COS Goodwin Average Flows by NMI yeartypes using COS' NMIs

	OCT	NOV	DEC	JAN	FEB	MAR	APR
W:	953	912	1305	955	1304	2808	1772
AN:	797	200	397	1454	1445	1683	1407
BN:	775	200	203	250	257	202	1585
D:	636	200	208	222	306	228	795
C:	578	200	242	215	286	233	566

PA Goodwin Average Flows by NMI yeartypes using COS' NMIs

	OCT	NOV	DEC	JAN	FEB	MAR	APR
W:	916	850	1318	993	2559	2990	1582
AN:	789	200	208	1471	1406	1306	1462
BN:	732	202	218	343	368	374	1324
D:	649	200	213	222	244	280	900
C:	621	200	242	215	217	214	754

PA Goodwin Average Flows by NMI yeartypes using PA' NMIs

	OCT	NOV	DEC	JAN	FEB	MAR	APR
W:	950	1036	1570	1212	3197	3410	1634
AN:	786	202	242	1125	1119	1130	1486
BN:	692	200	202	228	226	316	1102
D:	638	200	250	220	241	210	817
C:	622	200	200	216	217	222	796

Conclusion: Comparisons using yeartype averages is an apples &

COS Goodwin Average Flows by 60

MAY	JUN	JUL	AUG	SEP
2004	1520	1200	1030	1151
1564	982	303	300	300
1254	630	284	283	250
779	425	278	283	249
572	365	322	255	224

	OCT	NOV
W:	859	532
AN:	728	205
BN:	752	200
D:	677	200
C:	614	200

MAY	JUN	JUL	AUG	SEP
1732	2056	1424	983	1120
1453	734	288	294	282
1068	355	261	276	255
760	295	241	251	232
635	236	214	218	208

Above and below match Appendix D

PA Goodwin Average Flows by 60-

MAY	JUN	JUL	AUG	SEP
1783	2375	1745	1179	1329
1404	652	283	291	290
923	344	252	264	241
666	252	229	237	222
683	236	214	218	206

	OCT	NOV
W:	854	508
AN:	774	202
BN:	774	200
D:	626	200
C:	578	200

& oranges exercise no matter how you slice it. Better to look at excee

)-20-20 yeartypes

DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
863	999	1193	2014	1536	1691	1140	716	639
212	664	676	645	1224	1146	959	353	292
202	282	346	365	1454	1201	475	269	285
200	234	313	200	1030	930	375	276	277
236	227	255	234	742	700	282	272	264

Attachment 3-2 Table 37-3.

20-20 yeartypes

DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
735	1003	1750	2189	1475	1665	1499	834	625
223	694	695	577	1571	1255	363	265	283
202	546	528	247	1610	1242	363	265	283
209	224	228	200	825	655	256	255	270
236	220	222	218	501	445	200	200	200

ɛdance plots and monthly averages.

SEP
692
267
256
245
231

SEP
691
258
250
241
198

COS NM Average Storages by NMI yeartypes using COS' NMIs

	OCT	NOV	DEC	JAN	FEB	MAR	APR
W:	1904	1903	1909	1638	1834	1905	1992
AN:	1617	1622	1657	1713	1778	1786	1782
BN:	1295	1302	1328	1459	1528	1606	1562
D:	927	956	1033	1108	1160	1200	1188
C:	388	389	419	549	575	594	569

PA NM Average Storages by NMI yeartypes using COS' NMIs

	OCT	NOV	DEC	JAN	FEB	MAR	APR
W:	1896	1899	1904	1721	1848	1908	2006
AN:	1716	1721	1768	1768	1835	1866	1859
BN:	1502	1510	1537	1620	1683	1751	1725
D:	1201	1229	1306	1367	1423	1460	1443
C:	611	610	641	832	861	880	841

PA NM Average Storages by NMI yeartypes using PA' NMIs

	OCT	NOV	DEC	JAN	FEB	MAR	APR
W:	1928	1929	1934	1846	1964	2022	2116
AN:	1724	1732	1773	1737	1810	1854	1857
BN:	1418	1428	1457	1548	1606	1665	1641
D:	978	997	1070	1172	1221	1244	1212
C:	325	325	348	537	564	592	557

Conclusion: Comparisons using yeartype averages is an apples &

COS NM Average Storages by 60-2

MAY	JUN	JUL	AUG	SEP
2146	2285	2198	2053	1953
1860	1900	1819	1715	1660
1582	1562	1469	1372	1322
1202	1170	1081	996	955
556	549	492	438	410

	OCT	NOV
W:	1725	1729
AN:	1229	1239
BN:	1201	1206
D:	931	965
C:	614	616

MAY	JUN	JUL	AUG	SEP
2176	2284	2184	2041	1943
1943	1997	1918	1814	1760
1761	1762	1675	1582	1534
1460	1439	1357	1275	1236
819	810	743	676	643

Above and below match Appendix D

PA NM Average Storages by 60-20

MAY	JUN	JUL	AUG	SEP
2269	2348	2234	2082	1974
1950	2010	1927	1822	1766
1658	1643	1563	1477	1435
1216	1205	1129	1054	1016
536	519	451	384	353

	OCT	NOV
W:	1753	1758
AN:	1339	1349
BN:	1383	1387
D:	1234	1270
C:	938	940

& oranges exercise no matter how you slice it. Better to look at excee

0-20 yeartypes

DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
1754	1496	1637	1703	1757	1913	2035	1968	1845
1271	1174	1267	1342	1366	1470	1480	1387	1290
1228	1464	1518	1550	1495	1502	1502	1408	1307
1040	1254	1277	1315	1265	1226	1175	1080	996
657	978	993	994	935	860	805	734	674

Attachment 3-1 Table 7-3.

-20 yeartypes

DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
1791	1593	1703	1758	1816	1973	2073	1997	1874
1379	1304	1396	1474	1475	1570	1610	1515	1413
1407	1675	1719	1758	1691	1692	1695	1597	1493
1347	1495	1523	1563	1528	1509	1469	1380	1299
983	1245	1262	1266	1224	1168	1121	1056	997

edance plots and monthly averages.

SEP
1771
1240
1249
958
643

SEP
1800
1361
1433
1264
968

Columns A-D from Derek's 3/1 e-mail, with Wet=5 and Critical=1
Note that PA doesn't use the NMI yeartype; Column C just shows how the NMI yeartype might be affected
Took 60-20-20 yeartype from Column G of "Conv_Flags" tab of Calsim trend reporting workbook, with We
Converted Derek's coding to the coding used in the Calsim trend reporting workbook.

Because hydrology and yeartype method are the same; a change in PA NMI compared to COS NMI must b
--This is a coarse assessment of operations, since the yeartype bins are ~500 TAF apart (so, for example, a
--NMI (end of February New Melones storage + March through September inflow) ranges, in TAF, are:

Critical (0-1,400)
Dry (1,400-2,000)
Below Normal (2,000-2,500)
Above Normal (2,500-3,000)
Wet (3,000-6,000)

Because hydrology and operations are the same; a change in PA 60-20-30 compared to PA NMI must be ca
Because hydrology is the same; a change in PA 60-20-20 compared to COS NMI must be caused by a COM

	Derek's original ordering: Wet=5, Critical=1			CALSIM workbook ordering: Wet=1, Critical=5			CALSIM workbook ordering: Wet=1, Critical=5
WY	COS-NMI-D	PA-NMI-D	WOA-NMI-D	COS-NMI	PA-NMI	WOA-NMI	PA-60-20-20
1922	4	4	1	2	2	5	1
1923	4	4	1	2	2	5	2
1924	2	2	1	4	4	5	5
1925	3	3	1	3	3	5	3
1926	2	2	1	4	4	5	5
1927	2	3	1	4	3	5	2
1928	2	3	1	4	3	5	4
1929	1	2	1	5	4	5	5
1930	1	2	1	5	4	5	5
1931	1	1	1	5	5	5	5
1932	1	2	1	5	4	5	2
1933	1	1	1	5	5	5	5
1934	1	1	1	5	5	5	5
1935	1	1	1	5	5	5	2
1936	2	2	1	4	4	5	2
1937	2	2	1	4	4	5	2
1938	5	4	2	1	2	4	1
1939	3	2	1	3	4	5	4
1940	3	3	1	3	3	5	2
1941	4	4	1	2	2	5	1
1942	5	4	1	1	2	5	1

1943	5	5	1	1	1	5	2
1944	3	3	1	3	3	5	3
1945	3	3	1	3	3	5	2
1946	3	4	1	3	2	5	2
1947	2	3	1	4	3	5	5
1948	2	3	1	4	3	5	4
1949	2	2	1	4	4	5	4
1950	2	2	1	4	4	5	4
1951	3	4	1	3	2	5	3
1952	5	5	2	1	1	4	1
1953	4	4	1	2	2	5	3
1954	3	3	1	3	3	5	3
1955	2	2	1	4	4	5	5
1956	4	4	1	2	2	5	1
1957	3	3	1	3	3	5	3
1958	4	4	1	2	2	5	1
1959	3	3	1	3	3	5	4
1960	2	2	1	4	4	5	5
1961	1	2	1	5	4	5	5
1962	1	2	1	5	4	5	3
1963	2	2	1	4	4	5	2
1964	1	2	1	5	4	5	5
1965	3	3	1	3	3	5	2
1966	2	2	1	4	4	5	4
1967	4	4	2	2	2	4	1
1968	3	3	1	3	3	5	4
1969	5	5	2	1	1	4	1
1970	4	4	1	2	2	5	2
1971	3	4	1	3	2	5	3
1972	3	3	1	3	3	5	5
1973	3	4	1	3	2	5	2
1974	3	4	1	3	2	5	2
1975	3	4	1	3	2	5	2
1976	2	3	1	4	3	5	5
1977	1	2	1	5	4	5	5
1978	2	3	1	4	3	5	1
1979	3	3	1	3	3	5	2
1980	4	4	1	2	2	5	1
1981	2	3	1	4	3	5	4
1982	5	5	2	1	1	4	1
1983	5	5	3	1	1	3	1
1984	4	4	1	2	2	5	1
1985	3	3	1	3	3	5	4
1986	5	5	2	1	1	4	1

1987	3	3	1	3	3	5	5
1988	1	2	1	5	4	5	5
1989	1	2	1	5	4	5	5
1990	1	1	1	5	5	5	5
1991	1	1	1	5	5	5	5
1992	1	1	1	5	5	5	5
1993	1	1	1	5	5	5	2
1994	1	1	1	5	5	5	5
1995	3	3	2	3	3	4	1
1996	4	4	1	2	2	5	1
1997	4	4	2	2	2	4	1
1998	5	5	2	1	1	4	1
1999	4	4	1	2	2	5	2
2000	4	4	1	2	2	5	2
2001	2	3	1	4	3	5	5
2002	2	3	1	4	3	5	5
2003	2	3	1	4	3	5	3

d by the proposed change in ops.
et=1 and Critical=5.

e caused by a change in storage condition for that year due to differing operations under the PA.
n operational change that changes river releases by 300 TAF might not result in a yeartype change, but could rep

aused by a change in the yeartype method.
BINED change in the yeartype method and storage condition due to differing operations under the PA.

PA NMI minus COS NMI	PA 60-20-20 minus PA NMI	PA 60-20-20 minus COS NMI
0	-1	-1
0	0	0
0	1	1
0	0	0
0	1	1
-1	-1	-2
-1	1	0
-1	1	0
-1	1	0
0	0	0
-1	-2	-3
0	0	0
0	0	0
0	-3	-3
0	-2	-2
0	-2	-2
1	-1	0
1	0	1
0	-1	-1
0	-1	-1
1	-1	0

TABLE A	Count of water years in e	
	COS-NMI	**PA-NMI**
5 Critical	18	9
4 Dry	20	20
3 Below Normal	21	24
2 Above Normal	14	22
1 Wet	9	7
Total (should be 82)	82	82

TABLE B	Percent of water years in e	
	COS-NMI	**PA-NMI**
Critical	22	11
Dry	24	24
Below Normal	26	29
Above Normal	17	27
Wet	11	9
Total (should be 100)	100	100

TABLE C	Count of water years with each "y	
	PA NMI minus COS NMI	**PA 60-20-20 minus PA NMI**
min	-1	-3

0	1	1
0	0	0
0	-1	-1
-1	0	-1
-1	2	1
-1	1	0
0	0	0
0	0	0
-1	1	0
0	0	0
0	1	1
0	0	0
0	1	1
0	-1	-1
0	0	0
0	-1	-1
0	1	1
0	1	1
-1	1	0
-1	-1	-2
0	-2	-2
-1	1	0
0	-1	-1
0	0	0
0	-1	-1
0	1	1
0	0	0
0	0	0
-1	1	0
0	2	2
-1	0	-1
-1	0	-1
-1	0	-1
-1	2	1
-1	1	0
-1	-2	-3
0	-1	-1
0	-1	-1
-1	1	0
0	0	0
0	0	0
0	-1	-1
0	1	1
0	0	0

max	1	2
-3	0	2
-2	0	6
-1	25	17
0	54	30
1	3	21
2	0	6
3	0	0
Total (should be 82)	82	82

Table D Percent of water years (in 82 yea

	PA NMI minus COS NMI	**PA 60-20-20 minus PA NMI**
-3	0	2
-2	0	7
-1	30	21
0	66	37
1	4	26
2	0	7
3	0	0
Total (should be 100)	100.00	100.00

0	2	2
-1	1	0
-1	1	0
0	0	0
0	0	0
0	0	0
0	-3	-3
0	0	0
0	-2	-2
0	-1	-1
0	-1	-1
0	0	0
0	0	0
0	0	0
-1	2	1
-1	2	1
-1	0	-1

›resent a signficant biological effect).

ach yeartype	General conclusions based on Tables A & B (same info, just expressed as a
PA-60-20-20	Comparing PA-60-20-20 to COS-NMI, there are more Critical, Above Norma
24	See Conclusions for Table B and Table C for discussion about how these dif
10	
9	
20	
19	
82	

each yeartype	
PA-60-20-20	
29	
12	
11	
24	
23	
100	

yeartype differential"	General conclusions based on Tables C & D (same info, just expressed as a
PA 60-20-20 minus COS NMI	
-3	Comparing PA-NMI to COS-NMI controls for hydrology and yeartype metho

2	The operational changes, in isolation, result in storage changes that shift sc
	Specifically, the operational changes result in storage changes that shift th
4	Seeing only "single step" shifts isn't too surprising, since under the NMI me
6	
18	Comparing PA-60-20-20 to PA-NMI controls for hydrology and operations a
38	The change in yeartype method, in isolation, shifts some yeartypes by a "y
14	Specifically, the change in yeartype method, in isolation, shifts the yeartyp
2	
0	The yeartype method effect is larger (in terms of leading to a bigger "yeart
82	The yeartype method effect is relatively symmetric (33% of years are wett
	--It isn't surprising that the operations effect is asymmetric since the Stepp
ar record) with each	Comparing PA-60-20-20 to COS-NMI controls only for hydrology and thus r
PA 60-20-20 minus COS NMI	The combined effect is asymmetric, with 28 of 82 years (34%) being classif
5	--Because the Stepped Release Plan "downshifts" the two highest flow sch
7	
22	The PA's REQUIRED minimum flows are thus:
46	--lower in Above Normal and Wet years (based on Stepped Release Plan ta
17	--Because the distribution of yeartypes is shifted to drier overall, that effec
2	
0	The COS & PA's MODELED flows, however, are more similar than might be
100.00	--Table 37-3 (Attachment 3-2 of Appendix D of the BA) compares average r
	--Notable changes are seen in that April & May flows during Dry and Critica
	--June flows are also lower in the PA, particularly in Above Normal years; I
	Why aren't larger changes observed? Two primary reasons:
	1. Because in Above Normal and Wet years (the years in which required flc
	2. The assumptions in the Current Ops scenario assume only base Vernalis

count (in Table A) or a percent of the 82 year record (in Table B):

al, and Wet years and fewer Dry and Below Normal years.

ferences may be attributed to the change in operations (Stepped Release Plan and no VNS requirement

count (in Table C) or a percent of the 82 year record (in Table D):

od and thus coarsely represents the effect of the operational change in the PA relative to COS (see more

ome yeartypes by no more than one step of "yeartype differential", both wetter and drier.
e yeartype one step wetter (a "yeartype differential" of 1) in 3 of 82 years (4%), one step drier (a "yearty
ethod (controlling for hydrology), reservoir releases would have to change by 500 TAF to 1 MAF to trigge

and thus represents the effect of the yeartype method in the PA relative to COS.
eartype differential" of up to 3 steps drier or 2 steps wetter.
e one to two steps wetter (a "yeartype differential" of 1 or 2) in 27 of 82 years (33%), one to 3 steps drie

ype differential") than the operations effect.
er; 30% of years are drier) while the operations effect is very asymmetric (4% of years are wetter; 30% a
ed Release Plan proposes flows in Critical, Dry, and Below Normal years similar to current operations; w

epresents the effect of the COMBINED change in the yeartype method and storage condition due to diff

ied as drier yeartypes (which triggers a lower flow schedule per the Stepped Release Plan) and 16 of 82
edules in the 2009 BiOp (i.e., PA's "Wet flows"=BiOp's "Above Normal flows" and PA's "Above Normal fl

bles), so would be lower overall even if yeartype distribution was unchanged.
t exacerbates the trend to lower required minimum flows.

expected based on this yeartype analysis and the required flow schedules:
monthly flows in the PA vs. COS scenarios.
l years are about 200-250 cfs lower in the PA (probably due to the assumption that NO Vernalis flow re
interpret this as the signal from the SRP's implementation of the BiOp's Below Normal flows in an Above

ows in the PA differ from the BiOp), New Melones is likely to be in flood ops during part of the winter an
flows Feb-June, and not any of pulse flow elements in D-1641 (in October or mid-April to mid-May).

s vs. Appendix 2-E flows and partial VNS requirements) vs. change in yeartype method.

› detailed caveat in rows 6-13).

/pe differential" of -1) in 25 of 82 years (30%), and no change in 54 of 82 years (66%).
:r a "two step" yeartype shift.

:r (a "yeartype differential" of -1, -2, or -3) in 25 of 82 years (30%), and no change in 30 of 82 years (37%

are drier).
/hile proposing lower releases in Above Normal and Wet years.

fering operations under the PA.

years (20%) being classified as wetter yeartypes (which *might* trigger a higher flow schedule per the Ste
ows"=BiOp's "Below Normal flows"), a shift from Below Normal in COS to Above Normal in the PA (or fr

quirement is in effect in the PA).
e Normal year.

d spring.

ó).

ıpped Release Plan).
om Above Normal in COS to Wet in the PA) doesn't actually trigger a higher flow schedule.