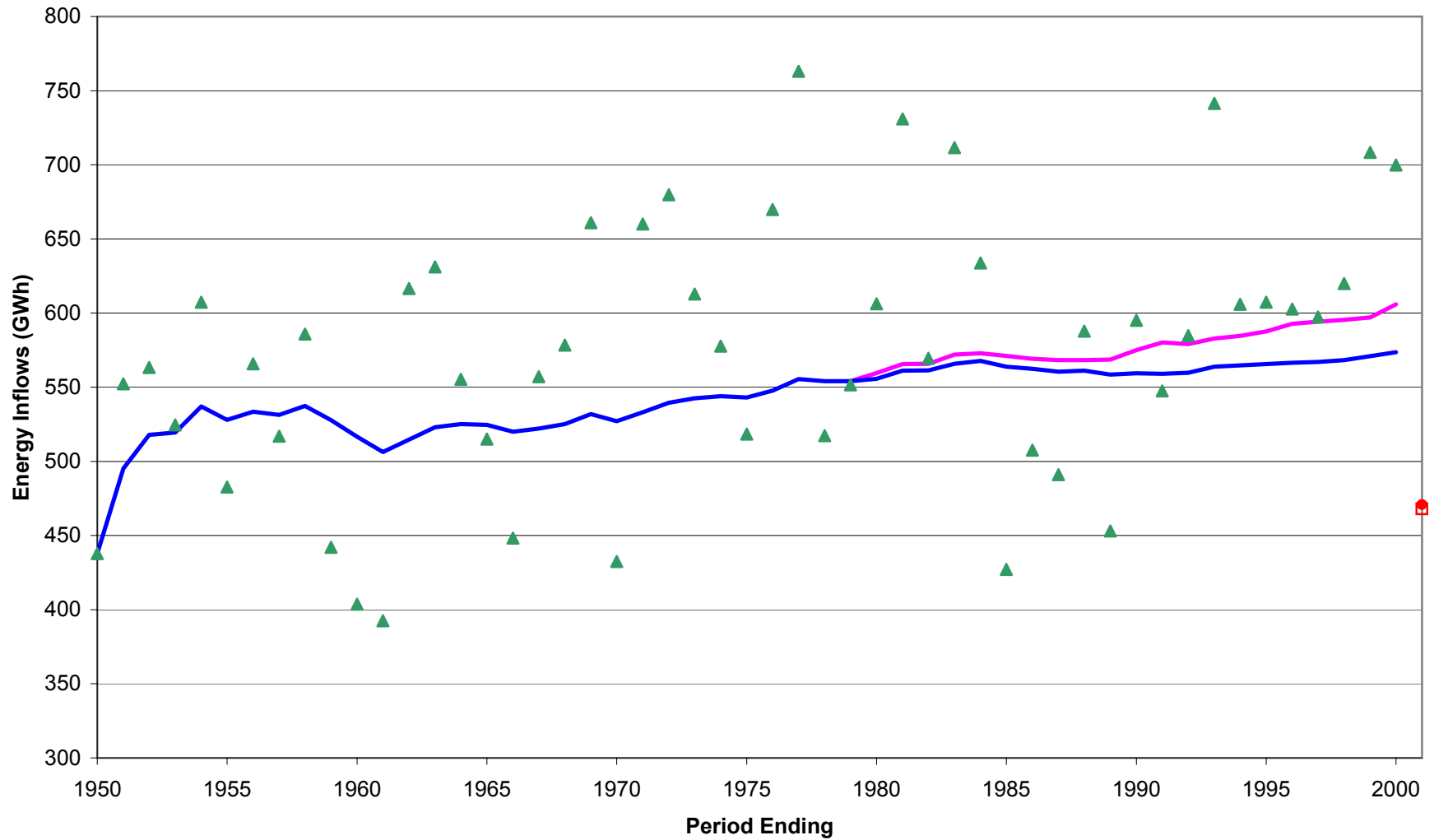


Figure 4: Hydrology Calculation Comparison: Bay D'Espoir

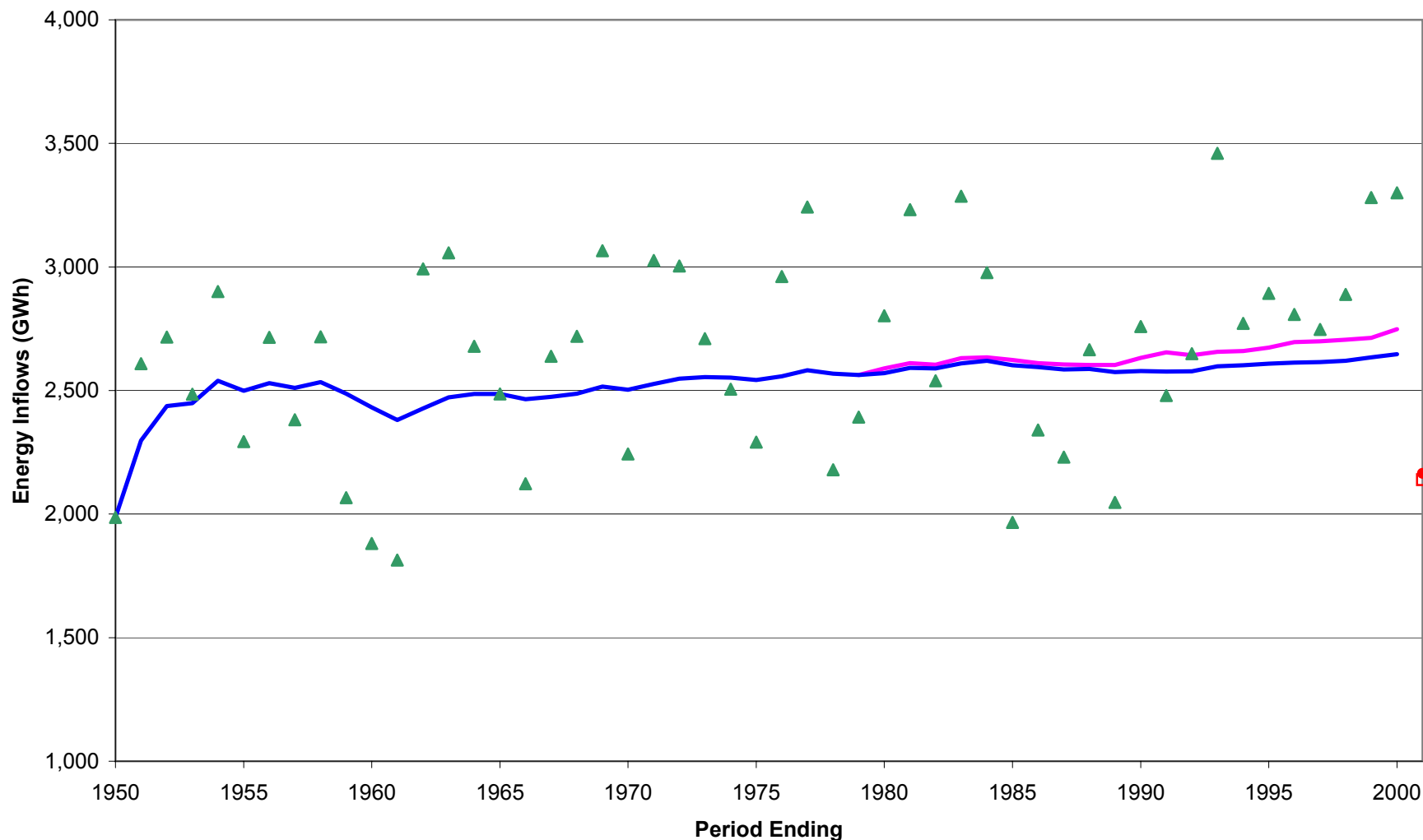


Figure 5: Hydrology Calculation Comparison: Cat Arm

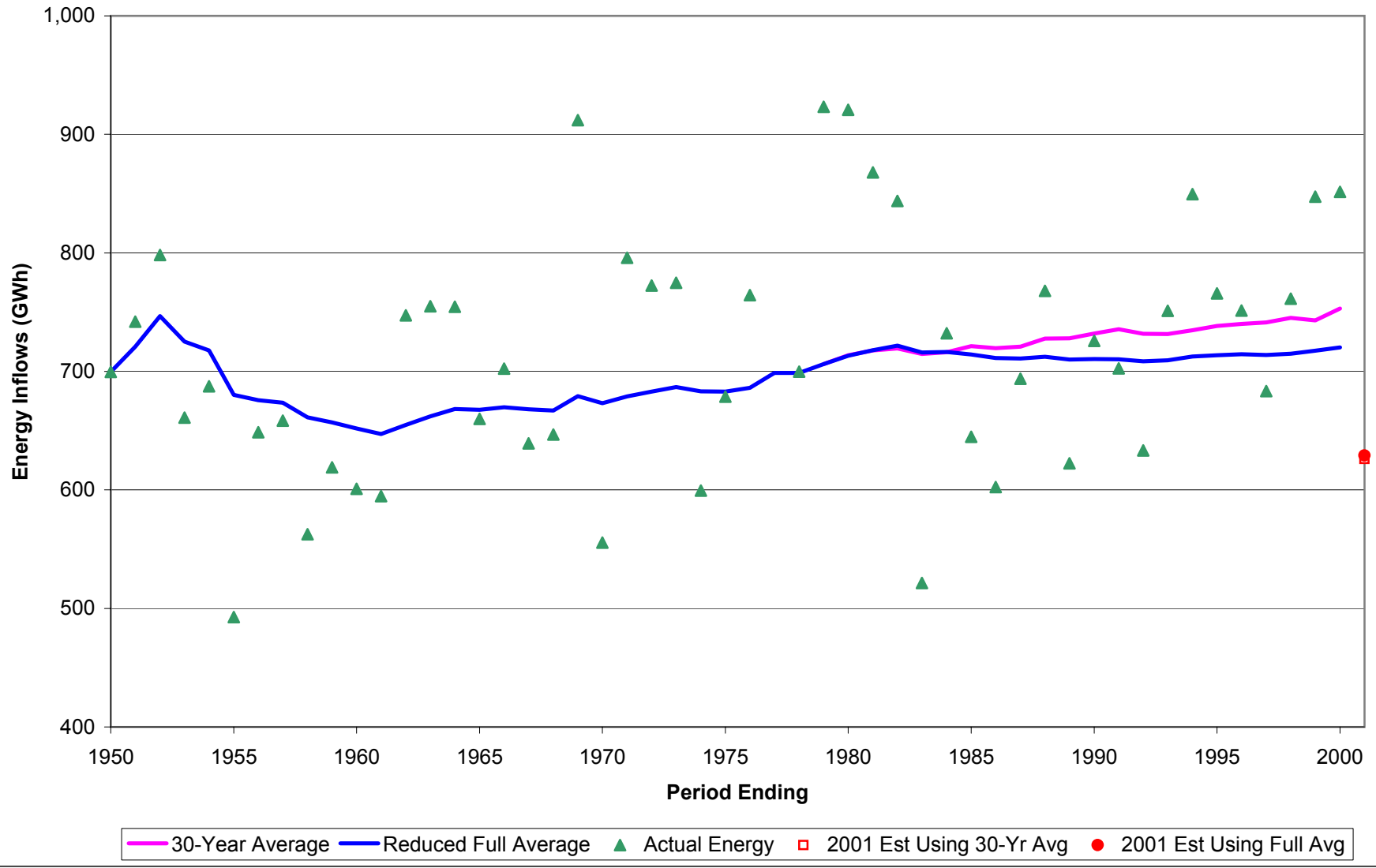


Figure 6: Hydrology Calculation Comparison: Hinds Lake

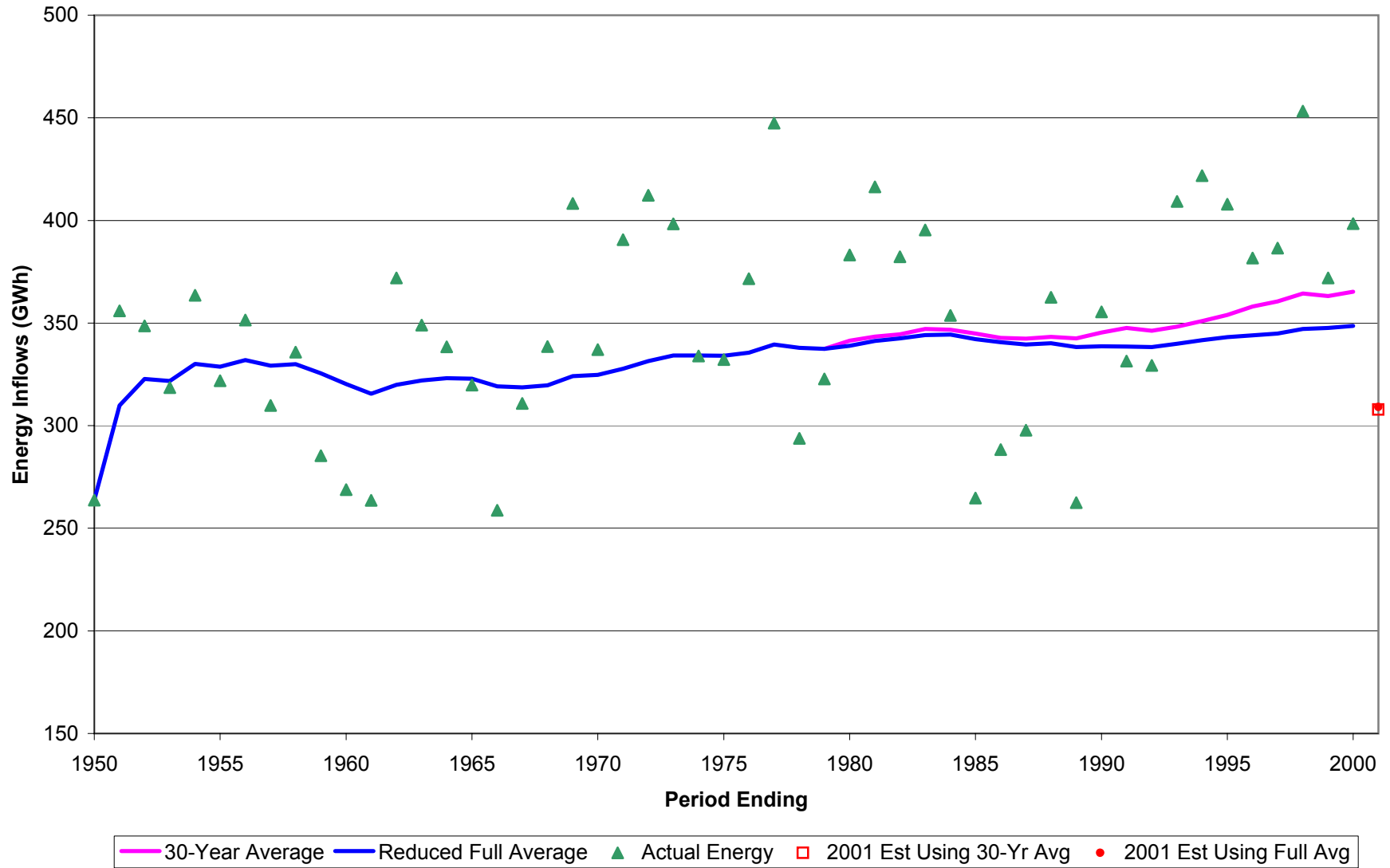


Figure 7: Hydrology Calculation Comparison: Combined Inflows
 (Bay D'Espoir, Upper Salmon, Cat Arm and Hinds Lake)

