LOWER SAN DIEGO RIVER WATER QUALITY

ANNUAL WATER QUALITY MONITORING REPORT FOR WY26



Buildup of Water Primrose (Ludwiga peploides) stem/roots in channel following winter storm.
(Admiral Baker Field Monitoring Site #7, January, 2026)

A Compilation of WQM Data (October 2004 - September 2026)

John C. Kennedy, P.E.

PO Box 80126, San Diego, CA 92138 • telephone: 619 297 7380 • fax: 619 297 7385 • info@SanDiegoRiver.org

Lower San Diego River Water Quality 2005-2026

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Questions regarding the San Diego RiverWatch WQM database or technical interpretation of results expressed in this and similar LSDR WQ data monitoring reports provided on the SDRPF Online Information Center can be directed to the attention of John Kennedy, P.E. through contacting SDRPF at info@SanDiegoRiver.org or the current RiverWatch Coordinator.

Section 1 - Introduction

This report provides a summary of monthly values, seasonal patterns and annual trends in water quality monitoring data gathered and evaluated by SDRPF's RiverWatch citizen volunteers. WQM data collected monthly over the past 22 years at all monitoring sites within the Lower San Diego River (LSDR) watershed have been aggregated, in conjunction with hydrologic streamflow data to develop a numeric water quality index (WQI). Basic monthly data regarding individual water quality parameters and river hydrology for each of the sites monitored are maintained in an extensive database file maintained at the SDRPF offices; this annual report examines Water Year 2026 (WY26) data in comparison to previous year results and 22 yr averages henceforth in this report refered to as 'Means'. The 16 LSDR water quality monitoring site locations are shown on **Figure 1-1**.

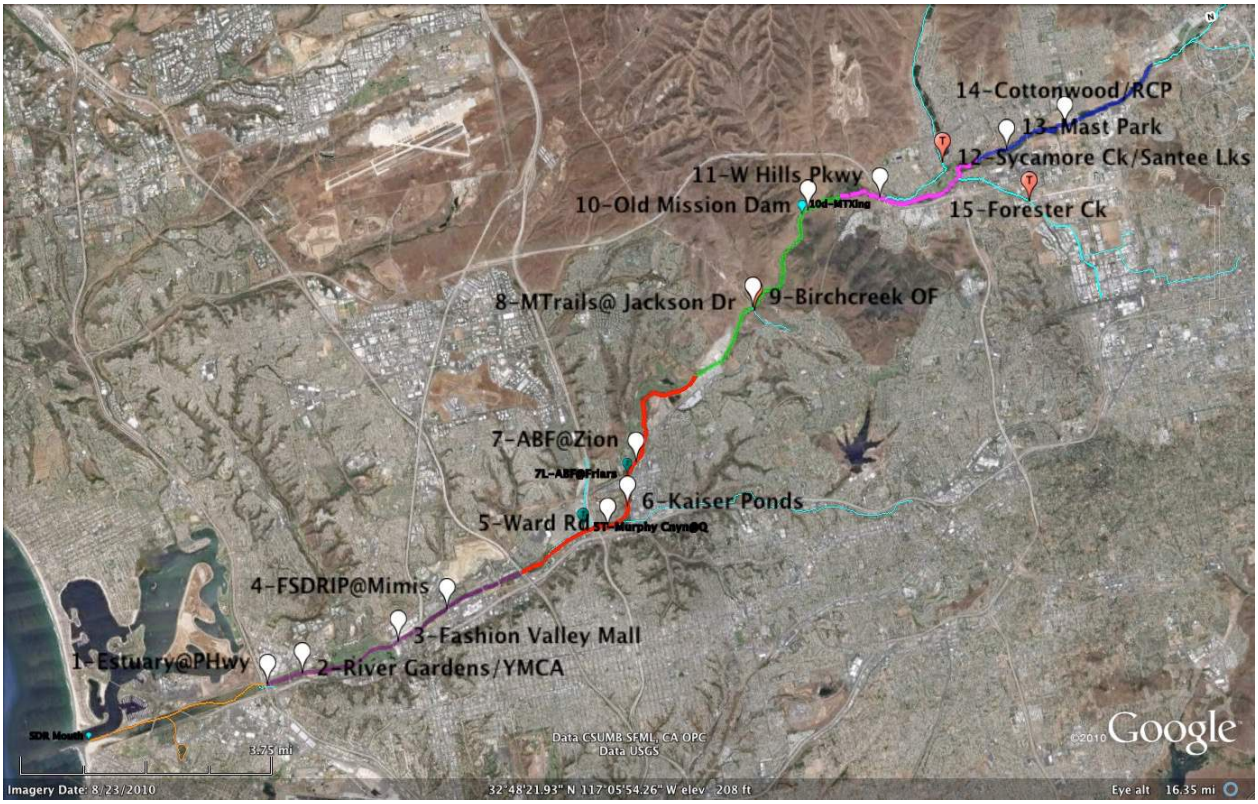


Figure 1-1 LSDR Watershed and Water Quality Monitoring Sites

Color Code for LSDR segments on Figure 1-1 above: Estuary (orange), Lower Mission Valley (purple), Upper Mission Valley (red), Mission Gorge (green), Lower Santee Basin (pink), Upper Santee Basin (dark blue), Lakeside to El Capitan Reservoir (light green) and principal tributaries (light blue)

The water quality sites on Figure 1-1 and monthly water quality data can be viewed in detail on the SDRPF RiverWatch Online Information Center webpage available at <www.sandiegoriver/river_watch.html>. The portal also contains: San Diego StreamTeam Bio-assessment data, 401 Project information and USGS real-time streamflow data regarding daily peak discharge and gauge height for two San Diego River gauging stations (Fashion Valley & Mast/W.Hills Pkwy Bridge near Santee). The data portal is updated as new information and reports become available.

The water quality index (WQI) represents a response to questions and concerns from SDRPF staff and the general public regarding overall health of the lower river system. The index is a numeric (0-100) where increasing values indicate better water quality. The numerical index incorporates basic physical, chemical and bacteriological data by integrating five parameters: water temperature (Temp), pH, specific conductance (SpC), dissolved oxygen (DO), percent saturation (%DOSat) and streamflow (ADF); through computation of weighted factors for each one. The resulting values are aggregated to arrive at an overall score for each monitoring site, river reach and section as well as the entire lower river watershed (LSDR). The range in index values, grades, color codes and general conventions utilized are presented in **Table 1.1.**

Table 1.1 LSDR Water Quality Index

WQI (0-100)	Grade	Color Code	Percentile Range	Water Quality Threshold	General
75 or >	A - Very Good	Dark Blue	25%	Well above acceptable WQ criteria	Healthy (>50)
50 - 74	B - Good	Light Blue	25%	Meets all acceptable WQ criteria	
38 - 49	C - Fair	Green	12.5%	Meets many (but not all) WQ criteria	Marginal (25-49)
25 - 37	D - Marginal	Yellow	12.5%	Meets few acceptable WQ criteria	
13 - 24	E - Poor	Brown	12.5%	Below minimum WQ criteria	Unhealthy (< 25)
0 - 12	F - Very Poor	Pink/ Rose	12.5%	Well below minimum WQ criteria	

Note: The WQI has been developed for inland fresh water quality metrics only and is not applicable to estuarine or ocean waters.

In general, sites with WQI values of 50 or above (blue zone) exceed expectations for acceptable water quality and are indicative of relatively 'healthy' conditions. Scores between 25 and 49 (yellow zone) describe 'impaired or ailing' quality where quantifiable evidence exists regarding failure to meet specific water quality criteria. Waters' with scores of less than 25 (red zone) do not meet minimum expectations and are considered 'unhealthy' and/or stressful to numerous aquatic life forms. For WQ parameters monitored by RiverWatch, the index expresses results relative to those levels necessary to sustain designated beneficial water uses for the LSDR (Hydrologic Area 907.1) based on California Water Quality Standards. Where criteria are non-specific, results are expressed relative to general freshwater objectives established for Southern California inland coastal areas. As such, the index does not apply to esturine or ocean waters. Fresh water is typically defined as having an overall salt content of less than one percent.

Index values were calculated using two formulas; one involving four metrics (Temp, SpC and DO) monitored by RiverWatch combined with streamflow (ADF); the second with two additional parameters (pH and total coliform counts). The equations used for both formulas (WQI_4 and WQI_6) are presented in Appendix F. Differences between the two calculations were found to be minor, however, the initial determination (WQI_4) provides a broader range in values than the second, as the 'normalizing' effects of pH and total coliform values (both of which present less spatial and temporal variance) are excluded. The broader range WQI_4 values are expressed in both the annual and monthly water quality reports. Although specifically developed for the Lower San Diego River, the index can also be applied to other coastal and inland watercourses where the same metrics (i.e., DO, SpC, water temperature and streamflow) are monitored and available on a consistent basis. A technical report comparing relative water quality in three San Diego County watercourses; Los Penasquitos Creek below Poway, Santa Margarita River below Temecula/near Fallbrook, and Lower San Diego River near Santee and in Mission Valley, prepared through the RiverWatch program in 2015, is on file at SDRPF offices.

Section 2 - Spatial Analysis of WY26 Water Quality Metrics

Monthly water quality data monitored at each site by RiverWatch WQM Team volunteers are used to determine averages, seasonal patterns and trends as presented in this annual report and its appendices. Supporting USGS streamflow data are also included in the analyses. The annual average water quality values for each of the monitoring sites for WY26 and 'means' i.e., average values taken over the past 22 years of monthly monitoring, are presented in **Table 2.1**. WY26 values (bold type) equal to or greater than means for each site (in italics) are shown in black, whereas values below the means are in red. This year's overall LSDR averages (of all 16 sites) for each metric are displayed in bottom two rows of the table.

Table 2.1 Average Annual WQ Metrics for WY26 and 22yr Means by Site, Reach and Section

WQM Site	*LSDR Reach/Sect.*		Temp, oC	SpC, mS/cm	pH	Dissolved Oxygen, mg/L (%Sat)	ADF, cfs	WQI, (Diff) & Grade[a]	
1	LMV	West	**20.7**/*19.7*	**2.65**/*2.71*	**7.60**/*7.74*	**6.47**/*6.19* **(72)**/*(68)*	**24**/*30*	**39**/*37* (+2)	**C**/*D+*
2			**20.5**/*19.1*	**2.59**/*2.65*	**7.50**/*7.66*	**5.14**/*4.63* **(57)**/*(49)*		**34**/*32* (+2)	**D**/*D*
3			**20.5**/*19.2*	**2.47**/*2.53*	**7.56**/*7.74*	**3.72**/*4.53* **(40)**/*(48)*		**25**/*31* (-6)	**D**/*D*
4	MMV		**20.9**/*19.6*	**2.37**/*2.44*	**7.67**/*7.77*	**5.73**/*5.98* **(64)**/(64)		**38**/*39* (-1)	**C**/*C*
5			**18.3**/*17.3*	**2.49**/*2.57*	**7.48**/*7.62*	**4.70**/*4.87* **(50)**/*(50)*	**23**/*28*	**31**/*33* (-2)	**D**/*D*
6	UMV		**19.4**/*18.3*	**2.46**/*2.55*	**7.44**/*7.59*	**2.86**/*3.49* **(30)**/*(36)*		19/*24* (-5)	E+/*E+*
7			**19.0**/*18.1*	**2.03**/*2.39*	**7.30**/*7.56*	**4.41**/*5.11* **(46)**/*(53)*		**30**/*34* (-4)	**D**/*D*
8	MG	Mid	**18.1**/*17.1*	**2.04**/*2.25*	**7.83**/*7.72*	**7.09**/*7.28* **(73)**/*(74)*	**17**/*23*	**49**/*48* (+1)	C+/*C+*
9T[b]			**16.0**/*15.6*	**4.22**/*4.59*	**8.17**/*7.95*	**9.90**/*9.35* **(101)**/*(94)*	*<1*	**39**/*34* (+5)	D/*D*
10			**18.3**/*17.5*	**2.06**/*2.19*	**7.74**/*7.90*	**5.52**/*6.77* **(57)**/*(70)*	**12**/*18*	**38**/*43* (-5)	**C-**/*C*
11	LSB	East	**17.8**/*16.7*	**2.12**/*2.19*	**7.64**/*7.59*	**5.50**/*6.10* **(56)**/*(60)*		**36**/*38* (-2)	**C**/*C-*
12T[b]			**14.5**/*17.1*	**1.51**/*1.59*	**7.58**/*7.90*	**6.27**/*7.07* **(62)**/*(72)*		**35**/*37* (-2)	**C**/*D+*
15T[b]			**18.5**/*17.8*	**2.45**/*2.63*	**7.86**/*8.00*	**5.95**/*7.13* **(63)**/*(70)*	**5**/*10*	**36**/*39* (-3)	**C-**/*C-*
13W[c]	USB		**16.8**/16.0	**1.78**/*1.79*	**7.44**/*7.56*	**3.67**/*3.70* **(38)**/*(37)*	**4**/*7*	**21**/*23* (-2)	**E**/*E+*
13E			**18.8**/*18.2*	**1.71**/*1.85*	**7.48**/*7.61*	**1.40**/*2.61* **(15)**/*(27)*		**9**/*15* (-6)	**F**/*E*
14			**20.8**/*18.1*	**1.51**/*1.50*	**7.83**/*7.84*	**4.20**/*3.76* **(47)**/*(39)*		**25**/*22* (+3)	**C**/*E*
all	LSDR Avg.		**18.9**/*18.0*	**2.14**/*2.25*	**7.56**/*7.70*	**4.76**/*5.28* **(50)**/*(54)*	**15**/*21*	**30**/*33* (-3)	**C**/*D*
1-16	**Rwt Avg[d]**		**18.9**/*17.9*	**2.13**/*2.25*	**7.61**/*7.72*	**4.90**/*5.40* **(52)**/*(55)*	**16**/*21*	**31**/*33* (-2)	**C**/*D*

a) *Average annual water quality index values, change (+/-) and resultant WQ letter grade for WY26 (bold) and 22yr means (in italics); WY26 values less than site means are in red; values greater than 22yr means are in black.*
b) Lower San Diego River water quality monitoring sites located on tributary (T) streams (3); all others (13) are main channel.
c) Mast Park West site (below Carlton Hill Blvd. bridge) was added in WY21 so the means are less statistically sound.
d) Reach-weighted (Rwt) WQI values are calculated based on the span of each site relative to total length of the lower river.
e) DO>7.0 mg/L values shown in blue cells; DO<5 mg/L values are shown in tan cells.

All 16 monitoring sites present average annual WQI values for WY26 very near the 22-yr means. Average WY26 water temperatures were slightly above means at all but one site (#12T); resulting in an overall increase of 1.0 oC from the 22 yr average of 17.9 oC. Specific Conductance values for WY26 were below the means at all monitoring sites but one (#14). The overall SpC (LSDR average) for WY26 is 5% below the weighted mean of 2.25 mS/cm. DO values are below the means for 12 of 16 sites in WY26. Overall this year's average DO value of 4.90 mg/L (52%Sat) is 9% below the weighted mean of 5.40 mg/L (55%Sat). FY26 pH values are lower than means at 13 out of 16 sites. Average daily streamflows (ADF) for WY26 (bold red type) are below the 22-yr average daily means in all reaches. WQI values are above means at 5 sites and below at 11 this year, resulting in a three point differential in the overall LSDR index.

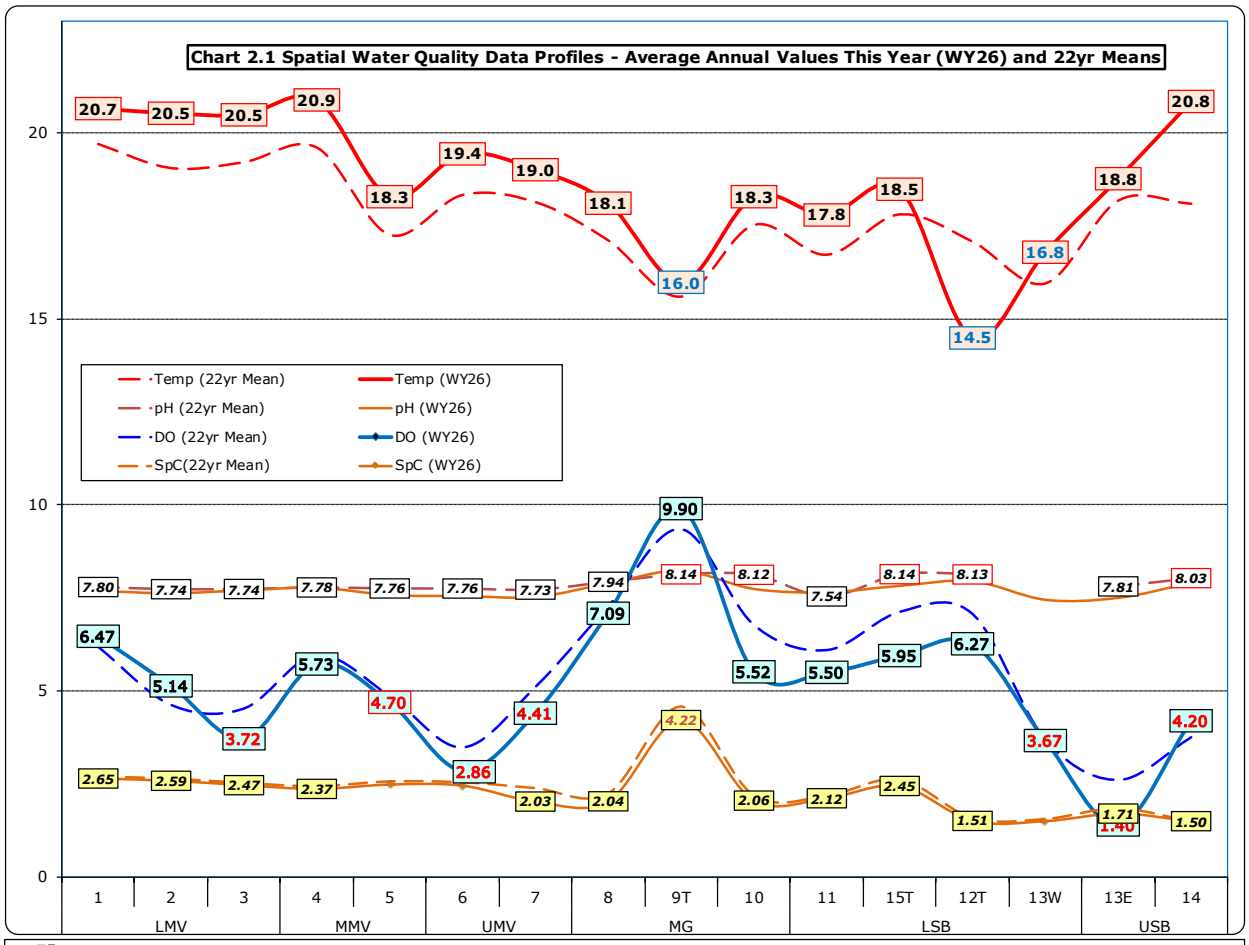
Average annual and monthly min.-max. range water quality metrics for WY26 and 22-yr means are expressed for the overall river (LSDR) and by each reach/section in **Table 2.2.** Average annual water temperatures are slightly above means in all reaches while Specific Conductance (SpC) for all reaches were below means throughout the year. WY26 pH values were below means in all but the Mission Gorge reach. DO values in all five reaches were above the 22-yr means. Streamflow (ADF) were below means in all reaches and sections throughout WY26. The only improvement in water quality metrics monitored within the lower river watershed in WY26 occurred in the Lower Mission Valley (Sites 1-3) reach.

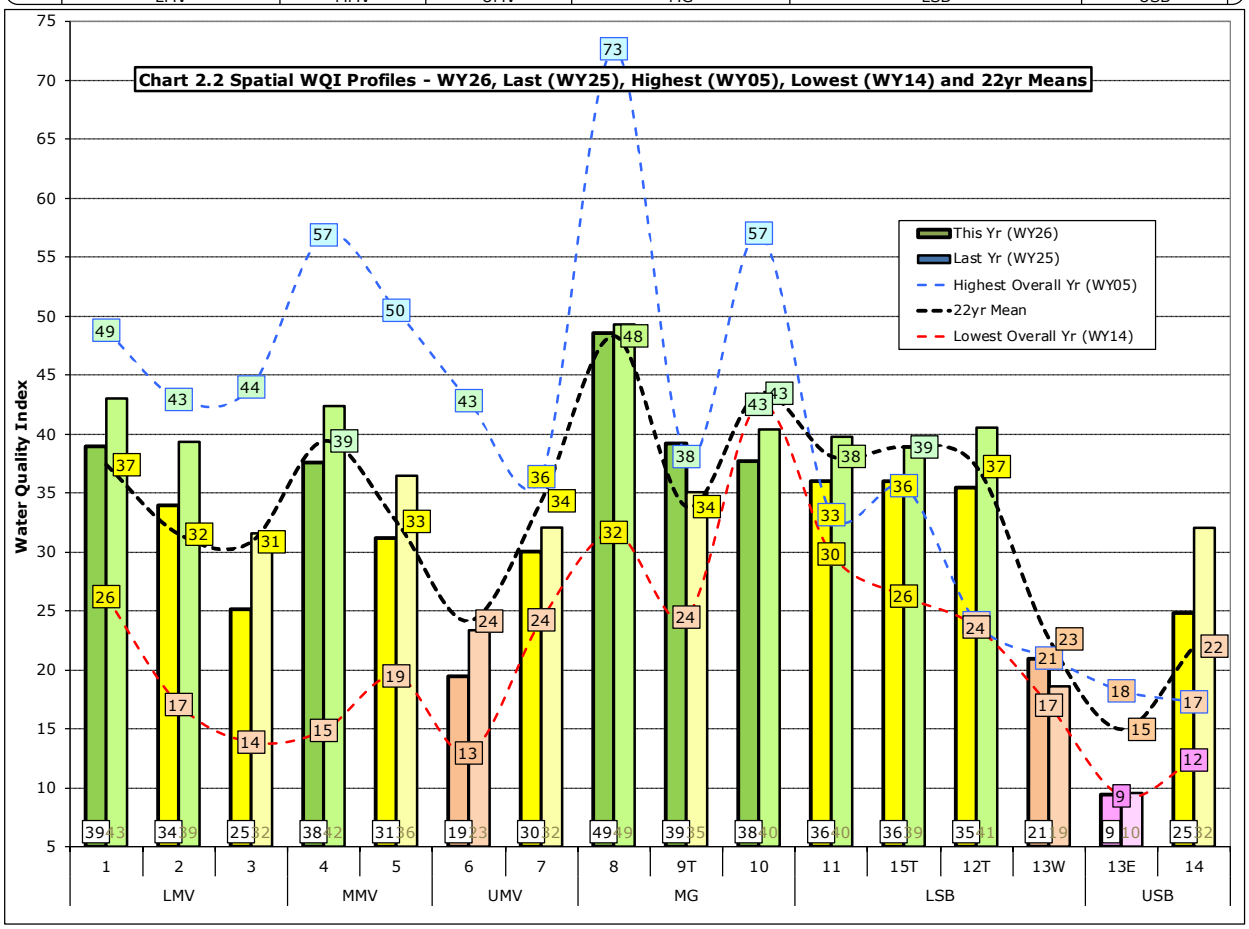
Table 2.2 Water Quality Metrics for WY26 and 22-yr Means by Range, Reach and Section

Parameter, units		Temp, oC	SpC, mS/cm	pH	Dissolved Oxygen, mg/L (%Sat)	ADF, cfs	WQI, (Difference) and Grade [a]	
Fall (O,N)		**16.4**/*16.7*	**2.70**/*2.86*	**7.60**/*7.69*	4.49/*4.82* **(45**/*(49)*	**11**/*5.3*	**29**/*27* (+2)	**D**/D
Winter (D,J,F,M)		**14.7**/*13.4*	**1.56**/*1.69*	**7.65**/*7.76*	**6.69**/*7.36* **(66**/*(70)*	**38**/47	**46**/*48* (-2)	**C**/C+
Annual Wt Avg.		**18.9**/*17.9*	**1.73**/*2.26*	**7.61**/*7.72*	**4.90**/*5.40* **(52**/(55)	**16**/*21*	**30**/33 (-3)	**D**/*D*
Summer (J,J,A,S)		**23.6**/*22.5*	**2.29**/*2.74*	**7.54**/*7.75*	**4.83**/*5.49* **(54**/*(59)*	**1.3**/2.6	**16**/*19* (-3)	**E**/*E*
Spring (A,M)		**20.4**/*19.0*	**1.00**/*1.52*	**7.71**/*7.69*	**2.94**/*3.69* **(35**/*(42)*	**5.1**/19	**33**/*38* (-5)	**D**/C-
LSDR Individual Reach Averages:								
USB	East	**19.5**/*18.2*	**1.25**/*1.74*	**7.65**/*7.72*	2.34/*3.00* **(25**/*(31)*	**5.1**/*7.2*	**17**/*18* (-1)	**E**/*E*
LSB		**17.8**/*17.3*	**1.75**/*2.22*	**7.54**/*7.73*	5.60/*6.44* **(58**/*(64)*	**12**/*17*	**36**/*38* (-2)	**C-**/C-
MG	Mid	**17.8**/*17.0*	**1.55**/*2.23*	**7.86**/7.80	**7.02**/*7.44* **(72**/*(76)*	**9.7**/*20*	**43**/*46* (-3)	**C**/C
UMV	West	**18.9**/*17.9*	**1.95**/*2.51*	**7.40**/*7.59*	**3.99**/*4.49* **(42**/*(46)*	**23**/*29*	**25**/*29* (-4)	D/*D*
LMV		**20.6**/*19.4*	**2.17**/*2.57*	**7.58**/*7.73*	4.86/*5.04* **(54**/*(54)*	**24**/*30*	**36**/35(+1)	**C-**/*D*

a) *Average annual water quality index value, difference (+/-) from 22-yr means and resultant WQI letter grades. Current values (bold-face type) and grades below means (shown in italics) are expressed in red; values and grades above means are in black.*
b) DO>7.0 mg/L shown in light blue cells; DO<5 mg/L shown in tan cells.

The numeric water quality values provided in Tables 2.1 and 2.2 for the LSDR system monitoring sites are presented graphically on **Charts 2.1** (Water Quality Data Profiles) and **2.2** (Water Quality Index and LSDR Streamflow Profile) on the next page.


Chart 2.1 Spatial Water Quality Data Profiles - Average Annual Values This Year (WY26) and 22yr Means
Temp (22yr Mean)
Temp (WY26)
pH (22yr Mean)
pH (WY26)
DO (22yr Mean)
DO (WY26)
SpC(22yr Mean)
SpC (WY26)
1 2 3 4 5 6 7 8 9T 10 11 15T 12T 13W 13E 14
LMV MMV UMV MG LSB USB


Chart 2.2 Spatial WQI Profiles - WY26, Last (WY25), Highest (WY05), Lowest (WY14) and 22yr Means
Water Quality Index
This Yr (WY26)
Last Yr (WY25)
Highest Overall Yr (WY05)
22yr Mean
Lowest Overall Yr (WY14)
1 2 3 4 5 6 7 8 9T 10 11 15T 12T 13W 13E 14
LMV MMV UMV MG LSB USB

Average annual water quality values for WY26 compared to 22yr means for water temperature, pH, DO and SpC at each monitoring site, river reach and section in order of their location upstream are presented on **Chart 2.1**. This year's results are shown as heavy solid lines with values listed in bold type; the dashed lines are 22yr annual averages (means) for each site. With exception of Site 12T, lowest water temperature values on the main channel are typically monitored in the mid-portion (MG section). Average annual DO values at seven sites; 4 in the west (#3,5,6&7) and 3 in the east (#13W/E&14), are below the depletion threshold of 5 mg/L. Monitored DO and DO%Sat results present the greatest variation between sites. Lowest values are typically recorded in the Upper Santee Basin and Upper Mission Valley reaches whereas highest values are observed in the Mission Gorge section (#8,9&10). Excluding tributary sites, average annual SpC values generally increase along the mainstem of the river from the upper reach (#14) downstream to the estuary (#1); similar to mainstream water temperatures. SpC averages for WY26 (solid blue line) are also similar to 22yr means (dashed line) at all sites. In terms of spacial variance pH values vary the least while DO values present the greatest range between sites both this year (WY26) and over the past 22 years.

The spacial WQI results, an aggregate or composite index of water quality monitoring metrics for this year and last (both shown as bars), as well the 22yr means, overall best (WY05) and poorest (WY14) year values (shown as dashed lines) are presented in **Chart 2.2**. This year (WY26) and last (WY25) WQI values (shown as bars) together with the 22yr means and high/low values, show that the three monitoring sites furthest upstream; Mast Park (#13E/W) and Magnolia Ave (#14) experience the poorest water quality followed by Kaiser Ponds site (#6) in Upper Mission Valley. On an average annual basis, highest WQI values continue to be associated with the Mission Gorge sites (#8,9&10). The overall WQI profile for WY26 (bold values) are less than last year's results at all but two sites (#9T&13W) and typically close to the 22-yr means (heavy black dashed line). In general WY26 water quality index values throughout the river system are slightly down from last year's (WY25) results to similar levels as the 22yr means. As found in the past, significantly below normal streamflows escalates greater degregation of the watercourse resulting in lower overall water quality primarily due to depleted DO levels. WY26 experienced below normal dry weather flows as well as average annual streamflow and elevated water temperatures which resulted in an overall decline in the river water quality index. Greater water temperatures and specific conductance values, monitored throughout the water year, when combined with lower DO levels found at nearly all sites, resulted in lower overall water quality index values.

Water quality data monitored in WY26 are further analysied over time (on a monthly and seasonal basis) in Section 3 of this report.

Section 3 - Temporal Analysis of LSDR WY26 Data

Monthly, seasonal and annual water quality monitoring metrics data and index results for the Lower San Diego River are presented in **Table 3.1** for this year (WY26) with comparison to 22yr means (shown italicized). WY26 values that are above the means are listed in black; values below in red. Temporal water quality values in WY26 vary little from means on an annual basis with the exception of streamflow where this year's values are below norms for all but two months (Mar. & Aug.) of the water year. The resultant annual average WQI for WY26 is one point (9%) above the 22yr mean of 33 and three points lower (-%) than last year's (WY24) overall value of 40.

Monthly and seasonal variances in water quality monitoring metrics for the past water year (WY26), displayed as bars, compared to WY25 dataand the 22yr means, shown as lines, are expressed in **Chart 3.1**. The numeric values presented in the chart are taken from columns 1-4 of Table 3.1. Dissolved oxygen values are highest during the winter months (Dec-March) whereas specific conductivity and water temperatures are greatest during the summer months (June-Sept.) extending into Oct. The pH values show very little overall temporal variation. However, the broad range in DO, SpC and water temperature metrics, as monitored at nearly all sites throughout the year when considered collectively, provide strong indication of the significant variance in overall water quality. Temporal variance between this year's data, (bars), last year's results (solid lines) and the 22yr means (dashed lines) show similar patterns. The temporal variance in WY26 data match more closely temporal patterns in the 22yr means, than do the WY25 values. This year's temporal water quality values are the result of normalized occurrences similar to last year and the 22 yr means.

Chart 3.2 provides a graphic of temporal variance in both streamflow and WQI values throughout WY26 compared to monthly averages for the previous water year (WY25) and the 22 yr mean. As shown in the chart, WQI values for WY26 (bars), also listed in Table 3.1 (far right column), are fairly close to 22yr means (dashed lines) for most months of the year. The positive correlation between streamflow (both wet weather and dry) and monthly water quality is also evident. Low DO levels throughout the summer and fall months, combined with below normal dry-weather flows, constitute the primary drivers in index values. In general, water quality for the Lower San Diego River watershed is highest (i.e., Good to Fair grades) when flows are greatest during the Winter months (Dec-March) and poorest (Poor to Very Poor) in Summer (June-Sept) when streamflow and DO values are lowest and water temperatures highest. The overall annual average WQI for the LSDR in WY26 of 31 (D Marginal) is three points below the overall 22yr average index value of 33 and points below the WY24 index of .

The temporal patterns in river water quality data, as expressed in this section of the report, are quite evident in context of monthly and seasonal values. The next section of this report examines the same temporal variances in river water quality data extending over the entire 22 year period based on computed 12-mo running average values. Examining the temporal patterns in running averages provides a sound basis of reviewing the trends in the water quality data over the past two decades.

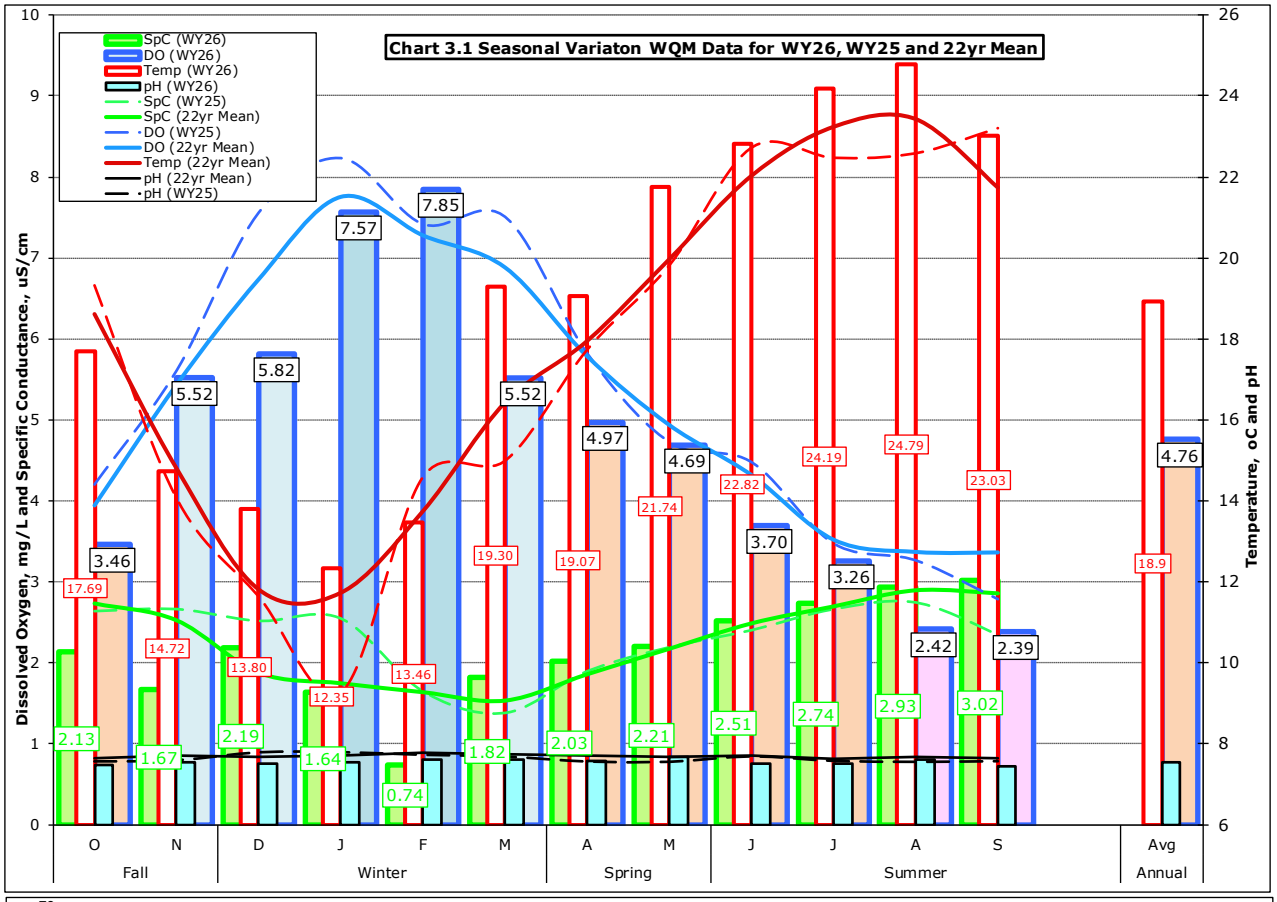
Table 3.1 LSDR WQM Metrics for WY26 and 22yr Means by Month and Season

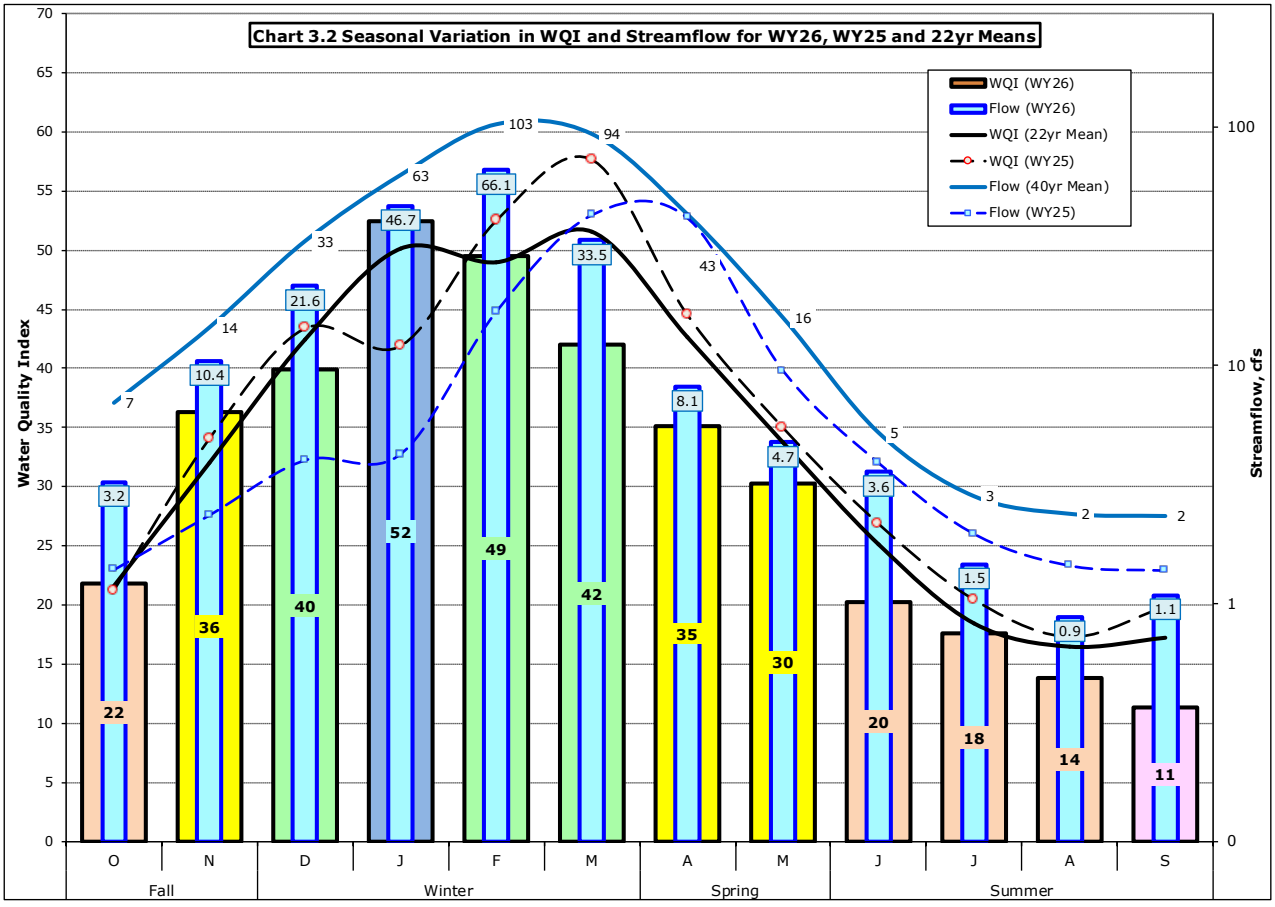
Month	Season:	Temp, oC	Sp Cond, mS/cm	pH	Dissolved Oxygen, mg/L	(%Sat)	ADF, cfs	WQI Value [a] and Grade	
Oct	Fall	17.6/*18.6*	2.14/*2.74*	7.57/*7.66*	3.51/*4.02*	37/*42*	**4**/*2*	**23**/*22*	**E+**/*E*
Nov		14.7/*14.8*	1.67/*2.53*	7.63/*7.72*	**5.79**/*5.61*	**57**/*55*	**18**/*8*	**37**/*32*	**D+**/*D*
Dec	Winter	**13.8**/*11.8*	2.19/*1.88*	**7.78**/7.73	6.05/*6.95*	59/*64*	15/*24*	38/*42*	**C-**/*C*
Jan		**12.3**/*11.7*	1.63/*1.75*	7.66/7.74	7.71/8.00	**73**/*73*	**81**/*55*	**52**/*49*	**B-**/C+
Feb		12.4/*13.8*	0.74/*1.64*	7.69/7.81	**8.09** /*7.44*	**78**/*71*	36/*55*	**51**/*49*	**B-**/*C+*
Mar		**19.3**/*16.4*	**1.81**/*1.53*	7.68/7.78	5.68/*7.05*	62/*71*	19/*52*	41/*51*	**C**/*B-*
Apr	Spring	**19.1**/*18.0*	**2.02**/*1.86*	7.67/7.76	5.14/*5.93*	56/*63*	6/*28*	35/*42*	**D**/*C*
May		**21.7**/*20.0*	**2.21**/*2.17*	**7.74**/7.74	4.81/ *5.05*	55/*55*	5/*10*	30/*34*	**D**/*D*
June	Summer	**22.8**/*22.0*	**2.51**/*2.48*	7.56/*7.76*	3.77/*4.36*	44/*50*	2/*5*	21/*26*	**E**/*D-*
July		**24.2**/*23.2*	**2.73**/*2.69*	7.54/*7.66*	3.36/*3.57*	40/*41*	1/*2*	16/*18*	**E**/*E*
Aug		**24.6**/*23.3*	**2.92**/*2.89*	7.59/*7.69*	2.52/*3.43*	31/*40*	1/*1*	11/*16*	**F+**/*E*
Sept		**22.9**/*21.7*	**3.01**/*2.85*	7.46/*7.66*	2.39/*3.40*	28/*38*	1/*2*	10/*17*	**F**/*E*
Fall (O&N)		16.1/*16.7*	1.91/*2.63*	7.60/*7.69*	4.49/*4.82*	45/*49*	**6**/*5*	**30**/*27*	**D**/*D-*
Winter (D,J,F,M)		**14.7**/*13.4*	1.59/*1.70*	7.65/*7.76*	6.69/*7.36*	66/*70*	24/*47*	46/*48*	**C**/*C+*
Spring (A&M)		**20.4**/*19.0*	**2.12**/*2.01*	7.71/*7.75*	4.83/*5.49*	54/*59*	5/*19*	32/*38*	**D**/*C-*
Summer (J,J,A,S)		**23.6**/*22.5*	**2.79**/*2.73*	7.54/*7.69*	2.94/*3.69*	35/*42*	1.4/*2.6*	15/*19*	**E**/*E*
Annual (O-S)		**18.9**/*17.9*	2.13/*2.25*	7.61/*7.72*	4.90/*5.40*	52/*55*	16/*21*	31/*33*	**D**/*D*

a) WQ index values based on RiverWatch physical-chemical metrics together with USGS streamflow data for East (West Hills Pkwy) and West sections (Fashion Valley). WY26 values/grades (in bold type) above 22-yr monthly means (in italics) are shown in black; values equal to or below means are in red.

b) DO>7.0 mg/L (65%Sat) are shown in light blue cells; DO<5.0 mg/L (55% Sat) are shown in tan cells.

c) WQI grade color coding as shown in Table 1.1: A Very Good (dark blue), B Good (light blue), C Fair (green), D Marginal (yellow), E Poor(brown), and F Very Poor (pink).


Chart 3.1 Seasonal Variaton WQM Data for WY26, WY25 and 22yr Mean
SpC (WY26)
DO (WY26)
Temp (WY26)
pH (WY26)
SpC (WY25)
SpC (22yr Mean)
DO (WY25)
DO (22yr Mean)
Temp (22yr Mean)
pH (22yr Mean)
pH (WY25)
Dissolved Oxygen, mg/L and Specific Conductance., uS/cm
Temperature, oC and pH
O N D J F M A M J J A S Avg
Fall Winter Spring Summer Annual


Chart 3.2 Seasonal Variation in WQI and Streamflow for WY26, WY25 and 22yr Means
WQI (WY26)
Flow (WY26)
WQI (22yr Mean)
WQI (WY25)
Flow (40yr Mean)
Flow (WY25)
Water Quality Index
Streamflow, cfs
O N D J F M A M J J A S
Fall Winter Spring Summer

Section 4 - LSDR Running Average Water Quality Metrics (WY05-WY26)

Variances in SDRPF monitored water quality metrics for the LSDR, based on data collected by RiverWatch from Sept.'04 through Sept. of 2026, are provided in this chapter. The metrics include water temperature, specific conductance, pH, dissolved oxygen, streamflow and the water quality index. Twelve month running average values considered with overall best-fit trendline equations represent a rational expression of relative change in values over the past 22 years of continous monthly monitoring.

Table 4.1 presents 12-month running average values for each of the key water quality metrics monitored by RiverWatch. Running averages above Means are listed in black; values below in red. 22yr means for each metric are expressed in italics in the bottom row of the table. The running average water temperature for WY26 of 18.9 oC is one degree (6%) above the 22yr average. The WY26 SpC average of 2.13 mS/cm is 5% below mean. Running average pH for this year is down slightly (1%) from last year. The average DO level for WY26 is down from last year to 9% below the 22yr Mean. Running average daily flow this year is also well below (26%) the Mean. The resultant average LSDR WQI for this year is down four points from last year to three points below the 22yr Mean of 33. A more definative view of the changes over the past 22 years in LSDR running averages, their range and trendlines for each metric by site and reach is expressed in subsequent charts (4.1-4.7) of this section.

Monthly **Water Temperatures**, running averages and trends are shown on **Chart 4.1**. Temperatures are cyclic with warmest temps occuring in Aug. and coolest in Dec. Summertime maximum water temps. are 150% greater than the average annual (mean) of 17.9 oC, while the winter lows reach 50% below the 22yr Mean. Variances in running average water temperature over the past 22 years fall within the range of 3% above to 3% below the Mean. Monthly variation in max. (red), min. (blue) and average (black) water temperatures for LSDR are both large and cyclic; the 12-month running average values show minimal variation. A very slight warming trend in running average water temperatures seems to have occured over the monitoring period. As shown on the chart, maxium temperature values monitored at all sites seeem to have increased slighlty (<1 oC), while minimums have remained near constant. A small but descernable increase in average LSDR water temperatures to slightly above the normative value is evident based the monthly data.

Variation in monitored **Specific Conductance** (SpC) values for the LSDR are presented in **Chart 4.2**. Min. (blue) and max. (red) running averages for all sites monitored have varied measurably over the 22 yr period, however, the overall LSDR running average ranged from a low 1.73 mS/cm range (23% below norm) in WY23 to 2.77 mS/cm (22% above) in WY18. The overall trend in maximum SpC for all sections of the river has shown some decline over the past decade of monitoring. The general rate of decline in minimums for all sites (blue) has has been less, however, the resultant overall average values (black line) have shown a slight decrease. The river's SpC values increase during periods of extended drought and decline when average streamflows rise. High specific conductance levels are primarily the result of extended below average dry wearther streamflow that become intensified during drought conditions. Low streamflow also effects river water temperatures; where in gerneral, less flow results in higher water temperatures under equivalent ambient air temperature and sunlight levels resulting in less flushing.

Variance in monthly **pH** values are presented in **Chart 4.3**. The overall or general trend in values monitored for the LSDR has been relatively consistant over the 22 years (WY05-WY26). The initial years (WY05-WY09) of below average pH are due, at least in part, to faulty equipment as monthly minima and maxima values (since WY10) are higher on a consistant basis. Excluding the initial year's, there has been but small variance (<3%) in the overall running average pH from the 22yr mean of 7.72. The overall trend in pH for the river seems to be slightly upward. Values have increased by an average of about 0.3% per annum since RiverWatch monitorins began, primarily as recorded minima have risen. It is concluded that the lower river system may be very gradually becoming slightly more alkiline (basic).

Table 4.1 - LSDR 12-mo Running Average WQM Metrics (WY05-WY26)

Water Year	Temp, *oC*	SpC, *mS/cm*	pH, *unit*	Dissolv. Oxygen, *mg/L*	(*%ofSat*)	ADF, *cfs*	WQI [a] Values, Grade & *(Diff.)*
WY05	17.8	2.06	7.62	6.84	(65%)	58	41 C Fair *(+8)*
WY06	18.3	2.14	7.39	6.04	(59%)	13	37 D+ Marginal *(+4)*
WY07	17.6	2.34	7.52	5.95	(60%)	8.6	37 D+ Marginal *(+4)*
WY08	17.6	2.22	7.90	6.20	(62%)	17	37 D+ Marginal *(+4)*
WY09	17.7	2.39	7.64	6.20	(63%)	20	35 D+ Marginal *(+2)*
WY10	18.0	2.28	7.86	5.35	(56%)	28	33 D Marginal *(0)*
WY11	17.8	2.17	7.88	5.76	(50%)	26	38 C- Fair *(+5)*
WY12	18.0	2.33	7.68	5.41	(56%)	13	34 D Marginal *(+1)*
WY13	17.3	2.43	7.78	5.51	(56%)	8.3	33 D Marginal *(0)*
WY14	17.8	2.50	7.66	3.95	(41%)	4.9	22 E Poor *(-11)*
WY15	18.0	2.18	7.78	4.62	(49%)	9.6	28 D Marginal *(-5)*
WY16	18.2	2.26	7.75	4.82	(50%)	14	27 D Marginal *(-6)*
WY17	18.5	2.14	7.79	5.19	(55%)	45	32 D Marginal *(-1)*
WY18	18.1	2.77	7.90	4.42	(46%)	5.4	24 E+ Poor *(-8)*
WY19	17.7	2.16	7.69	5.11	(53%)	24	32 D Marginal *(-1)*
WY20	18.3	2.15	7.82	5.52	(58%)	31	35 D Marginal *(+2)*
WY21	17.2	2.44	7.88	5.37	(54%)	8.2	32 D Marginal *(-1)*
WY22	18.1	2.31	7.66	4.73	(49%)	9.7	30 D Marginal *(-3)*
WY23	17.1	2.01	7.68	5.48	(56%)	49	35 D Marginal *(+2)*
WY24	18.1	1.73	7.75	5.88	(61%)	34.0	41 C Fair *(+8)*
WY25	17.7	2.34	7.70	5.56	(57%)	11	34 D Marginal (+1)
WY26	**18.9**	**2.13**	**7.61**	**4.90**	**(52%)**	**16**	**31 D Marginal (-2)**
22yr Mean	*17.9*	*2.25*	*7.72*	*5.40*	*(55%)*	*21*	*33 (D Marginal)*

a) Values based on SDRPF RiverWatch phys-chem monitoring results combined with USGS streamflow records for eastern (West Hills Pkwy) and western (Fashion Valley) gauging stations.Water year values/grades below 22yr Means (in italics) are in red; those equal to or above norms in black.WY26 values are shown in bold type.

b) LSDR DO<5 mg/L are in light brown cells; years with Poor WQIs (>25) are in pink while those in green are Fair (>38).

The most common cause of higher pH water is less available carbon dioxide caused by elevated rates of aerobic resperation (decomposition) that typically accompany warmer, still waters. Tracking the trend in pH can be a general indicator of the natural process of eutrophication occuring throughout many portions of the lower river. WY26 marks a small decline in the overall running average pH from the 22yr mean duing a year of below average streamflow and elevated eutrophication levels. The variation in pH shows

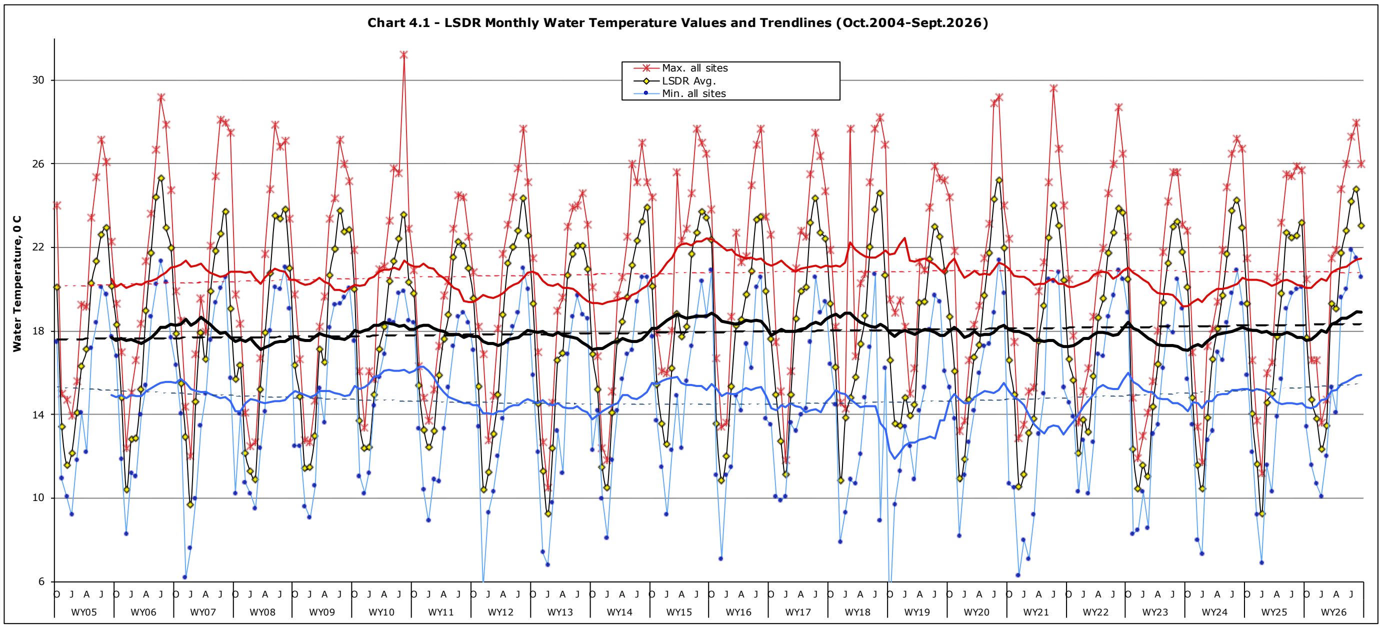
a cyclic pattern with little discernable decadel trends, irrespective of individual sites, reaches or sections of the river. Both surface and ground waters of the lower river system act as a natural buffer to larger fluctuations in pH at individual monitoring sites.

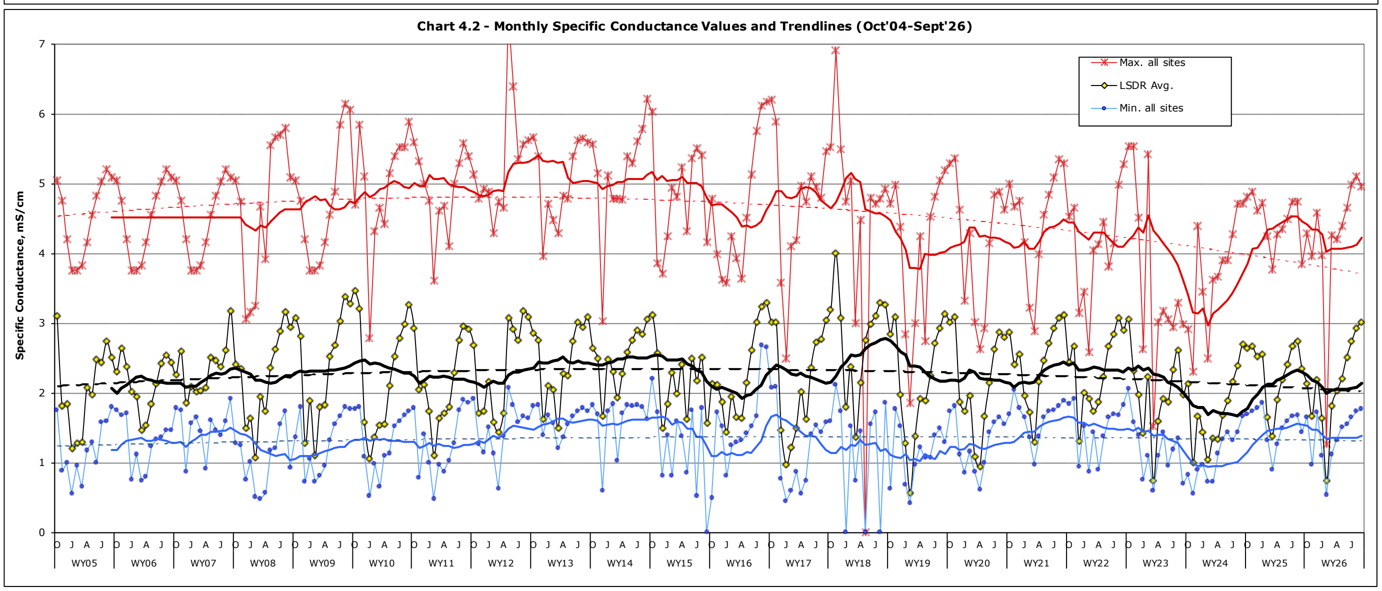
Running average **dissolved oxygen** (DO) values and monthly minima-maxima are presented in **Chart 4.4**. A general irregular decline in average DO as well as min/max values from Oct.'04 through 2015 is evident. LSDR max. monthly values from WY15 through WY21 increased to near the 22 yr mean. The current running average DO value of 4.90 mg/L is well below the mean of 5.40 mg/L. Low oxygen levels that have been monitored throughout various reaches and segments of the river result from low flow, especially during the dry-weather months, combined with elevated water temperatures and the subsequent decomposition of oxygen demanding organic matter. With a lack of significant flushing action during recent relatively mild stormflow events from 2013 through 2019, a large amount of decomposing biomass accrued within slow moving portions of the lower river system. Overall running average DO values typically increase subsequent to one or more major stormflow events resulting in significant channel flushing, displacement of organic-rich sediments and reduction of poorly-rooted and free-floating invasive aquatic plants*. The trend in overall LSDR DO values has, over the past 22 yrs, declined by nearly 2 mg/L from roughly 6.8 to 4.9 mg/L. As can also be seen on Chart 4.4, the rate of decline in minimum values is considerably greater than the rate of decline in maxima (3.0% vs 0.5%/yr). Extended periods of low-flow minima at many sites have resulted in lower overall average DO levels. DO averages have declined over the past year due to less streamflow resulting from lower annual rainfall.

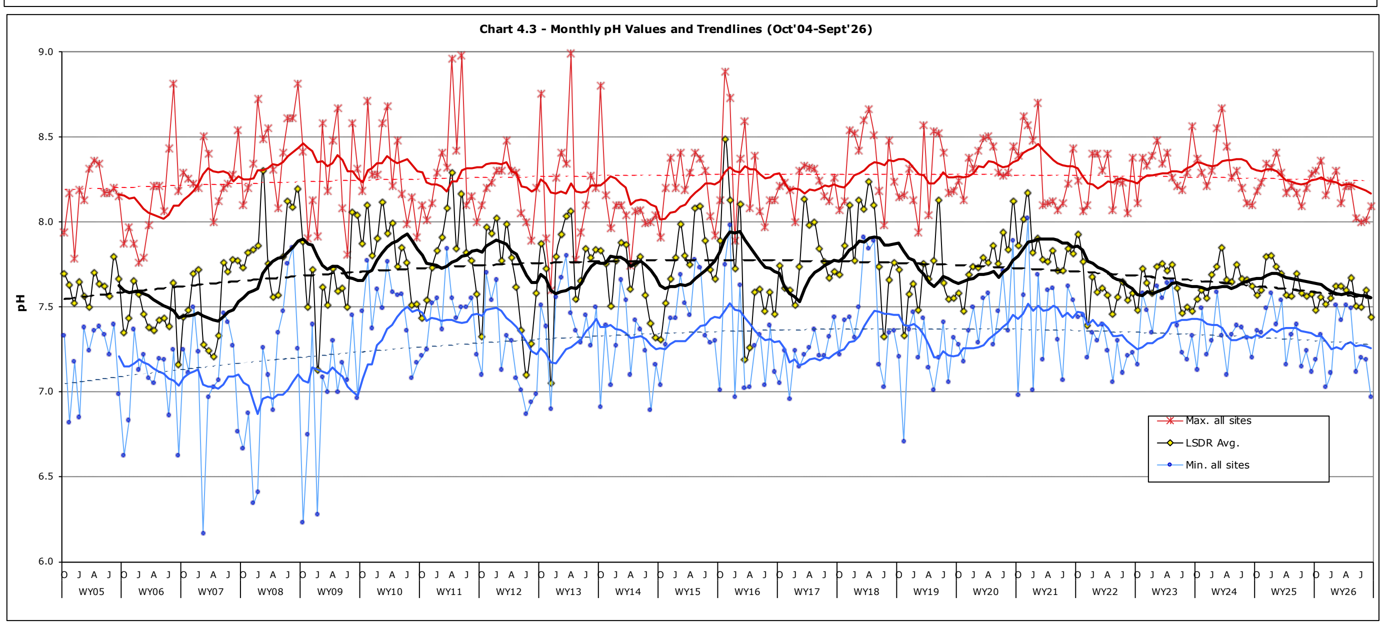
Variances and their trends for total monthly **rainfall** and running average **streamflow** for the Santee Basin (SB) and Mission Valley (MV) sections of the lower river system are expressed in **Chart 4.5.** The trend in average daily streamflow throughout the LSDR watershed fell by a full order of magnitude (from 58 cfs to 5 cfs) between WY05 to WY14, then rose to 45 cfs in WY17. Lowest running average annual streamflow of 7-8 cfs for Mission Valley and 3 cfs for the Santee Basin, occured in WY14. Due to the distribution and magnitude of rainfall in both WY15 and WY16, running average streamflow rose to 15-20 cfs (Mission Valley) and 8-12 cfs (Santee Basin). Streamflow again fell sharply in WY18 as the watershed recieved near record low rainfall. With above normal rainfall in WY19 and WY20, streamflows returned to above avaerage. Dry weather flows from June through Sept. of WY21 were some of the lowest recorded in the past five decades. WY23 and WY24 witnessed greater total rainfall than experienced in previous several years, resulting in above normal streamflow. The current running average annual flow of 16 cfs is well below average. Significant variance in average annual streamflow, as well as maxima and minima values found within the lower river watershed can be expected to persist as stormwater runoff is the driving factor.

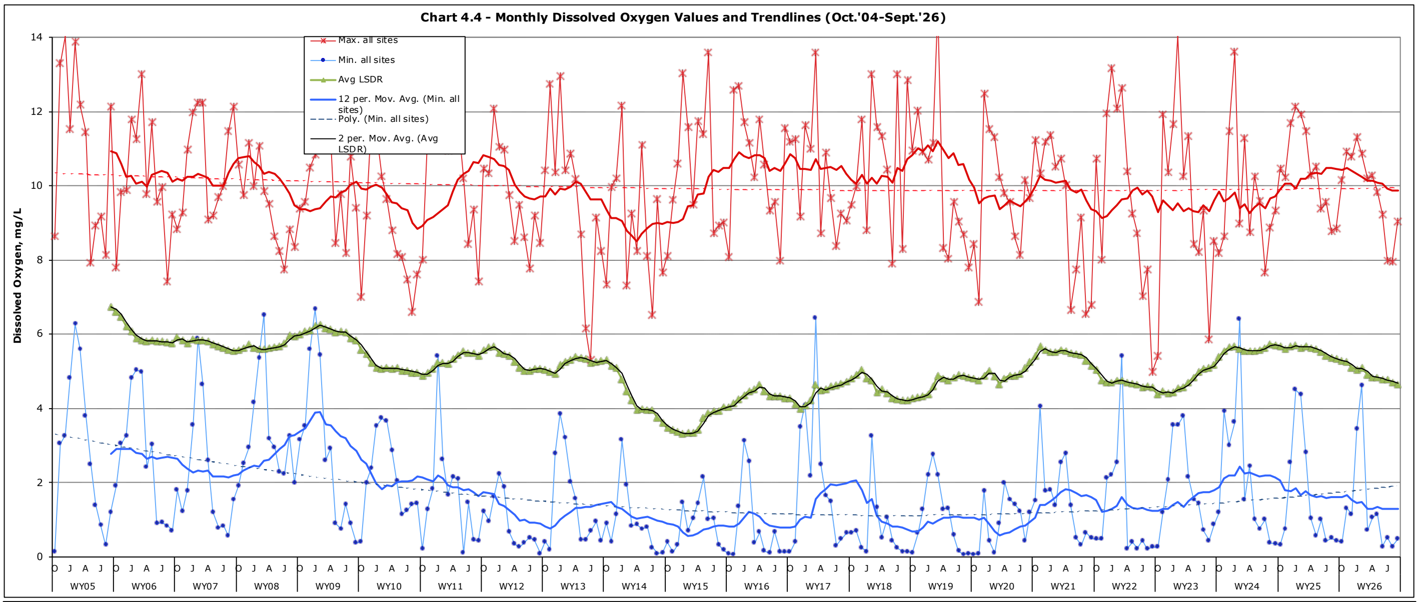
The overall **water quality index** (WQI) for LSDR as well as minimum and maximum running average values for all monitoring sites within the watershed are presented in the last three charts of this section**. Chart 4.6** expresses average, minimum and maxium WQI for the entire LSDR system based on distance (reach) averaging of index values calculated for each monitoring site. The greatest positive variation from the mean (blue line) is associated with the Mission Gorge section sites (#8,9&10) whereas the greatest negative variation is found in the Upper Santee Basin (USB) reach. The overall LSDR reach-averaged running average variation from the means are shown as black lines. The trendlines for each section and overall river system are shown as dashed lines using the same colors.

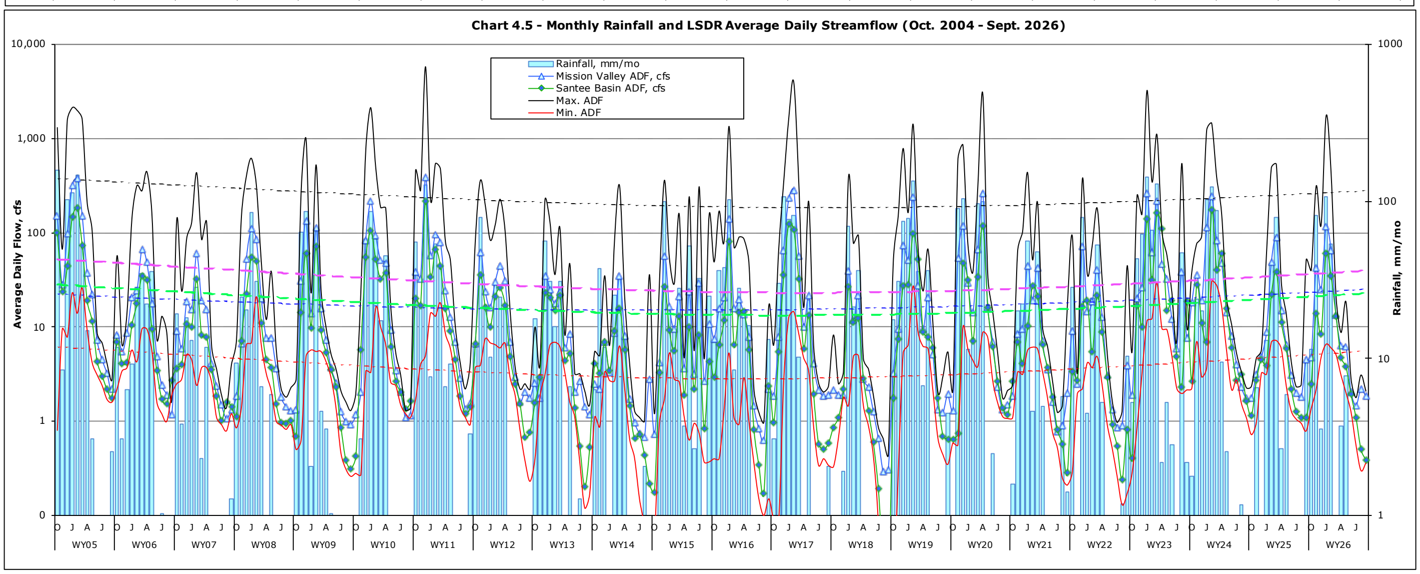
Charts 4.7A&B express four key water quality metrics (rainfall, streamflow, DO and WQI) as 12-month running average values in percent variation from their respective 22yr Means. All four metrics are displayed arithmetrictly on Chart 4.7A, whereas, rainfall and streamflow values are shown on (natural) log scale in Chart 4.7B while WQI, DSI, and DO variances are airthmetic. The strong correlations between variations are evident. The trends in running averages over the past several decades, shown as dashed lines for each metric, describe the high degree of correlation as well the degree of decline over the initial

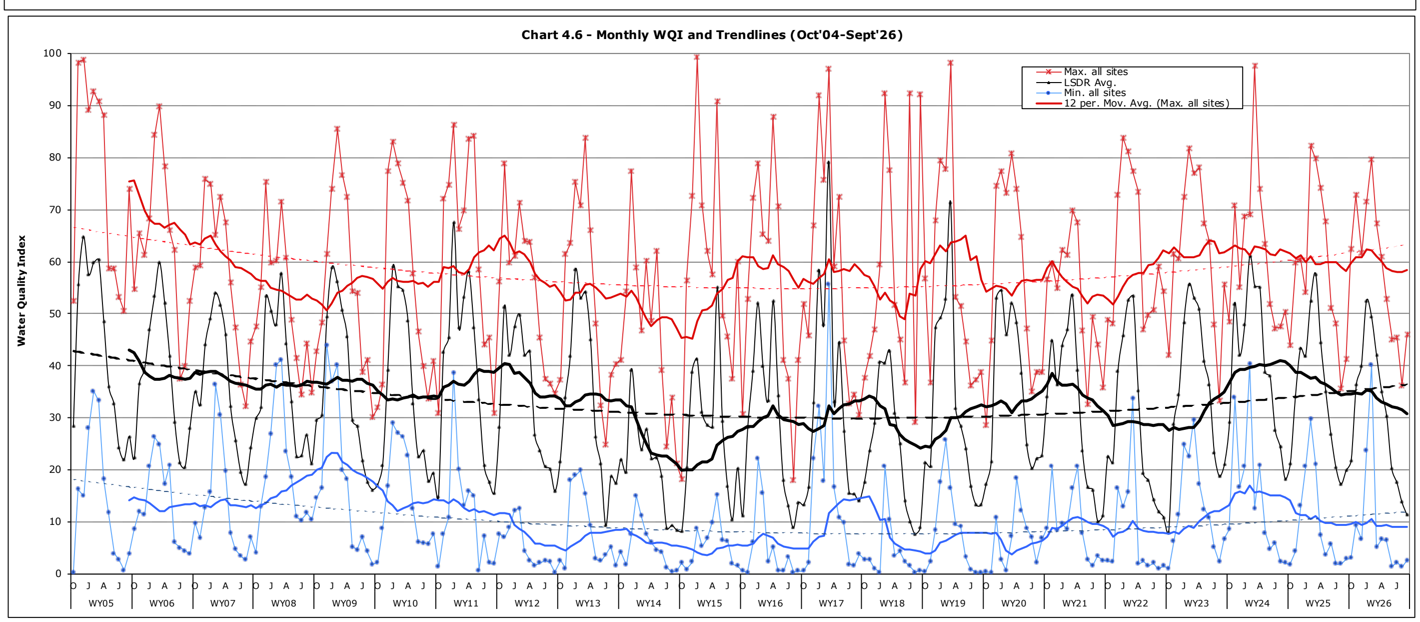

Chart 4.1 - LSDR Monthly Water Temperature Values and Trendlines (Oct.2004-Sept.2026)
Max. all sites
LSDR Avg.
Min. all sites
Water Temperature, 0 C
WY05
WY06
WY07
WY08
WY09
WY10
WY11
WY12
WY13
WY14
WY15
WY16
WY17
WY18
WY19
WY20
WY21
WY22
WY23
WY24
WY25
WY26

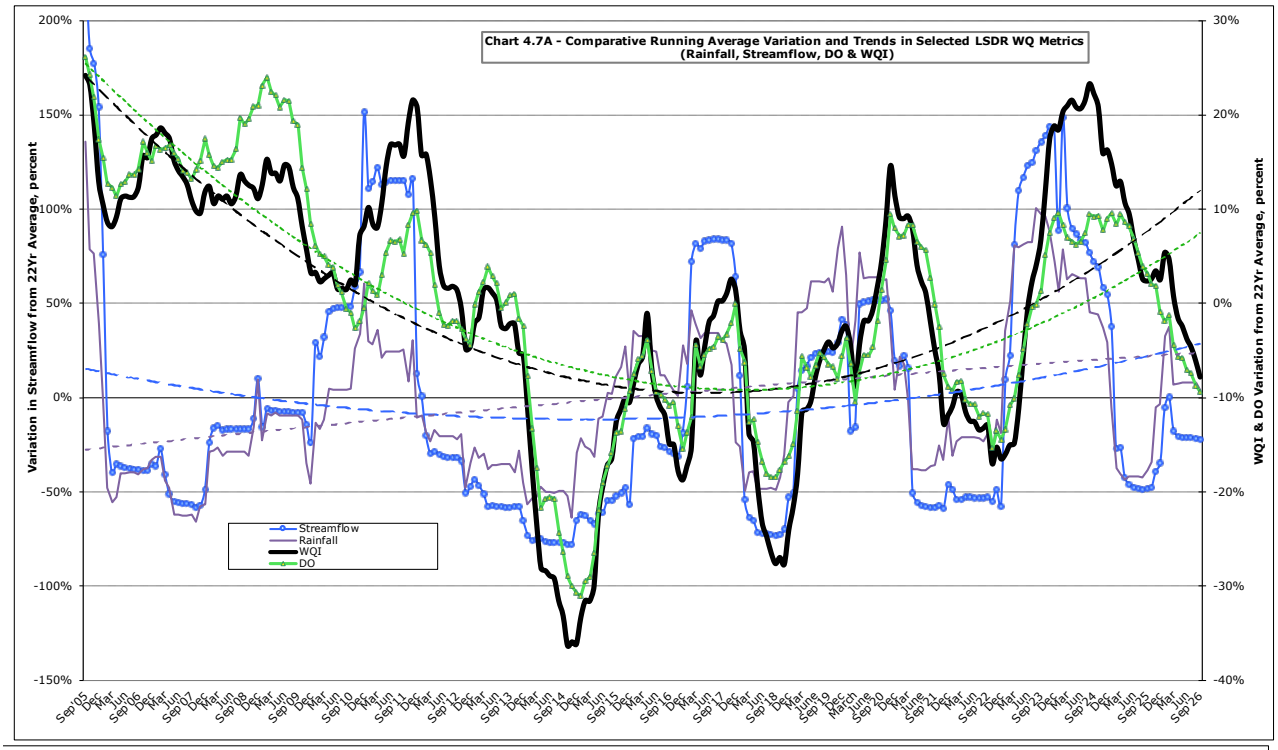

Chart 4.2 - Monthly Specific Conductance Values and Trendlines (Oct'04-Sept'26)
Max. all sites
LSDR Avg.
Min. all sites
Specific Conductance, mS/cm
WY05
WY06
WY07
WY08
WY09
WY10
WY11
WY12
WY13
WY14
WY15
WY16
WY17
WY18
WY19
WY20
WY21
WY22
WY23
WY24
WY25
WY26

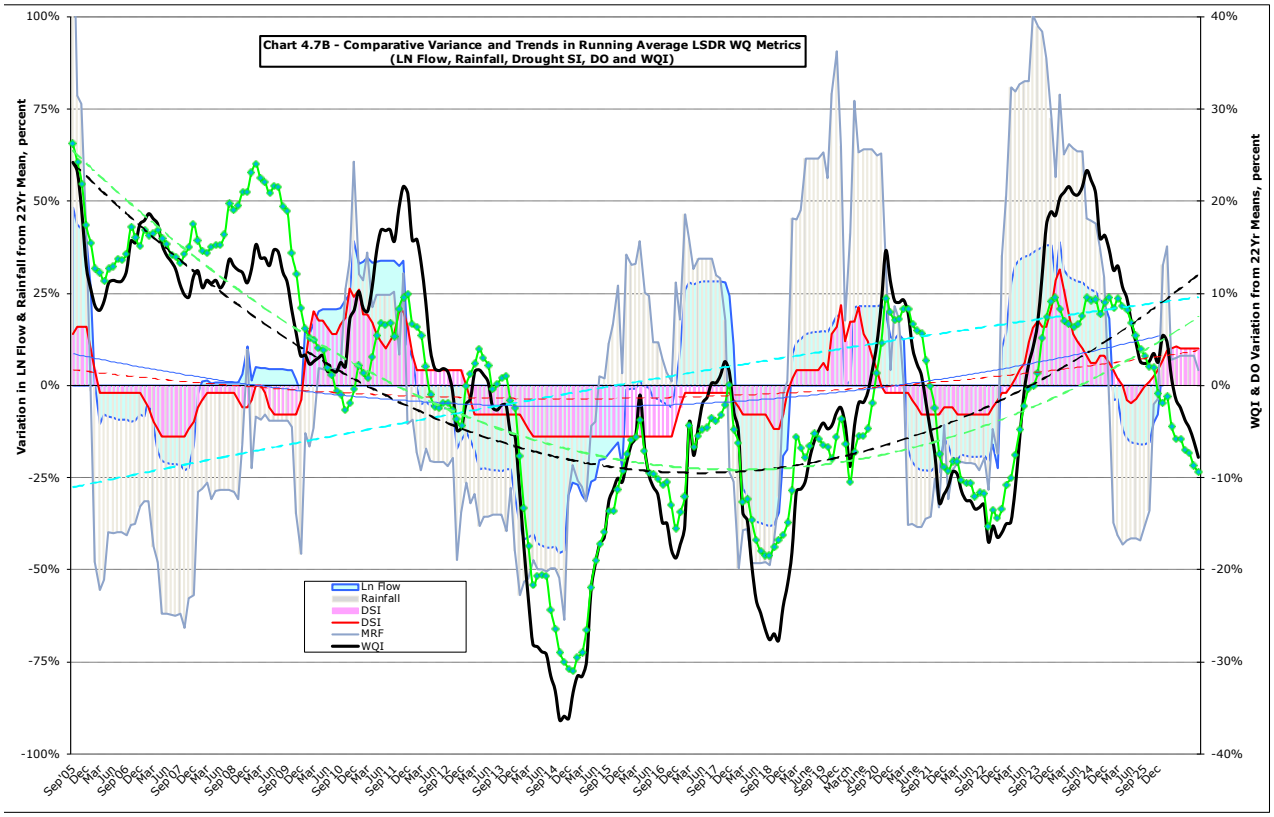

Chart 4.3 - Monthly pH Values and Trendlines (Oct'04-Sept'26)
Max. all sites
LSDR Avg.
Min. all sites
pH
WY05
WY06
WY07
WY08
WY09
WY10
WY11
WY12
WY13
WY14
WY15
WY16
WY17
WY18
WY19
WY20
WY21
WY22
WY23
WY24
WY25
WY26


Chart 4.4 - Monthly Dissolved Oxygen Values and Trendlines (Oct.'04-Sept.'26)
Max. all sites
Min. all sites
Avg LSDR
12 per. Mov. Avg. (Min. all sites)
Poly. (Min. all sites)
2 per. Mov. Avg. (Avg LSDR)
Dissolved Oxygen, mg/L
WY05
WY06
WY07
WY08
WY09
WY10
WY11
WY12
WY13
WY14
WY15
WY16
WY17
WY18
WY19
WY20
WY21
WY22
WY23
WY24
WY25
WY26


Chart 4.5 - Monthly Rainfall and LSDR Average Daily Streamflow (Oct. 2004 - Sept. 2026)
Rainfall, mm/mo
Mission Valley ADF, cfs
Santee Basin ADF, cfs
Max. ADF
Min. ADF
Average Daily Flow, cfs
Rainfall, mm/mo
WY05
WY06
WY07
WY08
WY09
WY10
WY11
WY12
WY13
WY14
WY15
WY16
WY17
WY18
WY19
WY20
WY21
WY22
WY23
WY24
WY25
WY26


Chart 4.6 - Monthly WQI and Trendlines (Oct'04-Sept'26)
Max. all sites
LSDR Avg.
Min. all sites
12 per. Mov. Avg. (Max. all sites)
Water Quality Index
WY05
WY06
WY07
WY08
WY09
WY10
WY11
WY12
WY13
WY14
WY15
WY16
WY17
WY18
WY19
WY20
WY21
WY22
WY23
WY24
WY25
WY26





decade followed by the sporadic and partial return to values above norms in wet years. Running average variation in index values and trends by individual river reach and river section for each of the water quality metrics are further examined in Section 5.

Section 5 - WQ Index by River Reach and Section (WY05 through WY26)

Annual and seasonal LSDR WQI values are presented in **Table 5.1** by river reach, section, and overall (LSDR) for each water year (WY05-WY26) of monitoring. Values and grades above norms are in black; values below italized norms (bottom row) are shown in red. The WY26 values, expressed in bold font, have decreased from last year's results for all reaches and sections of the Lower River. Overall the LSDR average annual WQI fell 3 points from last year's value of 40 to less than one point above the 22-year Mean. The overall annual WQI average remained Marginal (D) in WY26 similar to 17 of the prior 22 years. In addition to annual averages, the seasonal range, represented by winter highs and summer lows, are also presented by reach, section and overall in Table 5.1. With exception of two winter WY26 index values (Sites 1&2) all other values annual and seasonal are below (shown in red) 22yr means.

Table 5.1 - Average Annual and Seasonal WQI by Reach and Section (WY05-WY26)

Annual Avg	LMV Reach	MMV Reach	UMV Reach	West (MV) Section	MG Section	LSB Reach	USB Reach	East (SB) Section	LSDR Overall Avg.	
WY05	48	54	40	46	65	31	18	24	41	C (high)
WY06	39	47	30	37	54	34	21	28	37	D+
WY07	36	43	23	33	50	40	27	34	37	D+
WY08	38	39	28	35	46	39	33	36	37	D+
WY09	38	37	30	34	46	39	31	35	37	D+
WY10	36	36	31	34	48	37	17	27	34	D
WY11	39	39	39	39	56	44	15	29	38	C-
WY12	35	38	35	35	48	39	9	24	33	D
WY13	37	38	32	35	45	35	11	23	32	D
WY14	18	17	19	18	37	28	10	19	22	E (low)
WY15	24	22	23	23	46	43	10	27	29	**D**
WY16	35	30	22	29	40	37	8	23	28	D
WY17	34	34	33	33	41	40	19	29	33	D
WY18	26	28	21	24	33	29	11	20	24	E+
WY19	36	37	30	34	43	35	14	24	32	D
WY20	37	37	34	36	46	41	14	28	34	D
WY21	31	33	28	31	41	38	17	28	31	D
WY22	29	31	25	28	40	32	16	24	29	D
WY23	34	35	32	34	48	43	19	31	35	D
WY24	43	43	38	41	51	44	25	35	40	C
WY25	39	39	28	33	45	38	17	28	34	D
WY26	**34**	**35**	**25**	**31**	**43**	**35**	**15**	**25**	**31**	**D**
22yr Mean	*35*	*36*	*29*	*33*	*46*	*37*	*17*	*27*	*33*	*(Margina)*
Winter	*LMV*	*MMV*	*UMV*	*MV*	*MG*	*LSB*	*USB*	*SB*	*LSDR Overall*	
WY05	63	72	61	64	87	44	33	39	58	B (high)
WY06	54	63	49	52	61	40	29	35	48	C+
WY07	49	54	41	46	63	56	40	48	50	B-
WY08	56	52	47	52	55	52	52	52	52	B-
WY09	57	53	49	53	62	54	49	52	54	B
WY10	54	55	54	54	66	54	28	41	51	B-
WY11	57	55	57	56	67	54	27	40	52	B-
WY12	48	52	50	49	60	45	14	29	43	C
WY13	58	56	55	56	68	49	21	35	50	B-

WY14	26	25	26	26	55	39	15	27	31	D (low)
WY15	33	31	27	31	59	53	11	32	36	D+
WY16	44	42	38	41	57	52	14	33	41	C
WY17	53	55	60	55	64	61	35	48	54	B
WY18	38	40	37	38	58	41	16	29	38	C-
WY19	58	58	57	57	69	58	29	43	54	B
WY20	54	55	57	55	65	54	19	37	49	C+
WY21	47	48	44	47	59	51	20	35	44	C
WY22	47	50	48	47	63	46	32	39	47	C
WY23	47	49	48	48	61	56	30	42	48	C+
WY24	50	53	55	52	60	53	38	45	51	B-
WY25	50	52	49	49	60	48	33	41	48	C+
WY26	**48**	**48**	**43**	**46**	**61**	**49**	**27**	**38**	**46**	**C**
22yr Mean	*50*	*51*	*48*	*49*	*63*	*51*	*28*	*39*	*48*	*(Fair)*
Summer	*LMV*	*MMV*	*UMV*	*MV*	*MG*	*LSB*	*USB*	*SB*	*LSDR Overall*	
WY05	31	36	18	28	46	21	5	13	25	D-
WY06	23	31	8	19	45	31	18	24	26	D-
WY07	23	31	7	19	35	24	13	19	22	E
WY08	23	28	16	22	33	25	17	21	24	E+
WY09	21	21	14	18	32	25	16	20	22	E
WY10	21	22	16	20	33	26	9	17	21	E
WY11	23	21	16	20	38	30	5	18	22	E
WY12	22	23	18	20	25	27	4	16	20	E
WY13	18	23	11	16	20	23	5	14	16	E
WY14	10	10	12	10	12	16	9	12	12	F+
WY15	15	12	14	14	35	37	9	23	21	E
WY16	18	14	7	13	17	20	5	12	13	E-
WY17	20	20	16	18	20	22	11	17	18	E
WY18	12	14	6	10	9	19	8	14	11	F+(low)
WY19	23	19	10	18	24	22	3	13	16	E
WY20	25	24	17	22	31	29	10	20	22	E
WY21	14	16	10	13	15	18	10	14	14	E-
WY22	17	19	12	15	9	19	7	13	13	E-
WY23	27	24	15	22	40	37	10	23	25	D-
WY24	31	28	17	27	39	36	10	23	27	D (hi)
WY25	29	27	11	23	23	26	9	17	20	E
WY26	**22**	**23**	**9**	**18**	**15**	**19**	**5**	**12**	**15**	**E**
22yr Mean	*21*	*22*	*13*	*18*	*27*	*25*	*9*	*17*	*19*	*(Poor)*

Table 5.1 WQI Letter/Color Code: A (>75) Very Good (dark blue), B (50-74) Good (light blue), C (38-49) Fair (green), D (25-37) Marginal (yellow), E (13-24) Poor (brown), and F (0-12) Very Poor (pink). WQI values below 22yr Means (bottom row in italics and parenthese) are listed in red for the same reach/section of the river; values at or above Means are shown in black.

Running averages and variation in monthly index values, for each reach of the lower watershed are presented in charts 5.1 through 5.6 on pages 21 and 22 of this section. Trends in values considered over the entire monitoring period are expresed as dashed lines based on best-fit, using second-order polynomial equations. The range in trendlines between the highest and lowest sites located within each

reach are also presented. The heavy black line is the running average for each reach whereas the red line represents the 22yr mean for the overall LSDR.

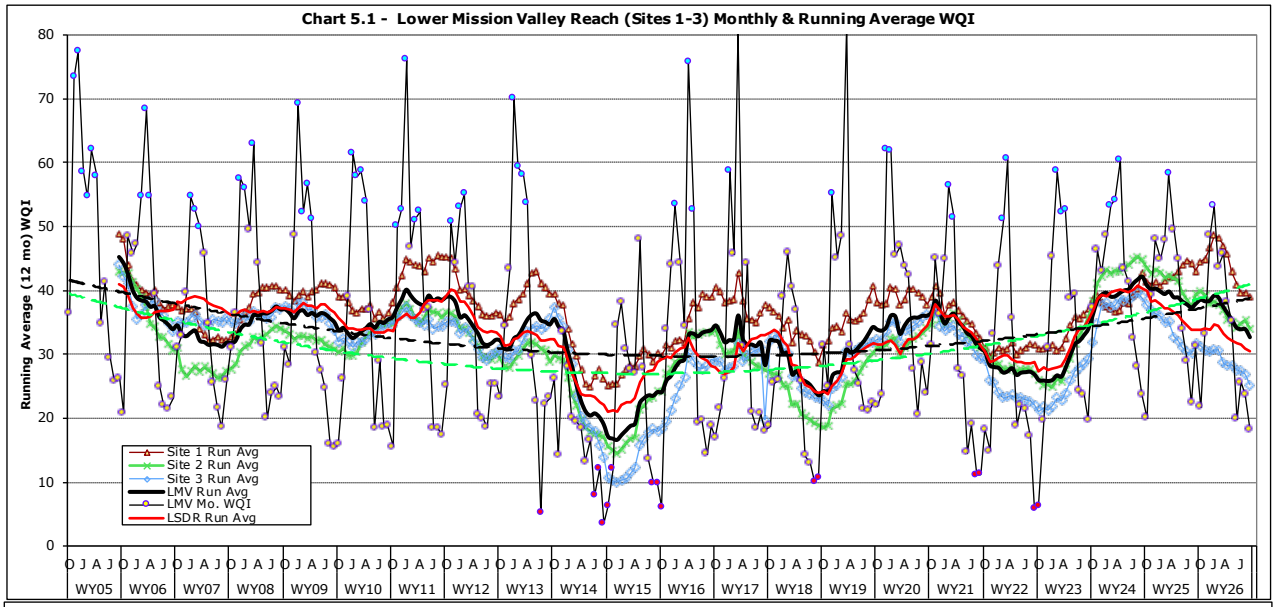
As shown in **Chart 5.1**, average annual WQI values associated with the **Lower Mission Valley Reach** (Sites 1-3) have varied from a high of 50 (B-Good) in WY05 to a low of 18 (E Poor) in WY14. The general trend in running average WQI for this lower-most reach, as well as the individual monitoring sites, declined from the mid 40's (C Fair) in WY05 to below 25 (E Poor) by WYs14-15. The running average WQI (*black line*) recovered to the mid-30's during WYs16-17, declined to the mid 20's in WY18, rose back up in WY's19-20, to again fall below 30 in WY22. WY23 and WY24 signify two years of overall recovery. WY25 was a year of general decline with exception of Site 1. Site 3 (FVM) the *blue line* has since WY11 exhibited the lowest running average WQI, while Site 1 (*brown line*) has typically witnessed the highest values for the reach. The most significant decline in the WQI for the reach and at all three sites occurred in WY14. The running average index for this reach fell from the mid-40's to the present upper-30's (an approximate 5% decline) over the 22-yr monitoring period. The overall trend for this reach has been positive since WY16. The reach RA for WY26 (*black line*) is slightly above the overall LSDR mean (*red line*).

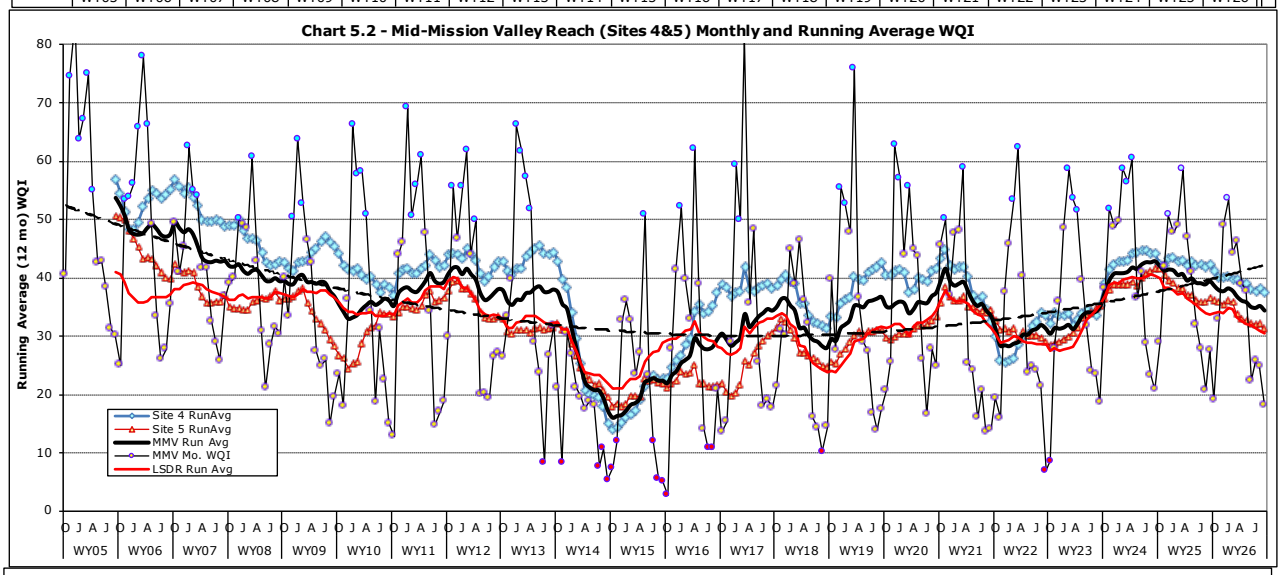
As shown in **Chart 5.2** , the range in monthly WQI values for the **Mid-Mission Valley Reach** (Sites 4&5) are similar to those in Lower MV reach; although slighly more elevated. Site 4 (FSDRIP at Mission Center Rd, *blue line*) presents the highest WQI values of all seven Mission Valley sites. Site 5 (Ward Rd bridge, *brown line*) is commonly four to eight points lower. The patterns of improvement and decline in index values over time are very similar to the other Mission Valley sites. Highest values (B Good) were in WYs 05-06 while minimums (E Poor) occured in WY14. WY26 is a year of slight decline in index values from WY25 to a current index in the mid 30's (D Marginal). The reach RA (*black line*) has been consistantly several points above the overall LSDR mean (*red line*).

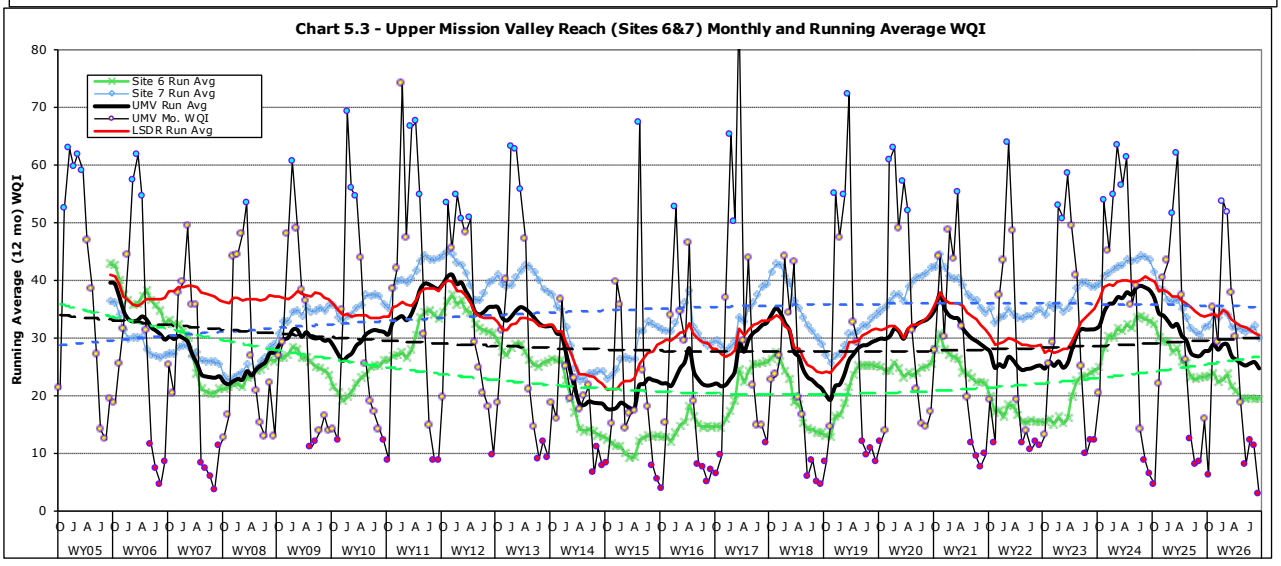
As shown in **Chart 5.3** , the range in monthly WQI values for the **Upper Mission Valley Reach** (Sites 6&7) of the river are similar to those in Lower and Mid-Mission Valley, although less variable and lower. Site 6 (Kaiser Ponds outlet at Mission Valley Rd, *green line*) has continuously presented lowest running average WQI values since 2017, while Site 7 (Admiral Baker Field at Zion, *blue line*), situated just upstream of the ponds, has presented higher values on an extended basis since mid-2008. The highest average annual WQI reading of 65 (A Very Good) for the Upper Mission Valley reach occured in WY05, whereas the lowest reading of 19 (E Poor) was in WY14.. The overall Upper Mission Valley trend since 2006 has been downward as growth of invasive aquatic plants and increase in biomass has proliferated throughout much of this reach during extended low-flow dry-weather periods. The rate of decline in running average index in this reach over 22 years is about two percent/annum, decreasing from 40 in WY05 to the present value of 25. Significant recovery in this reach is problemmatic without improved channel maintence due to the extensive accrual of biomass, deep ponding and inadaquate flushing especially in Kaiser Ponds.

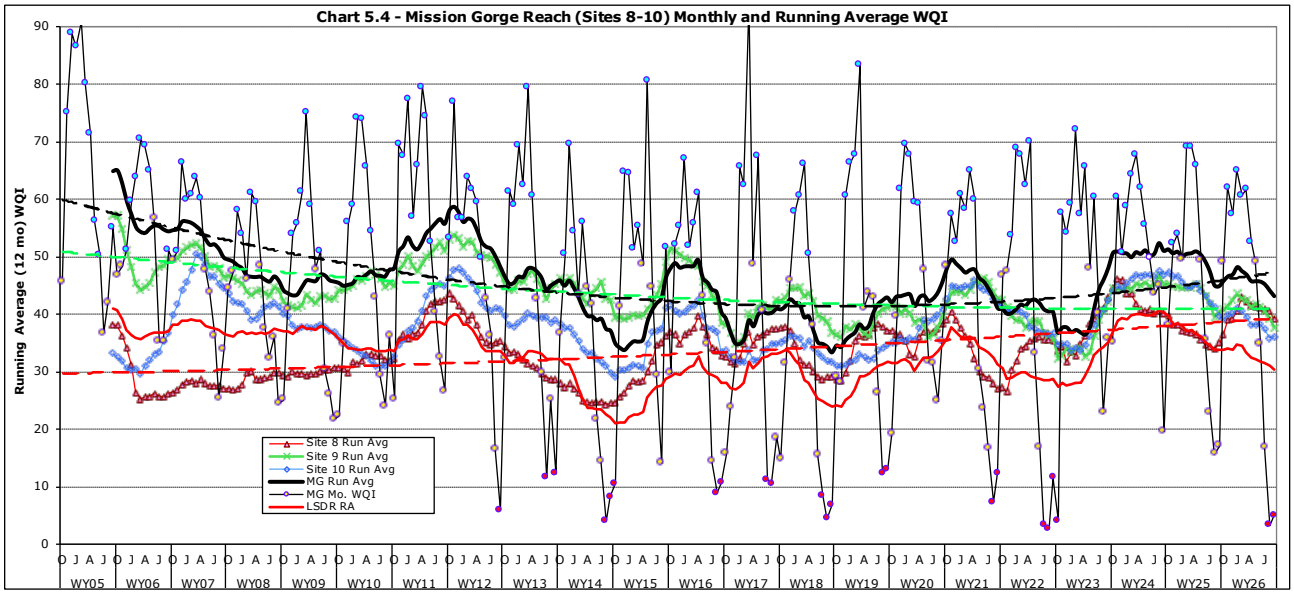
Overall running average WQI for the **Mission Gorge Reach** (Sites 8-10) of the river, as shown in **Chart 5.4** also declined over the past 22 years. Highest annual WQI values of 63 (B Good) occured in WY05, contrasted with a low of 33 (C Marginal) in WY18. In general running average WQI values are the highest of all five reaches with an average WQI of 46 (B Good). The trend in Mission Gorge WQI values (*black line*) are, however, comparable to those in Mission Valley. The overal index has declined 20 points (from mid-60s to mid-40s) over 22 years in this section of the river. The running average index value for this reach has remained well above the overal LSDR mean throughout the 22-yr monitoring period by 15-16 index points.

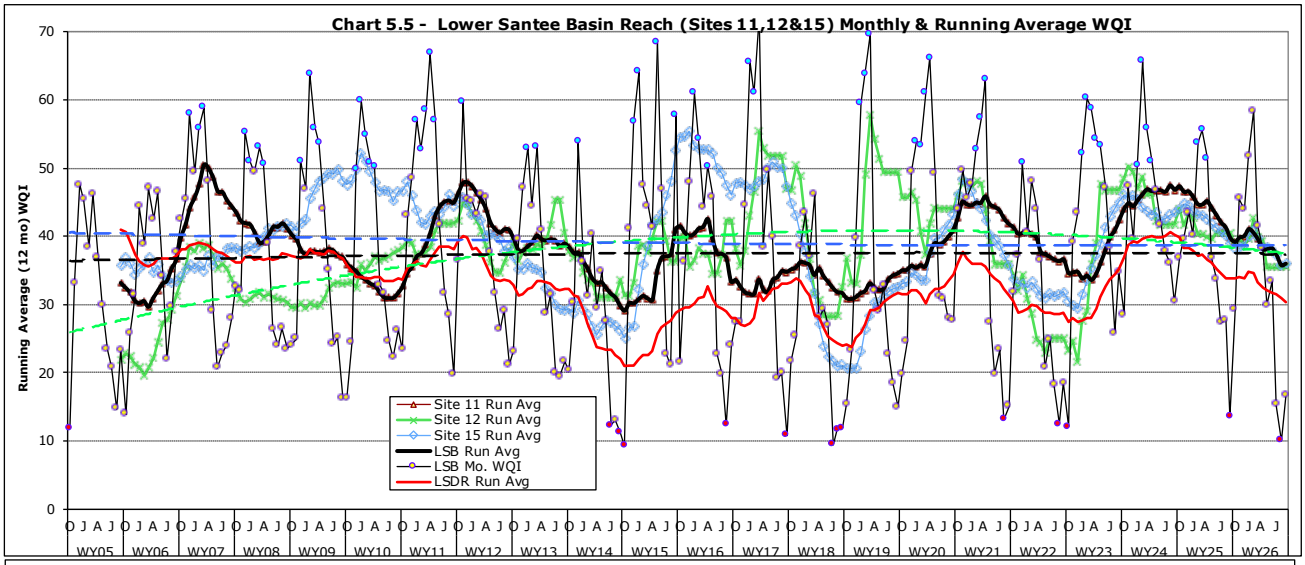
The **Lower Santee Basin Reach** (Sites 11, 15T, 12T) WQI values and running averages are shown on **Chart 5.5**. The range from winter month highs in the 50-70 range (B Good) to summer lows in the 10-15 range (E Poor) are common. Completion of the Forester Creek enhancement project (expressed by the *blue line*)

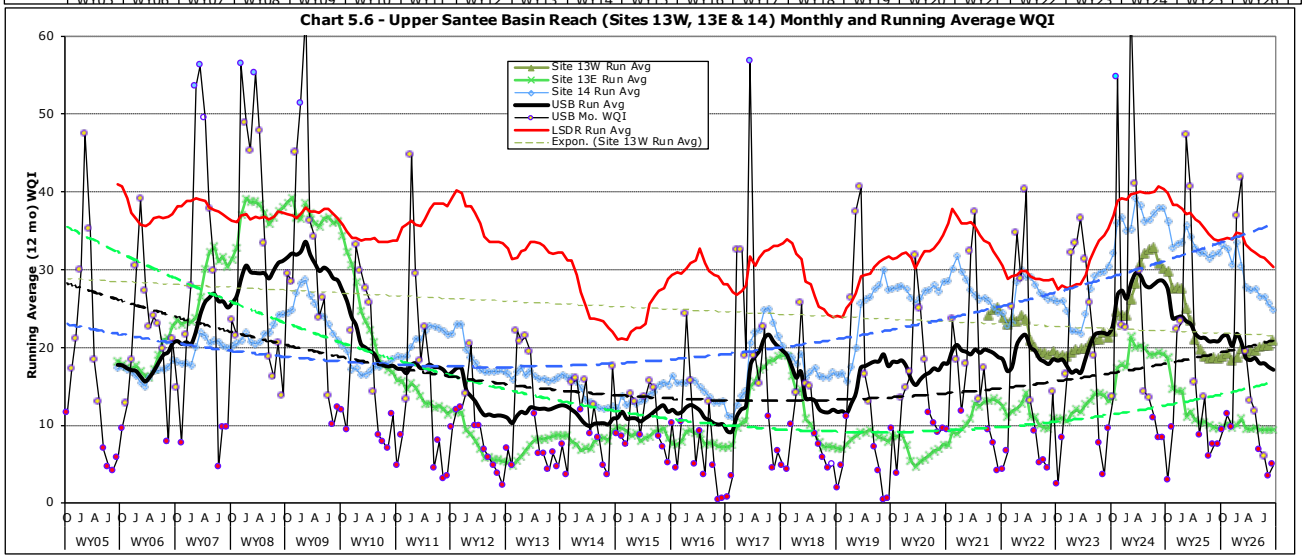

Chart 5.1 - Lower Mission Valley Reach (Sites 1-3) Monthly & Running Average WQI
Running Average (12 mo) WQI
Site 1 Run Avg
Site 2 Run Avg
Site 3 Run Avg
LMV Run Avg
LMV Mo. WQI
LSDR Run Avg
WY05 WY06 WY07 WY08 WY09 WY10 WY11 WY12 WY13 WY14 WY15 WY16 WY17 WY18 WY19 WY20 WY21 WY22 WY23 WY24 WY25 WY26


Chart 5.2 - Mid-Mission Valley Reach (Sites 4&5) Monthly and Running Average WQI
Running Average (12 mo) WQI
Site 4 RunAvg
Site 5 RunAvg
MMV Run Avg
MMV Mo. WQI
LSDR Run Avg
WY05 WY06 WY07 WY08 WY09 WY10 WY11 WY12 WY13 WY14 WY15 WY16 WY17 WY18 WY19 WY20 WY21 WY22 WY23 WY24 WY25 WY26


Chart 5.3 - Upper Mission Valley Reach (Sites 6&7) Monthly and Running Average WQI
Running Average (12 mo) WQI
Site 6 Run Avg
Site 7 Run Avg
UMV Run Avg
UMV Mo. WQI
LSDR Run Avg
WY05 WY06 WY07 WY08 WY09 WY10 WY11 WY12 WY13 WY14 WY15 WY16 WY17 WY18 WY19 WY20 WY21 WY22 WY23 WY24 WY25 WY26


Chart 5.4 - Mission Gorge Reach (Sites 8-10) Monthly and Running Average WQI
Running Average (12 mo) WQI
Site 8 Run Avg
Site 9 Run Avg
Site 10 Run Avg
MG Run Avg
MG Mo. WQI
LSDR RA
WY05 WY06 WY07 WY08 WY09 WY10 WY11 WY12 WY13 WY14 WY15 WY16 WY17 WY18 WY19 WY20 WY21 WY22 WY23 WY24 WY25 WY26


Chart 5.5 - Lower Santee Basin Reach (Sites 11,12&15) Monthly & Running Average WQI
Running Average (12 mo) WQI
Site 11 Run Avg
Site 12 Run Avg
Site 15 Run Avg
LSB Run Avg
LSB Mo. WQI
LSDR Run Avg
WY05 WY06 WY07 WY08 WY09 WY10 WY11 WY12 WY13 WY14 WY15 WY16 WY17 WY18 WY19 WY20 WY21 WY22 WY23 WY24 WY25 WY26


Chart 5.6 - Upper Santee Basin Reach (Sites 13W, 13E & 14) Monthly and Running Average WQI
Running Average (12 mo) WQI
Site 13W Run Avg
Site 13E Run Avg
Site 14 Run Avg
USB Run Avg
USB Mo. WQI
LSDR Run Avg
Expon. (Site 13W Run Avg)
WY05 WY06 WY07 WY08 WY09 WY10 WY11 WY12 WY13 WY14 WY15 WY16 WY17 WY18 WY19 WY20 WY21 WY22 WY23 WY24 WY25 WY26

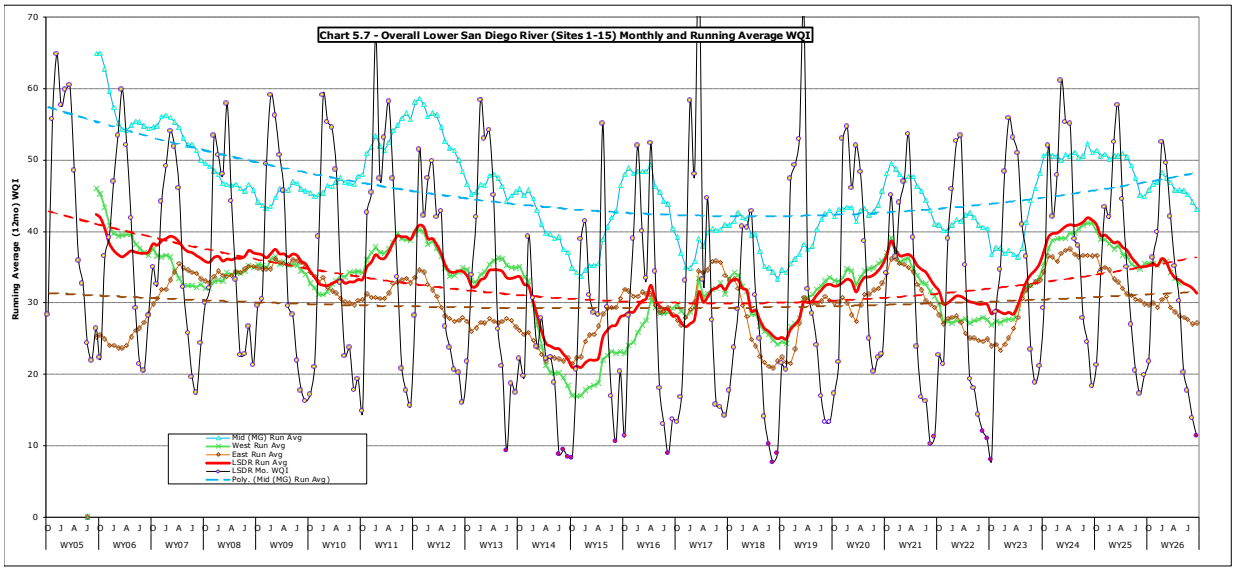
extending from Prospect Ave. to Mission Gorge Rd. has had a significant impact on overall river quality (*black line*) in the Lower Santee Basin portion of the river system. With above normal rainfall in WYs 23&24 the Lower Santee Basin running average index improved to values comperable to those experienced in other above average flow years. This reach of the river has witnessed the least variation in index values over time and has consistantly remained 5-6 points higher than the overall LSDR mean.

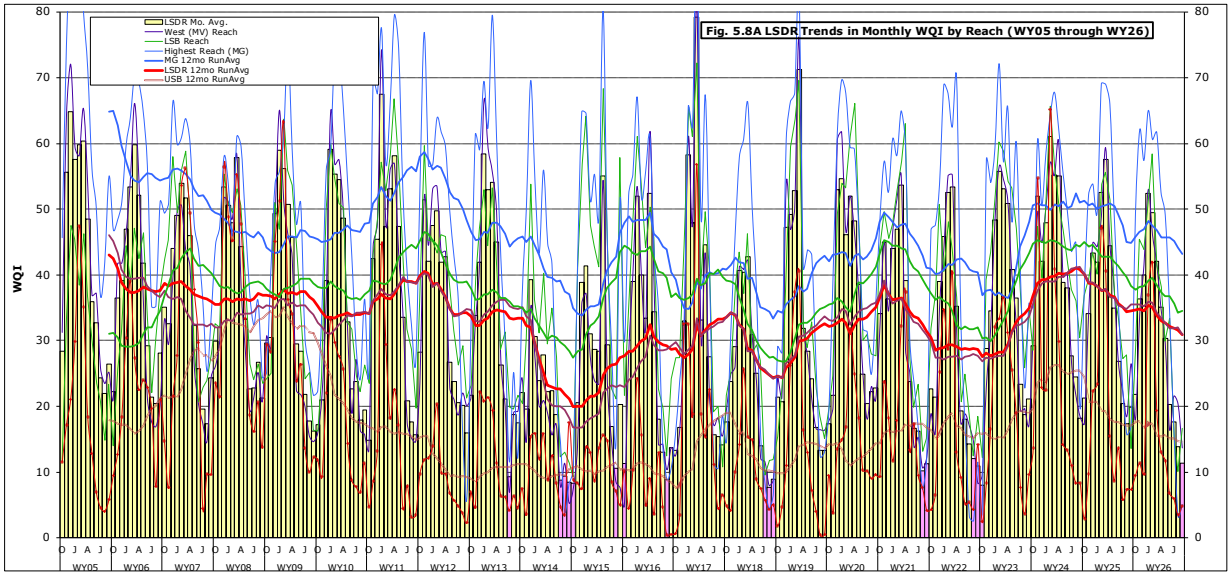
C**hart 5.6** presents monthly and running average WQI values for the **Upper Santee Basin Reach** (Sites 13W,13E&14) of the river. This reach presents the poorest water quality values of all sections of the river. Monthly values seldom exceed 20 (E Poor) since the summer of 2011 and are often less than 12 (F+ Very Poor) throughout all but the wet-weather/winter months. The running average WQI for this reach has declined from highs above 30 (D Marginal) in WY09 to continuously between 10 and 12 (F Very Poor) during the 5-yr drought period (WY12-WY16). WY17 saw a noticeable increase (ten points) in the running average index from early in the year reaching 18 (E-Poor) in September, however the following year witnessed a reversal with a steady decline toward previous lows. WY19 witnessed partial recovery to prior highs, especially at site 14. The greatest variability has been associated with site 13E, Mast Park East (*green line).* The index for this reach has fallen more than 80% over the last 15 years presenting the greatest decline in running average values of all reaches. Advanced eutrophication within multiple ponds and backwaters located upstream of Mast Park has lead to high levels of oxygen depletion throughout the year. Hypoxic conditions (DO<2.5 mg/L) are common at Site 13E (Walmart Ponds) in all but the highest runoff months of the year. WYs 25&26 were years of continued decline in index values at all three monitoring sites compared to the previous two years.

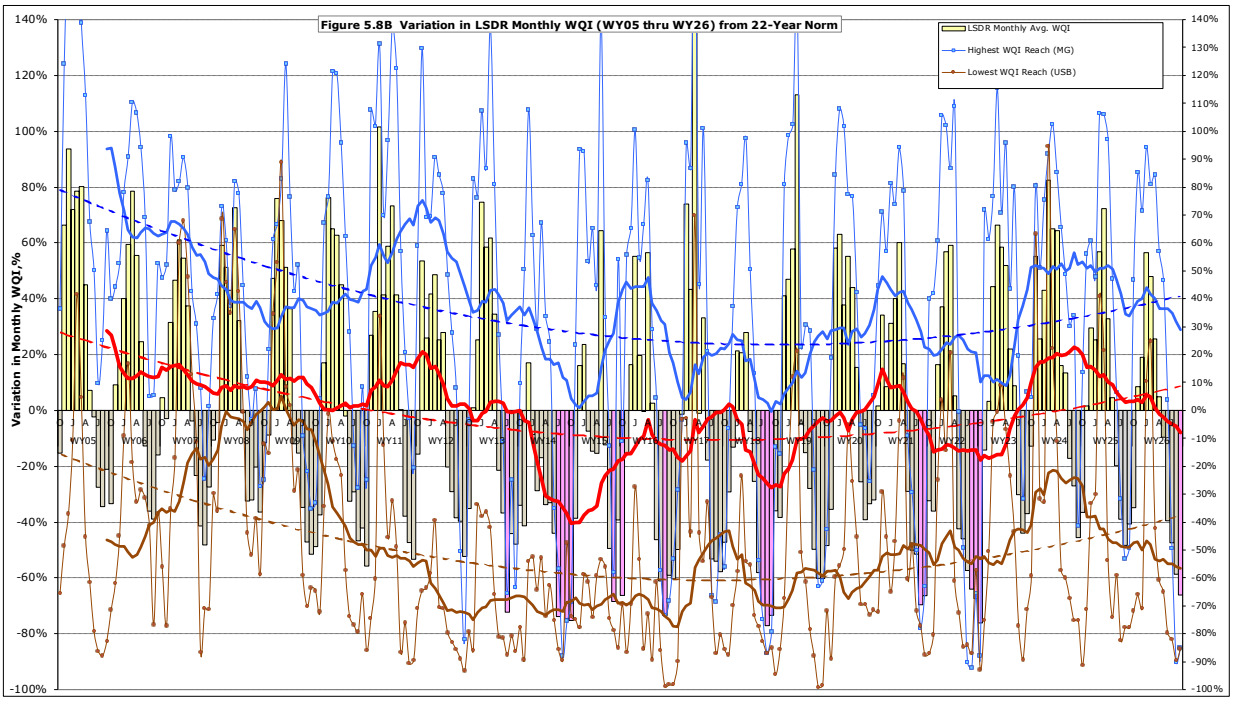
The monthly and running average variation in WQI values for the three main sections of the lower river (i.e., Santee Basin, Mission Gorge and Mission Valley) and the overall **Lower San Diego River** system (distance-weighted average of all 16 monitoring sites) are presented in **Chart 5.7** on the next page**.** WQI running average values increased from WY14 lows in all three sections of the lower river system from WY15 thru WY17. Values again declined in WY18 then rebounded in WYs19/20 to again fall in all three sections of the lower river follwed by recovery in WYs23/24 and a return to partial decline during WY25. The Mission Gorge section (*green*) changed least, while the upstream section (Santee Basin *blue*) the most. The current LSDR running average WQI of 32 (D Marginal) is three percent below the 22-yr norm of 33. WQI values typically increase when streamflow exceeds annual norms and aquatic growth abatement occurs through natural flushing (or periodic control measures) within specific reaches of the river. Higher minimum index values during the dry summer months often result in positive gradients for 12-mo. running averages within a single water year, especially the case in the Mission Gorge section. Without human intervention, however, overall negative trends in WQI values can be expected to repeat for many portions of the lower river due to natural processes of organics deposition and subsequent eutrofication especially in the deeper ponded reaches.

Charts 5.8A and 5.8B summarize the differences in running average WQI values over the past two decades by individual reach and overall as well as the range from minmum to maximum expressed as variance from the overall 22yr LSDR Mean (red line). The primary drivers of annual changes in water qualty within the watershed, as expressed in Chapter 4 (refer to Charts 4.7A&B), are rainfall and resultant runoff (streamflow).

Variations from the running average mean as shown in chart 5.8A are a very strong indicator of the relative change in overall (LSDR) water quality considered over the complete 22-yr period of monitoring. Highest LSDR index values and associated greatest positive variation from the mean occuring in the inital year of monitoring (WY05) were followed by fluctuating declines in values over the next decade extending through 2014. Since 2015 there was a similarly fluctuating rise in running average index values through WY24. WYs25 & 26 witnessed an overall declines in all reaches. The Mission Gorge section of the river consistantly shows highest index values, while the Santee Basin section is the lowest. River water


Chart 5.7 - Overall Lower San Diego River (Sites 1-15) Monthly and Running Average WQI
Running Average (12mo) WQI
Mid (MG) Run Avg
West Run Avg
East Run Avg
LSDR Run Avg
LSDR Mo. WQI
Poly. (Mid (MG) Run Avg)
WY05
WY06
WY07
WY08
WY09
WY10
WY11
WY12
WY13
WY14
WY15
WY16
WY17
WY18
WY19
WY20
WY21
WY22
WY23
WY24
WY25
WY26


Fig. 5.8A LSDR Trends in Monthly WQI by Reach (WY05 through WY26)
LSDR Mo. Avg.
West (MV) Reach
LSB Reach
Highest Reach (MG)
MG 12mo RunAvg
LSDR 12mo RunAvg
USB 12mo RunAvg
WQI
WY05
WY06
WY07
WY08
WY09
WY10
WY11
WY12
WY13
WY14
WY15
WY16
WY17
WY18
WY19
WY20
WY21
WY22
WY23
WY24
WY25
WY26


Figure 5.8B Variation in LSDR Monthly WQI (WY05 thru WY26) from 22-Year Norm
LSDR Monthly Avg. WQI
Highest WQI Reach (MG)
Lowest WQI Reach (USB)
Variation in Monthly WQI,%
WY05
WY06
WY07
WY08
WY09
WY10
WY11
WY12
WY13
WY14
WY15
WY16
WY17
WY18
WY19
WY20
WY21
WY22
WY23
WY24
WY25
WY26

quality conditions throughout the lower river system continue to be greatly dependent on total rainfall and resultant streamflow. An above average year of precipitation commonly results in higher running average index values whereas dry years (as the last two) result in relative declines in LSDR water quality.

The overall WQ index for WY26 of 31 (D Marginal) is two points (6%) below the average annual mean of 33. This year's value remains 9 points above the lowest average annual WQI of 22 (E Poor) experienced in WY14. The river's highest overall average annual index of 40 (Fair) occurred in WY05. Two water year's (WYs14&18) presented an overall average index value in the Poor E (WQI 13-24) range, while two others (WYs05&11) had values in the Fair C (WQI 38-49) range. Marginal (D) water quality (WQI 25-37) has occurred 16 out of the past 22 years (70% of the time).

The key water quality metric for the lower river is the relative level of dissolved oxygen present. Low DO levels are the result of extensive and persistent eutrophication caused by buildup of organic-rich detritus that, when combined with restricted water movement within specific reaches, especially in deeper pools and slack water, can become pervasive. Until the spread of invasive aquatic plants such as creeping water primrose (Ludwigia,et.al.)[a] are better managed and the effects of eutrophication effectively controlled, water quality index values can be expected to remain below those recorded at monitoring sites where better circulation, mixing and re-oxygenation occurs naturally.

a) Ludwigia peploides, L. grandiflora, L. hexapetala are all members of a highly productive emergent aquatic perennial native to the Americas and likely Australia (USDA-ARS, 1997). It was 'introduced' in France in 1830 and rapidly became one of the most damaging invasive plants growing there. It is a perenial herb (a dicot) also termed marsh purslane; a member of famility ORAGRACEAE. More recently it was introduced to areas beyond its native range in the U.S. where it is often considered a noxious weed. *L. grandiflora, et. al.* are adaptable and tolerate a wide variety of habitats where they can transform ecosystems both physically and chemically. It sometimes grows in nearly impenetrable mats; can displace native flora and interfere with flood control and drainage systems, clog waterways and adversly impact recreation. The plant also has 'allelopathic' properties that can lead to dissolved oxygen crashes, the accumulation of sulphide and phosphate, 'dystrophic crises' and what ecologists term 'intoxicated' ecosystems (Dandelot et al., 2005). The common names are "floating water primrose" or "creeping primrose willow"; the plant produces a distintive small yellow or white flower during its summer bloom cycle (May-Nov.). *L. peploides,* the green colored plant extending accross Walmart Pond (site #13E) as shown on this report's cover page, is pervasive growing throughout much of the lower reaches of the San Diego River.

(AWQRpt.page JCK 10/13/26)