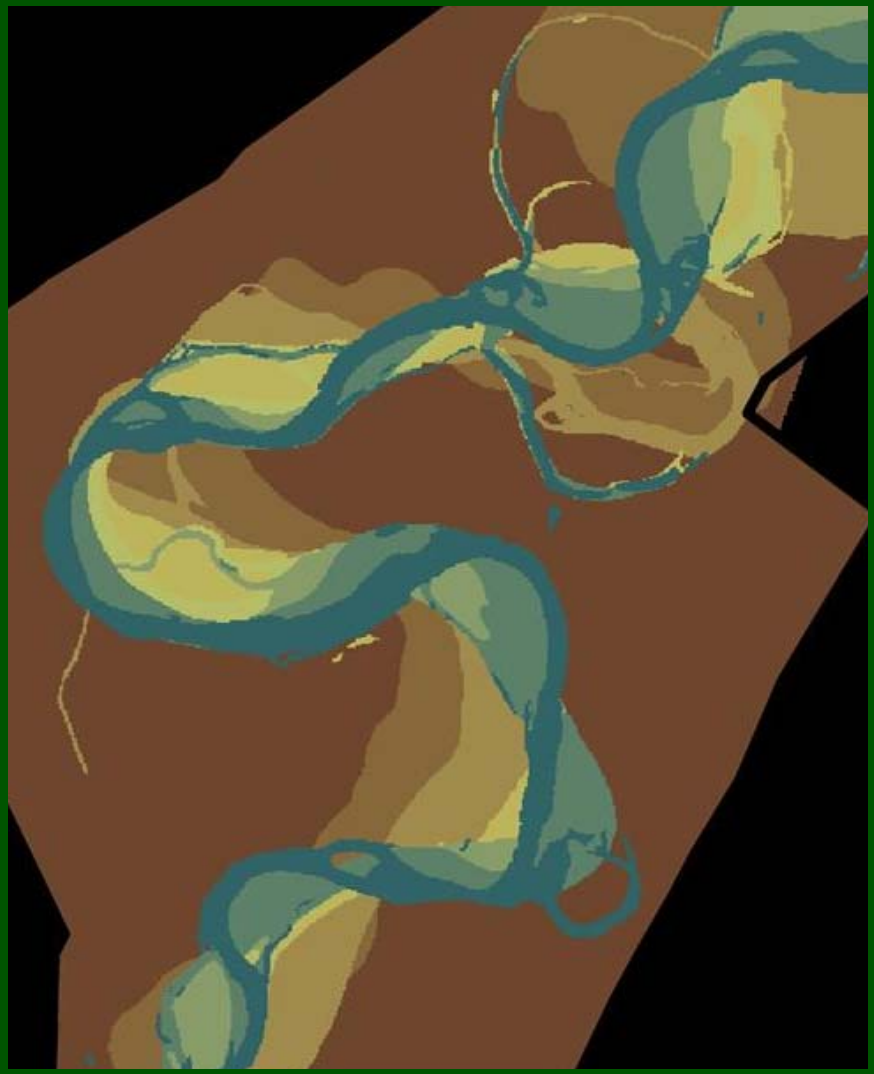
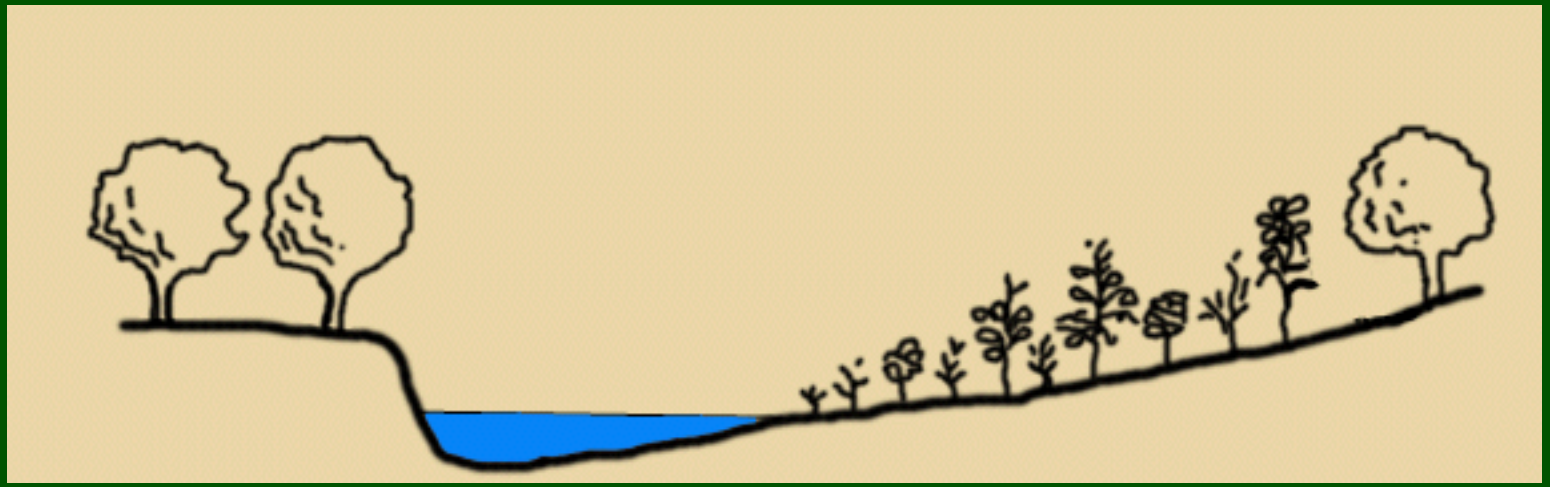
Channel Dynamics Analysis Monitoring

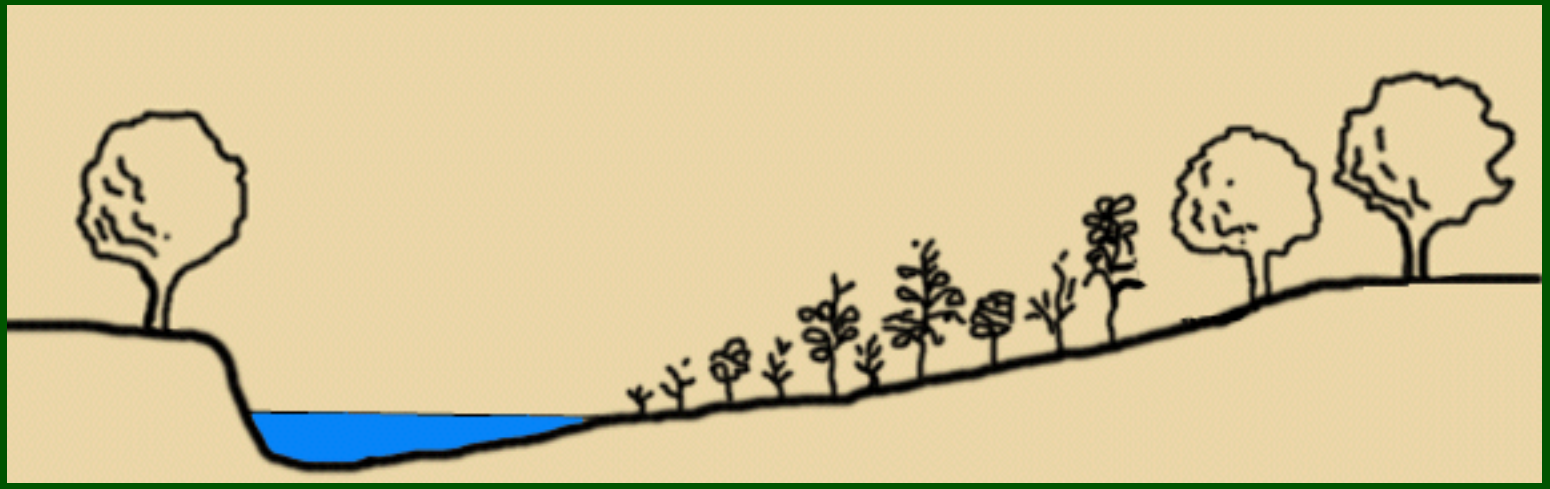
Eric W. Larsen
Dept. of Environmental Design
University of California, Davis

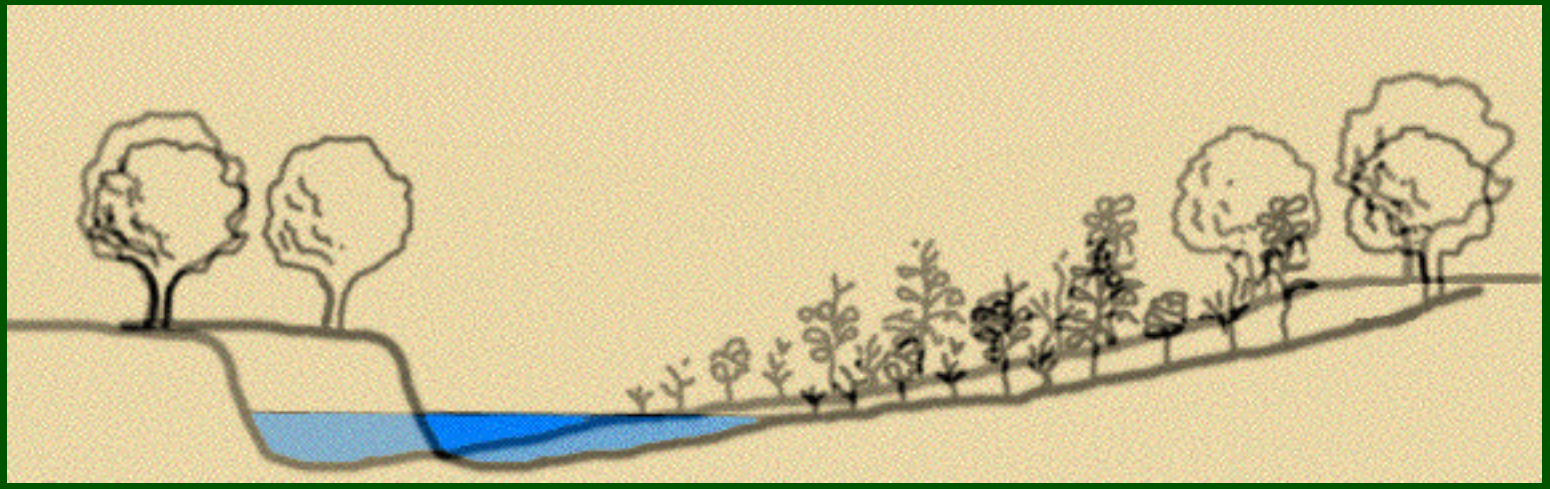


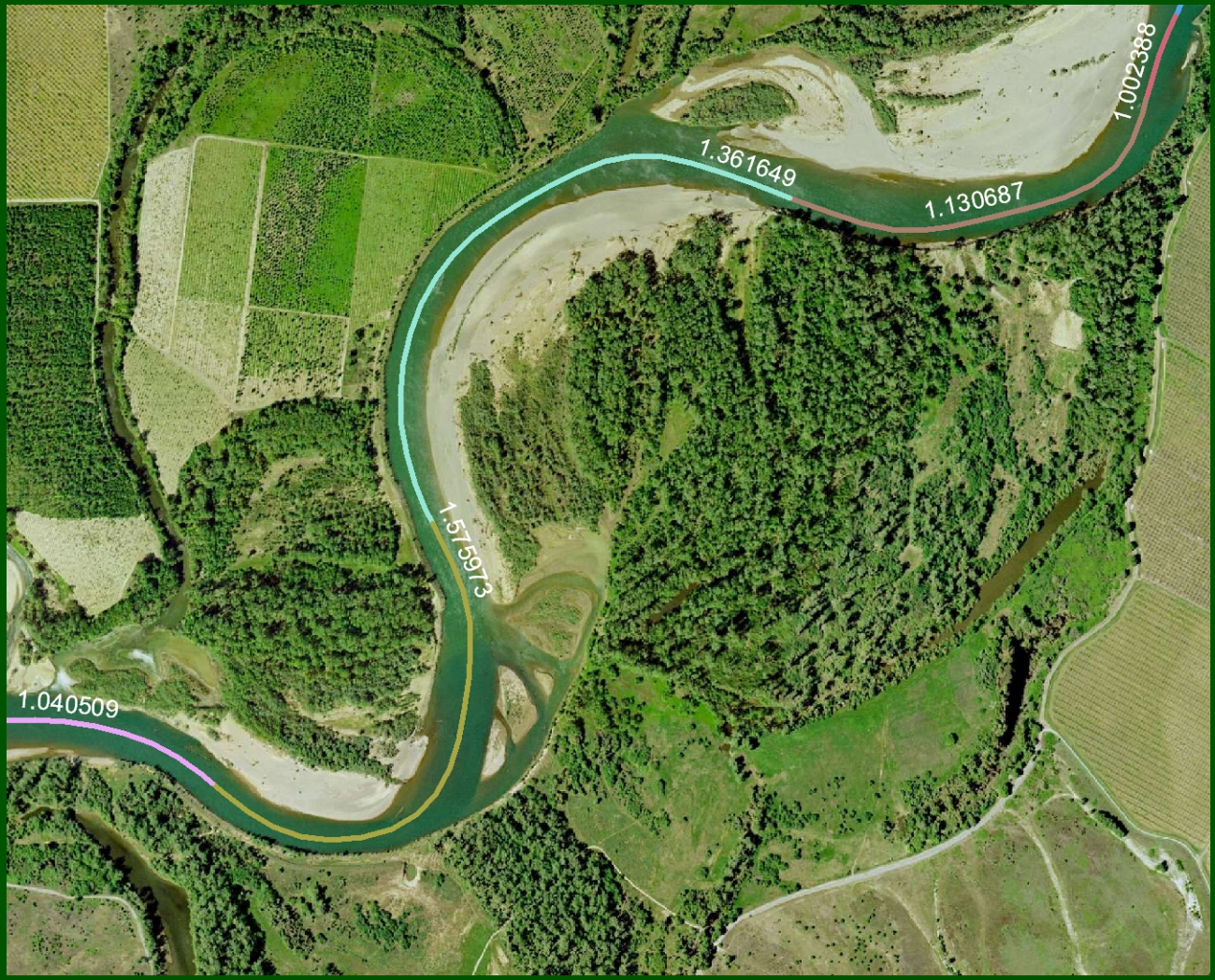
Meander migration – basis for ecosystem functions

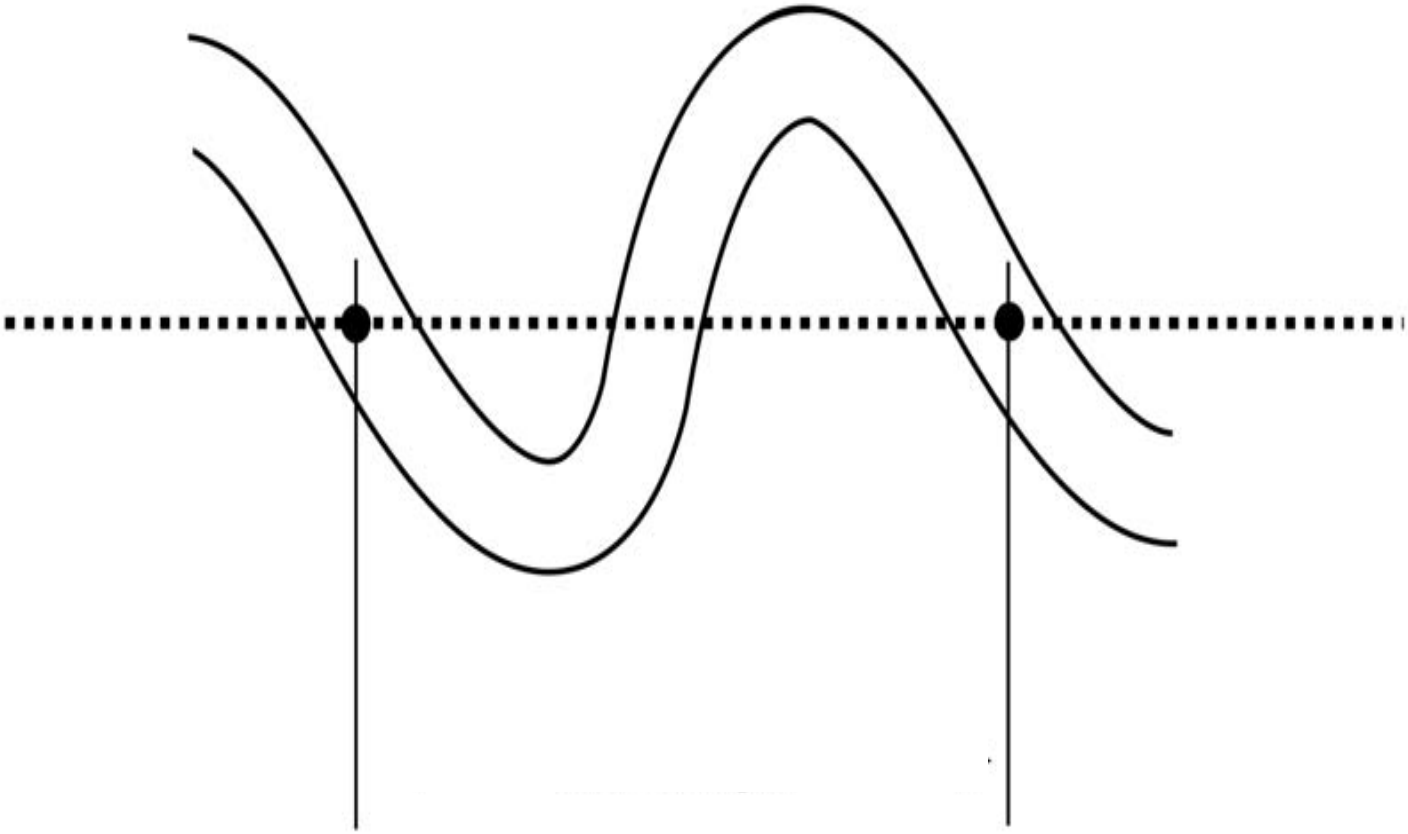
1. Vegetation establishment
2. Floodplain creation
3. Habitat creation (bank swallow habitat)
4. Off channel water habitats (through cut-off)
5. Aquatic habitats

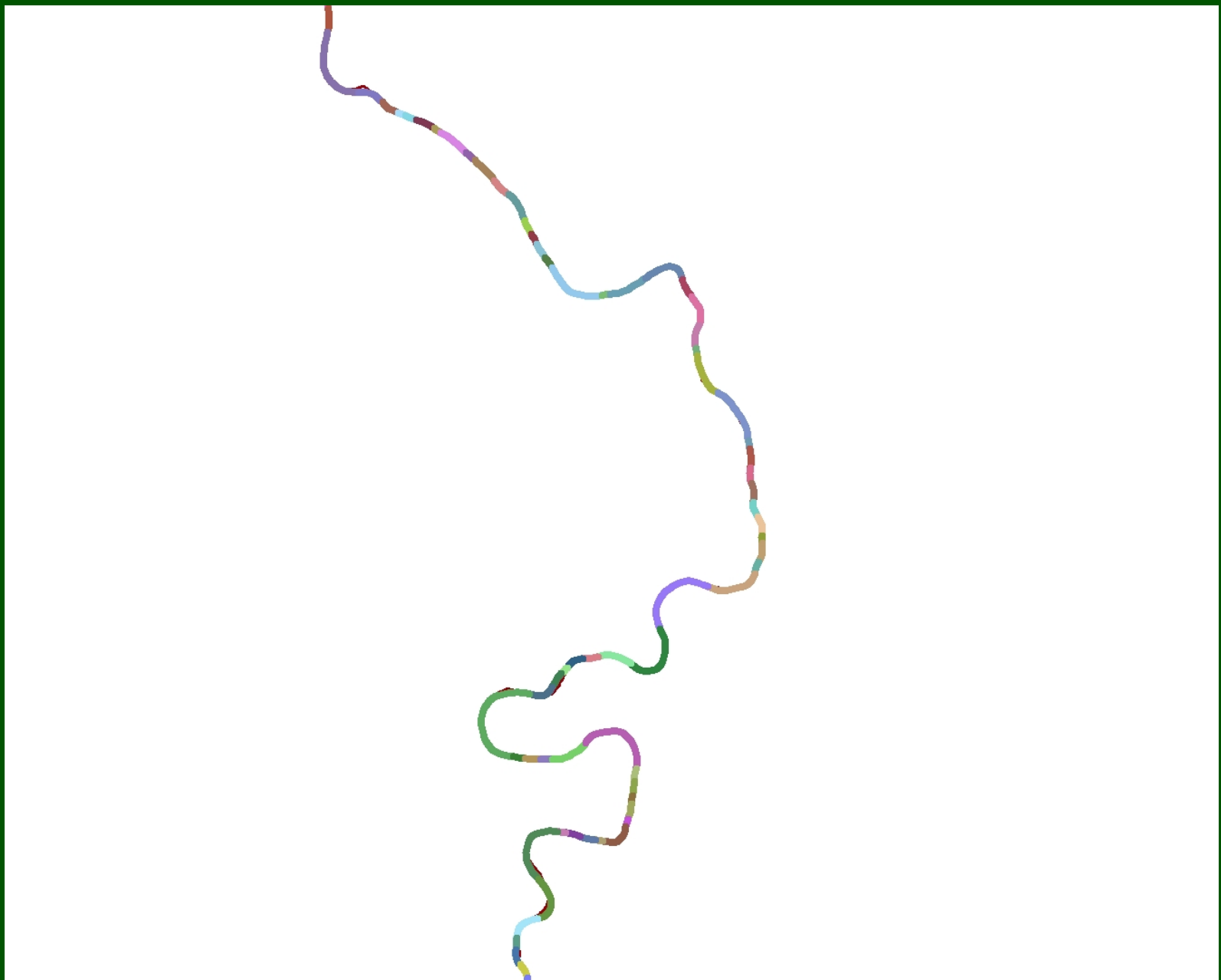


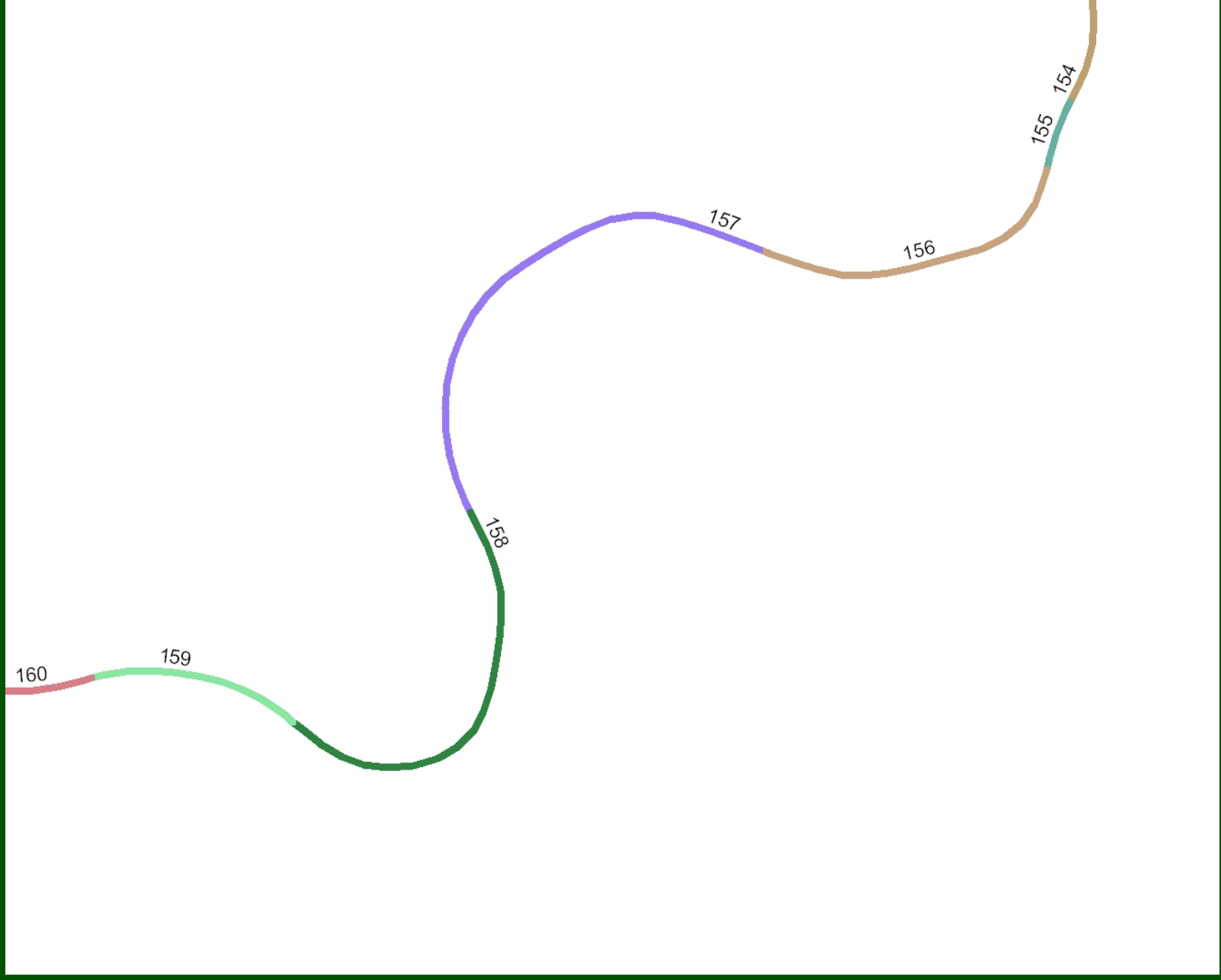


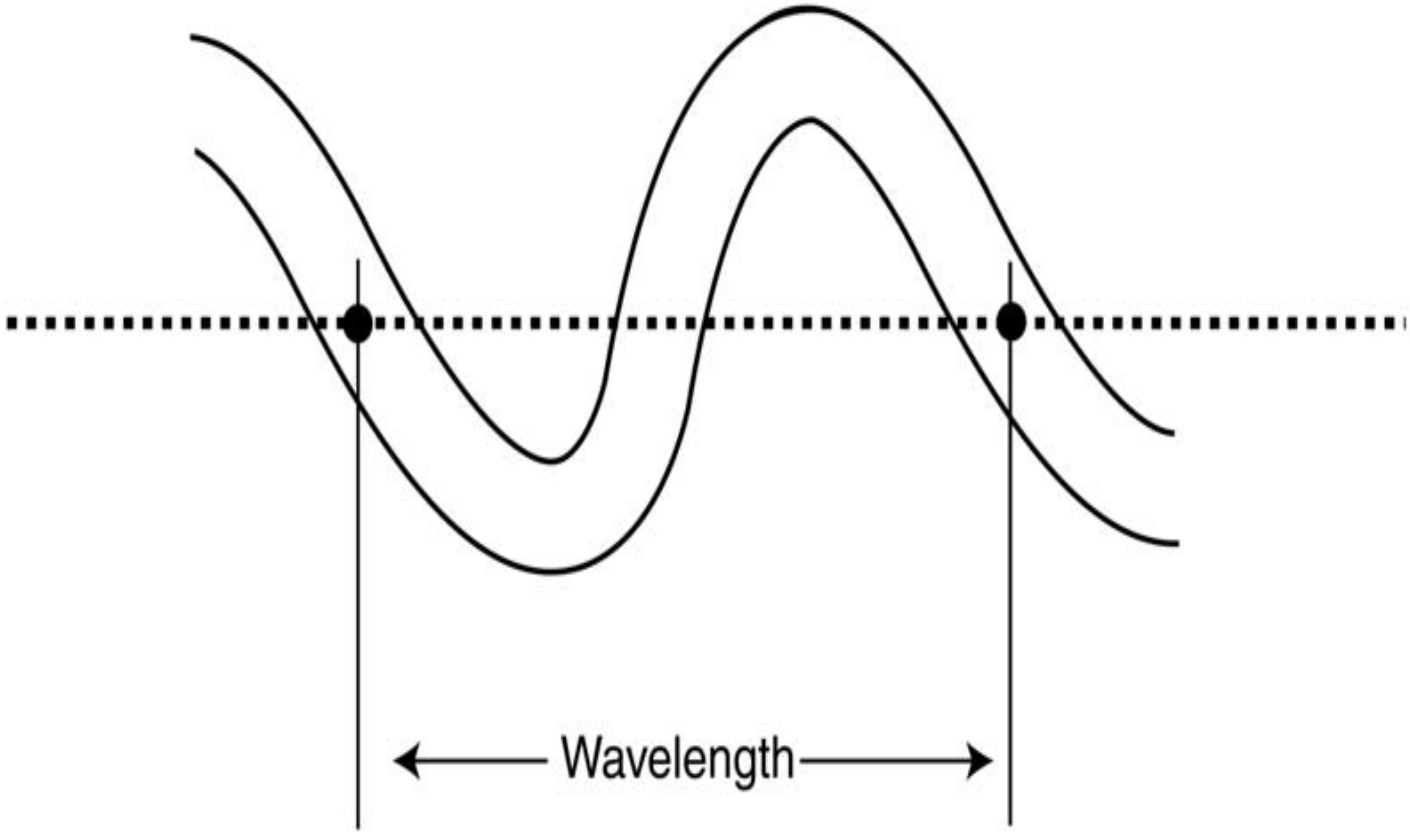


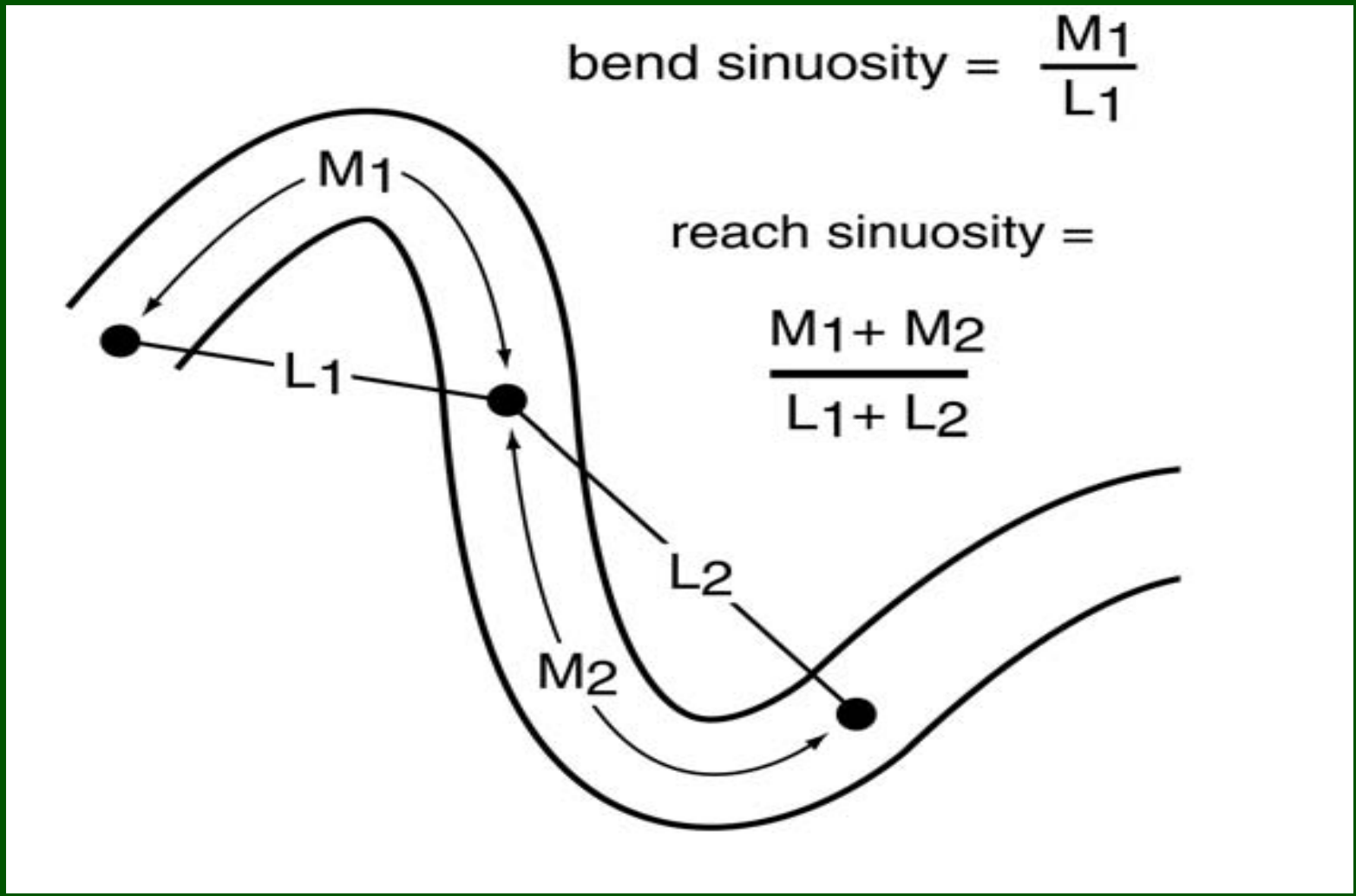

1.002388
1.361649
1.130687
1.575973
1.040509

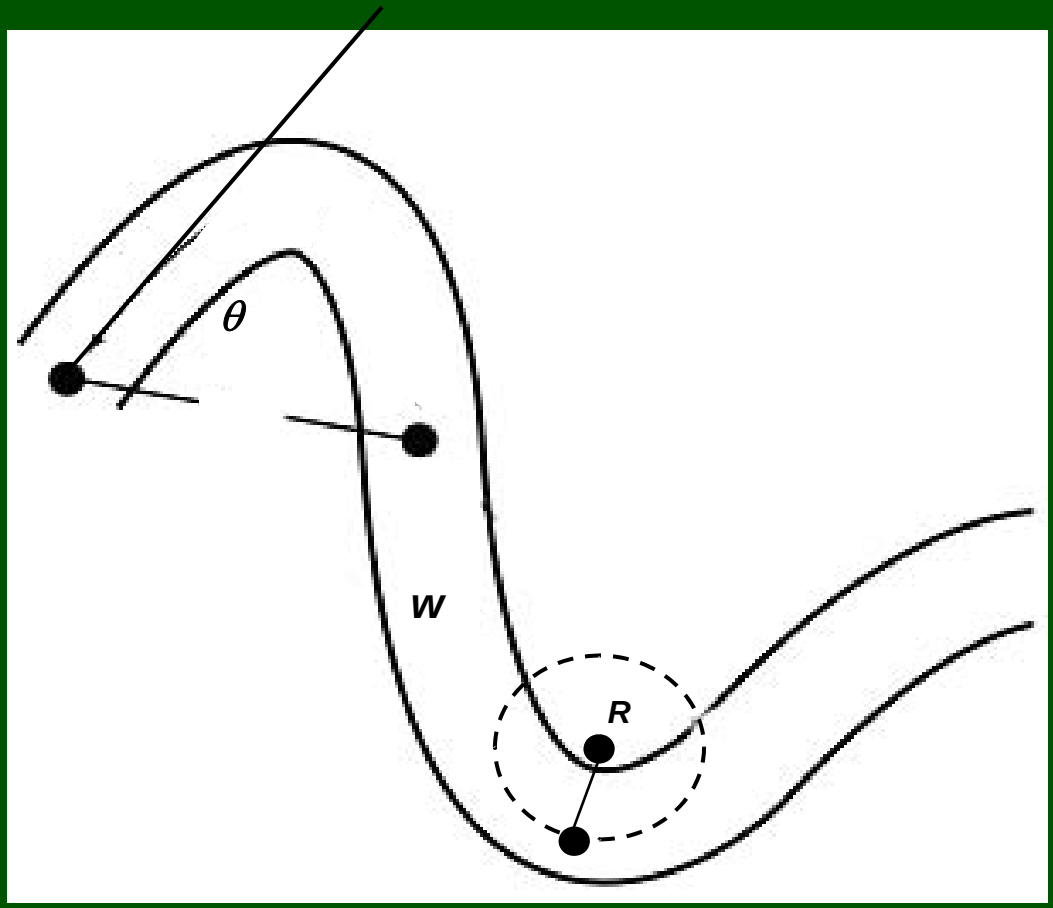


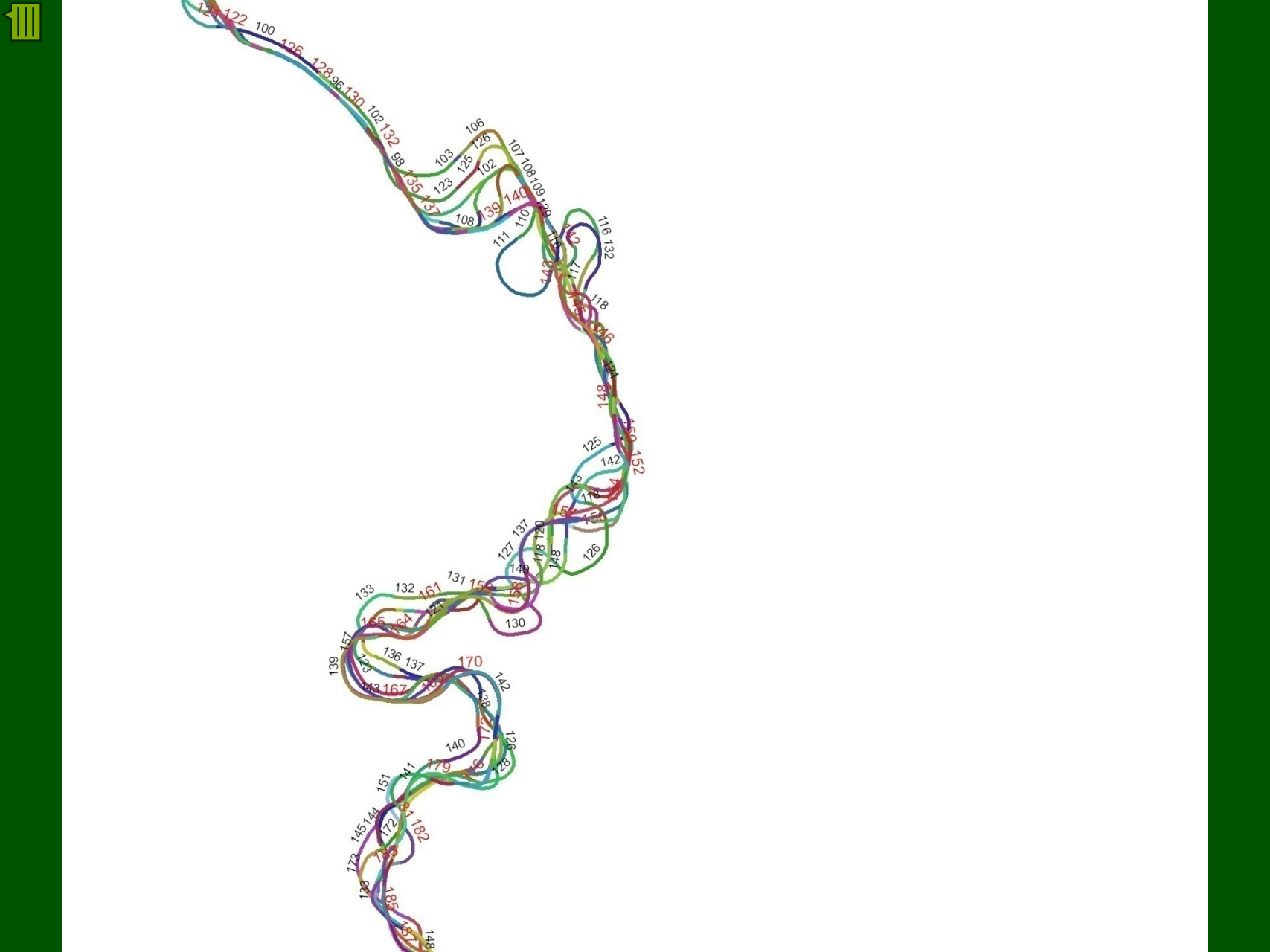



154
155
156
157
158
159
160


Wavelength


bend sinuosity = M1 / L1
M1
reach sinuosity =
M1+ M2
L1+ L2
L1
L2
M2

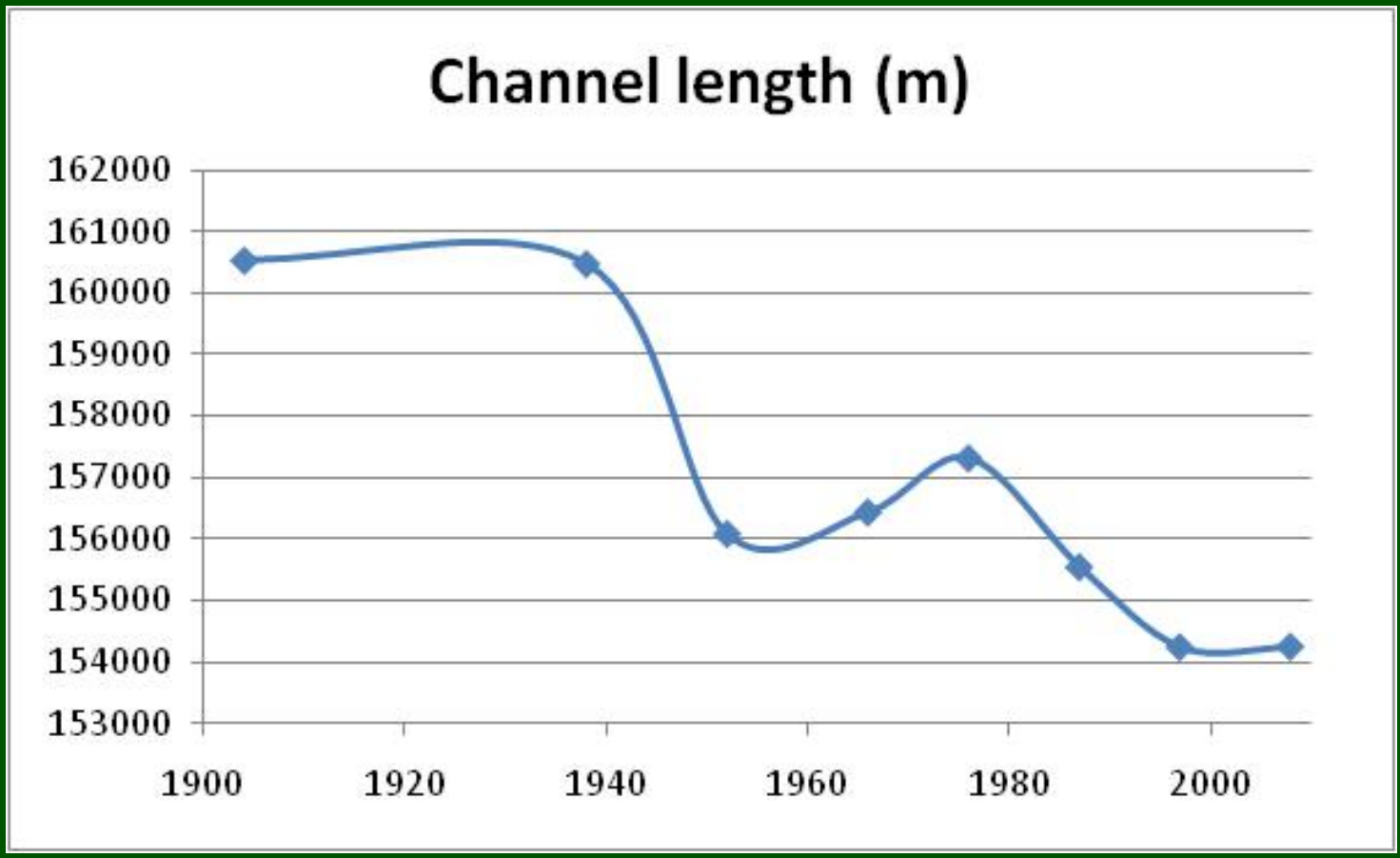

θ
W
R

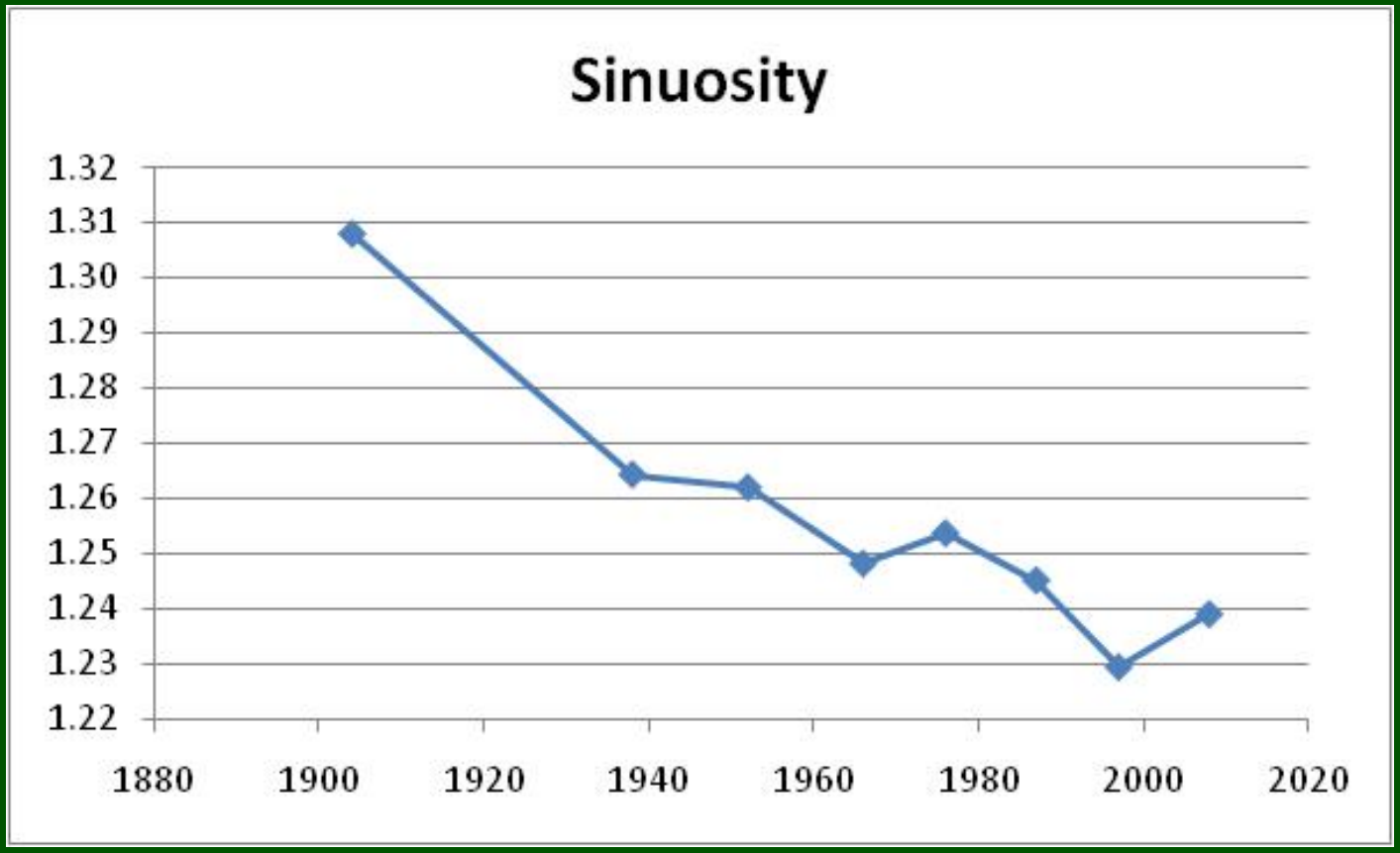


BEND_ID	START_S	ARC_LENGTH	LINE_DIST	SINUOSITY	AVG_RADIUS	AVG_CURVE	MAX_CURVE	MAXCURVE_S	AVG_U_D	MAX_U_D	MAXUD_S	AVG_ETA	MAX_ETA	MAXETA_S	ENTR_ANGLE	EXIT_ANGLE
1	0	300	298	1.01	-1080	-0.00093	-0.00154	0.44	0.08	0.20	0.44	1.21	2.00	0.44	0.15	0.16
2	300	203	203	1.00	4122	0.00024	0.00044	0.50	-0.18	-0.22	0.50	-0.34	-0.60	0.50	0.02	0.03
3	503	343	341	1.01	-1077	-0.00093	-0.00147	0.50	0.02	-0.17	0.90	1.20	1.94	0.50	0.16	0.16
4	846	268	267	1.00	1588	0.00063	0.00101	0.38	-0.19	-0.29	0.38	-0.80	-1.25	0.38	0.09	0.08
5	1114	137	137	1.00	-2535	-0.00039	-0.00040	0.75	0.05	0.06	0.24	0.49	0.51	0.75	0.03	0.03
6	1251	1229	1160	1.06	1128	0.00089	0.00276	0.19	0.06	0.34	0.42	-1.14	-3.50	0.19	0.71	0.38
7	2480	1498	1382	1.08	-1133	-0.00088	-0.00158	0.84	-0.01	-0.37	0.98	1.13	2.20	0.84	0.59	0.73
8	3978	751	705	1.07	678	0.00147	0.00238	0.23	-0.08	-0.49	0.14	-1.89	-2.87	0.23	0.63	0.48
9	4729	206	206	1.00	-1478	-0.00068	-0.00089	0.51	0.31	0.38	0.17	0.82	1.07	0.51	0.07	0.07
10	4935	819	790	1.04	1010	0.00099	0.00144	0.21	0.04	0.30	0.96	-1.27	-1.92	0.29	0.42	0.40
11	5753	272	271	1.00	-979	-0.00102	-0.00131	0.62	0.27	0.38	0.12	1.32	1.67	0.37	0.14	0.14
12	6026	545	537	1.02	1176	0.00085	0.00158	0.44	-0.05	-0.25	0.31	-1.09	-2.02	0.44	0.25	0.21
13	6571	1152	1141	1.01	-2354	-0.00042	-0.00120	0.85	0.05	0.21	0.03	0.55	1.55	0.85	0.17	0.32
14	7723	273	272	1.00	1341	0.00075	0.00111	0.38	-0.18	-0.28	0.38	-0.93	-1.39	0.38	0.11	0.10
15	7996	205	205	1.00	-1365	-0.00073	-0.00103	0.50	0.10	0.15	0.50	0.90	1.26	0.50	0.08	0.07
16	8201	823	763	1.08	660	0.00151	0.00278	0.21	0.00	-0.37	0.21	-1.95	-3.49	0.21	0.68	0.56
17	9024	1096	900	1.22	-616	-0.00162	-0.00320	0.53	0.04	0.44	0.09	2.08	3.70	0.53	0.84	0.94
18	10121	818	778	1.05	876	0.00114	0.00252	0.71	-0.18	-0.43	0.04	-1.47	-3.10	0.71	0.37	0.56
19	10939	1358	1293	1.05	-1413	-0.00071	-0.00154	0.82	0.06	0.38	0.03	0.92	1.98	0.82	0.37	0.59
20	12296	202	202	1.00	4041	0.00025	0.00039	0.50	-0.22	-0.30	0.17	-0.30	-0.46	0.50	0.03	0.02
21	12498	206	205	1.00	-2460	-0.00041	-0.00061	0.50	-0.06	-0.11	0.83	0.49	0.74	0.50	0.05	0.03
22	12704	1015	795	1.28	458	0.00219	0.00369	0.77	0.05	0.63	0.97	-2.80	-4.85	0.23	1.16	1.05
23	13719	1559	1096	1.42	-615	-0.00163	-0.00278	0.28	0.03	0.65	0.02	2.10	3.33	0.63	1.13	1.40
24	15278	752	701	1.07	585	0.00171	0.00390	0.77	-0.26	-0.63	0.05	-2.24	-5.04	0.77	0.46	0.83
25	16031	272	268	1.02	-571	-0.00175	-0.00293	0.63	0.59	0.80	0.38	2.21	3.43	0.63	0.19	0.28
26	16302	744	725	1.03	998	0.00100	0.00269	0.23	-0.01	-0.38	0.14	-1.26	-3.26	0.23	0.46	0.29
27	17046	136	136	1.00	-1842	-0.00054	-0.00056	0.25	0.21	0.25	0.25	0.58	0.58	0.75	0.04	0.04
28	17182	342	336	1.02	668	0.00150	0.00233	0.49	-0.08	-0.22	0.49	-1.89	-2.88	0.49	0.23	0.28
29	17524	674	656	1.03	-969	-0.00103	-0.00189	0.76	0.16	0.42	0.15	1.32	2.16	0.76	0.32	0.38
30	18198	408	402	1.02	792	0.00126	0.00210	0.41	-0.19	-0.47	0.25	-1.63	-2.81	0.41	0.32	0.20
31	18607	205	205	1.00	-3655	-0.00027	-0.00035	0.50	0.17	0.25	0.17	0.46	0.61	0.17	0.03	0.02
32	18811	272	272	1.00	5821	0.00017	0.00029	0.38	0.02	0.09	0.88	-0.26	-0.54	0.38	0.03	0.02
33	19083	340	339	1.00	-1720	-0.00058	-0.00091	0.50	0.06	0.14	0.10	0.71	1.06	0.30	0.11	0.09
34	19423	137	137	1.00	6820	0.00015	0.00018	0.25	-0.07	-0.09	0.25	-0.01	-0.07	0.25	0.01	0.01
35	19560	545	542	1.00	-1979	-0.00051	-0.00099	0.31	-0.03	-0.16	0.94	0.64	1.05	0.31	0.17	0.11
36	20105	271	271	1.00	1437	0.00070	0.00103	0.62	-0.13	-0.20	0.13	-0.88	-1.17	0.62	0.09	0.10
37	20376	341	338	1.01	-954	-0.00105	-0.00178	0.50	0.12	0.25	0.30	1.30	2.11	0.50	0.18	0.18
38	20717	203	202	1.00	1300	0.00077	0.00104	0.50	-0.22	-0.26	0.50	-0.90	-1.20	0.50	0.08	0.08
39	20920	961	941	1.02	-1435	-0.00070	-0.00147	0.18	-0.02	-0.21	0.96	0.89	1.95	0.25	0.38	0.29
40	21881	206	206	1.00	2636	0.00038	0.00055	0.50	-0.14	-0.23	0.17	-0.48	-0.70	0.50	0.05	0.03
41	22087	275	274	1.00	-1131	-0.00088	-0.00118	0.37	0.05	0.13	0.37	1.13	1.56	0.37	0.12	0.12
42	22362	747	695	1.07	630	0.00159	0.00473	0.78	-0.15	-0.46	0.69	-2.02	-5.43	0.78	0.33	0.84
43	23109	203	203	1.00	-1993	-0.00050	-0.00097	0.50	0.50	0.58	0.17	0.43	0.97	0.50	0.05	0.05
44	23312	272	269	1.01	647	0.00154	0.00227	0.37	0.07	0.24	0.87	-1.88	-2.60	0.37	0.23	0.19
45	23584	1353	1065	1.27	-649	-0.00154	-0.00360	0.72	0.03	-0.64	0.98	1.97	4.73	0.77	0.79	1.30
46	24938	204	204	1.00	1645	0.00061	0.00081	0.49	-0.47	-0.61	0.16	-0.64	-0.84	0.49	0.07	0.06
47	25142	266	266	1.00	-1217	-0.00082	-0.00126	0.64	-0.07	-0.13	0.13	0.94	1.32	0.64	0.09	0.12
48	25408	1345	1161	1.16	703	0.00142	0.00356	0.28	0.03	-0.50	0.12	-1.79	-4.69	0.23	1.11	0.81
49	26754	281	277	1.02	-556	-0.00180	-0.00285	0.36	0.38	0.60	0.12	2.08	2.97	0.36	0.30	0.20
50	27035	561	558	1.01	1475	0.00068	0.00127	0.19	-0.07	-0.24	0.19	-0.80	-1.30	0.19	0.21	0.17

BEND_ID	ARC_LENGTH	LINE_DIST	SINUOSITY	AVG_RADIUS	AVG_CURVE	MAX_CURVE	MAXCURVE_S	ENTR_ANGLE	EXIT_ANGLE
155	203	203	1.00	-1069	-0.00094	-0.00145	0.50	0.11	0.08
156	952	842	1.13	570	0.00175	0.00429	0.18	1.04	0.63
157	1501	1102	1.36	-629	-0.00159	-0.00319	0.25	1.10	1.29
158	1225	777	1.58	451	0.00222	0.00442	0.58	1.16	1.56
159	606	583	1.04	-643	-0.00156	-0.00220	0.28	0.48	0.46

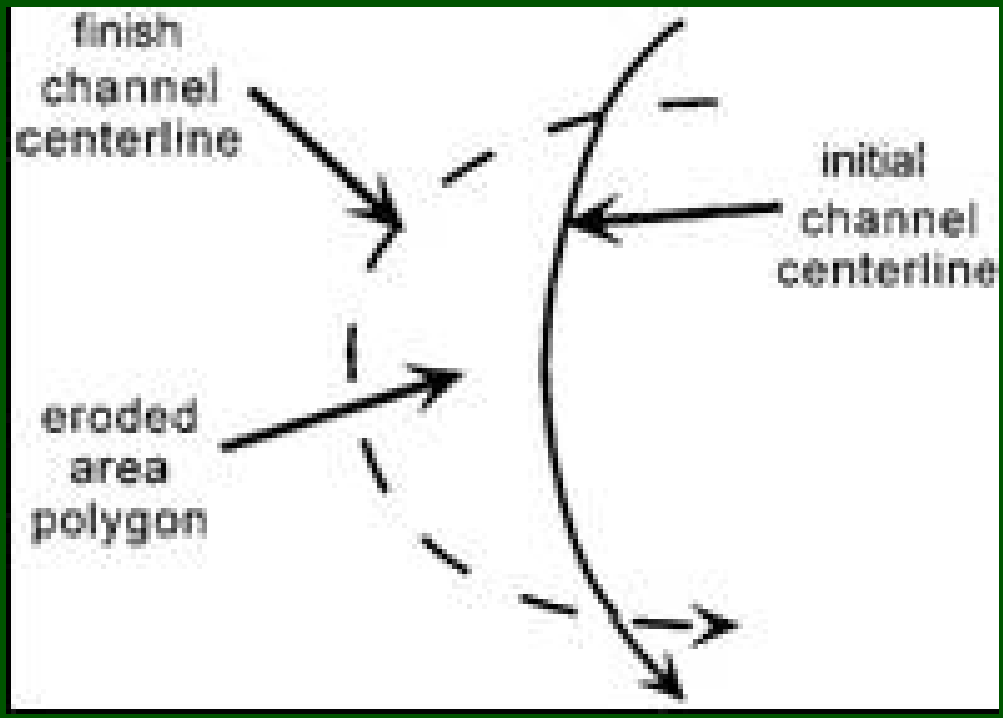
Including straight reaches							
Year	Count	Wave length (m)	SINUOSITY	RADIUS (m)	Entrance Angel (Degrees)	Exit Angle (Degrees)	Channel length (m)
1904	119	1057	1.31	2101	46	47	160529
1938	129	996	1.26	1550	47	46	160474
1952	119	1045	1.26	1210	42	42	156070
1966	119	1052	1.25	1361	44	42	156423
1976	124	1019	1.25	1928	43	44	157303
1987	122	1023	1.25		45	41	155528
1997	120	1046	1.23	1192	40	40	154221
2008	119	1050	1.24	1299	40	41	154229
Mean	121	1036	1.26	1871	43	43	156847

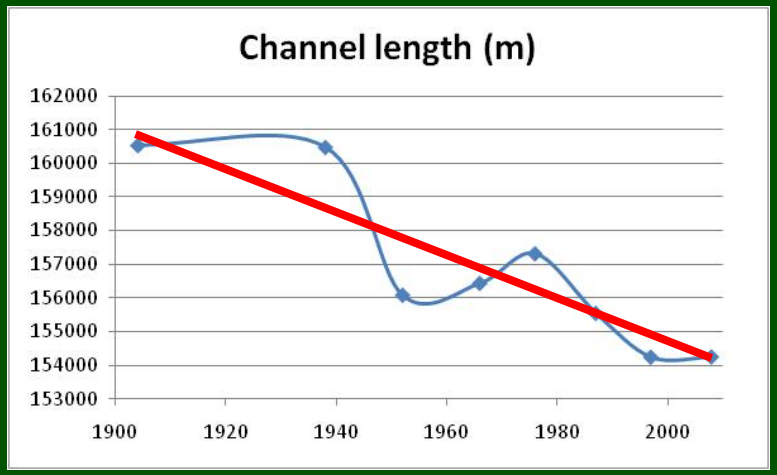

Channel length (m)
162000
161000
160000
159000
158000
157000
156000
155000
154000
153000
1900
1920
1940
1960
1980
2000

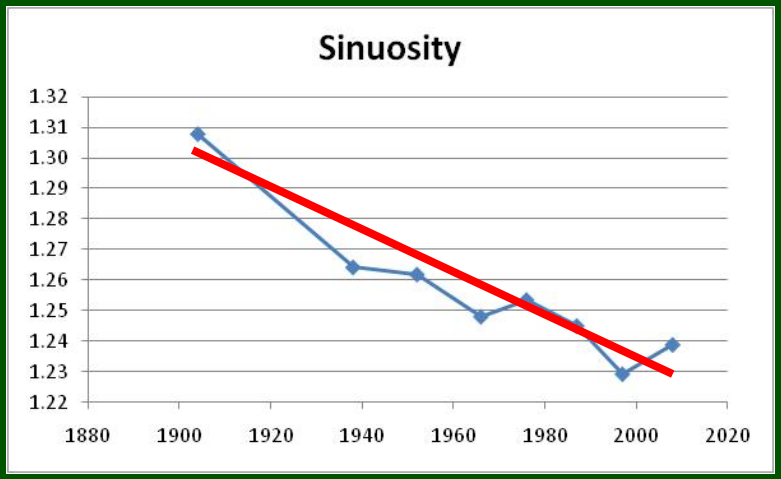

Sinuosity
1.32
1.31
1.30
1.29
1.28
1.27
1.26
1.25
1.24
1.23
1.22
1880
1900
1920
1940
1960
1980
2000
2020

Scorecard Indicators

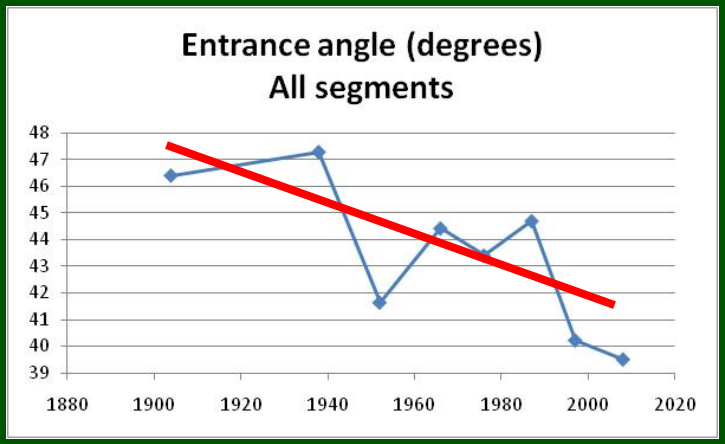
1. Total river length
2. Total river sinuosity
3. Entrance angle
4. Line distance between inflection points (half wave length)
5. Bend migration rate
6. Area of floodplain reworked

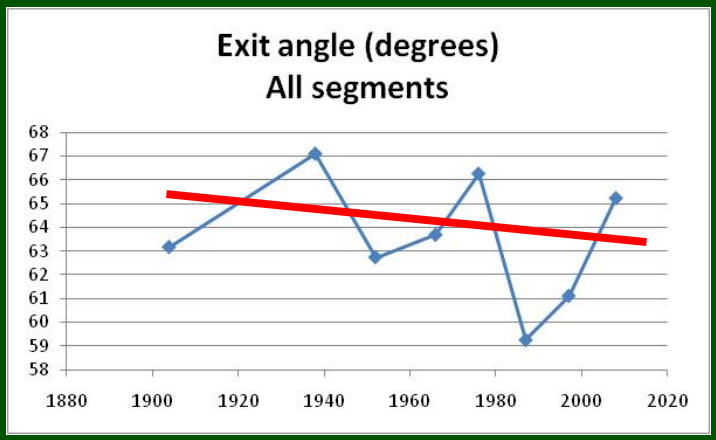

finish
channel
centerline
initial
channel
centerline
eroded
area
polygon


Channel length (m)
162000
161000
160000
159000
158000
157000
156000
155000
154000
153000
1900
1920
1940
1960
1980
2000

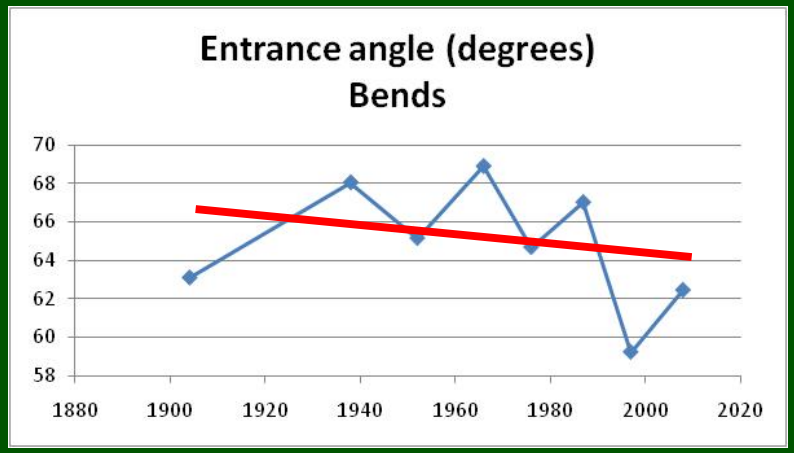

Sinuosity
1.32
1.31
1.30
1.29
1.28
1.27
1.26
1.25
1.24
1.23
1.22
1880
1900
1920
1940
1960
1980
2000
2020

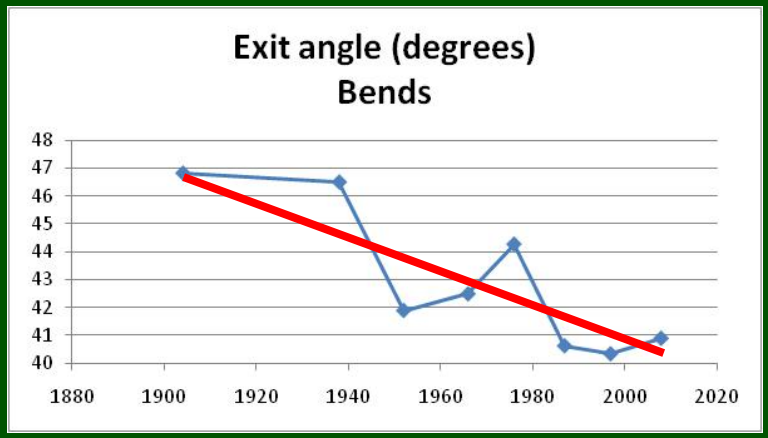
All segments

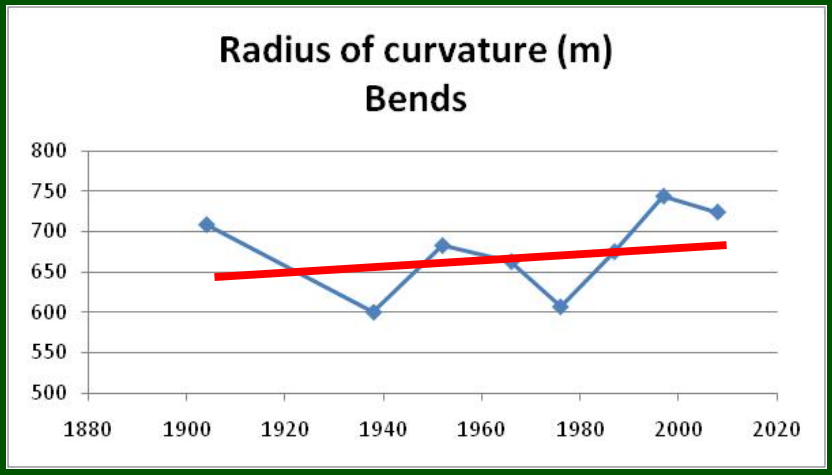


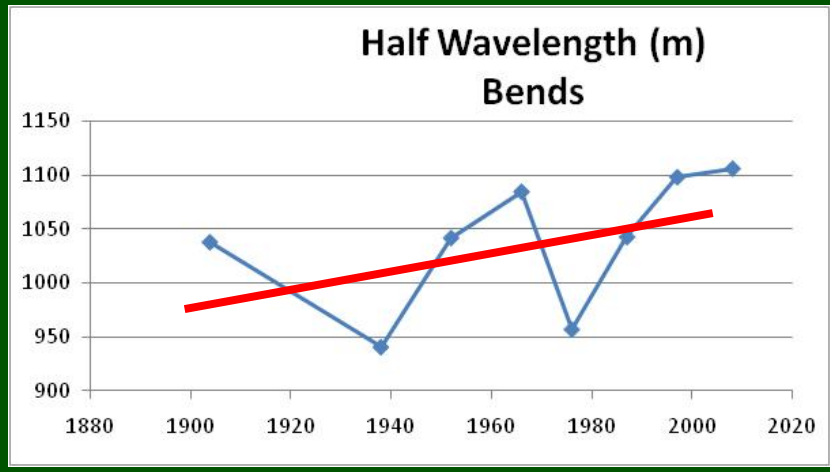


Bends only






Radius of curvature (m)
Bends
800
750
700
650
600
550
500
1880
1900
1920
1940
1960
1980
2000
2020


Half Wavelength (m)
Bends
1150
1100
1050
1000
950
900
1880
1900
1920
1940
1960
1980
2000
2020

Rationale for these being meaningful indicators

- Characterize river's ability to create new floodplains.
- Dynamic river processes (e.g., erosion, sediment deposition) revitalize riverine habitats and are beneficial to native flora and fauna.
- Cottonwood and willow forests naturally regenerate on freshly deposited floodplain surfaces, and salmon and other aquatic species benefit from fresh gravel inputs.

Assessment of Target Viability

Sacramento River

Double-click opens entry form

#	Conservation Targets	Category	Key Attribute	Indicator	Indicator Ratings: Poor (**Bold = Current**)	Fair (*Italics = Desired*)	Good	Very Good	Ratings Source	Indicator Measurements (latest measurement only): Date	Current Indicator Measurement	Current Rating	Trend	Source	Predicted Rating	Desired Rating	Date for Desired Rating
	terrestrial riparian habitat	Size	Community architecture	Area of geomorphic surfaces <10 years old	**< ____ acres**	____ - ____ acres	____ - ____ acres	> ____ acres	Onsite Research	Jun-07		Poor				Very Good	Jun-20
	aquatic riverine habitats	Landscape Context	Landscape pattern (mosaic) & structure	Number of bends with sinuosity greater than 2.0	**< 5 bends**	5 - 6 bends	6 -7 bends	> 7 bends	Onsite Research	Jun-07	4 bends	Poor	Mild Decrease	Intensive Assessment		Fair	Jun-20
			Successional dynamics	Area of floodplain reworked					Onsite Research								
			Successional dynamics	Channel bend meander migration rate					Onsite Research								
		Size	Community architecture	Average bend entrance angle					Onsite Research	Jun-07	39.5 degrees		Mild Decrease	Intensive Assessment			
			Community architecture	Average distance between inflection points					Onsite Research	Jun-07	1050 meters		Mild Increase	Intensive Assessment			
			Community architecture	Total river length	**< 156,000**	156,000-158,000 meters	158,000 - 160,000 meters	> 160,000 meters	Onsite Research	Jun-07	154,229 meters	Poor	Mild Decrease				
			Community architecture	Whole river sinuosity	**< 1.25**	1.25 - 1.26	1.26 - 1.30	> 1.30	Onsite Research	Jun-07	1.24	Poor	Mild Decrease	Intensive Assessment		Good