city of austin
Watershed Protection

EII (WQ, Contact Rec) Quality Assurance Project Plan

Project #16

Introduction

The Environmental Integrity Index (EII) is a tool to monitor and assess the ecological integrity and the degree of impairment of Austin's watersheds. The EII combines biological and physical criteria with chemical and toxicity data to provide a comprehensive assessment of the structure and integrity of the aquatic ecosystem. The mission of the City of Austin's Environmental Resource Management Division is to protect the water quality in Austin area watersheds. The EII is used in the Department's master plan process to evaluate the current water quality conditions of Austin's watersheds. Because the EII is a cost-effective, comprehensive and direct means of monitoring the health of Austin's receiving waters, it was also incorporated into the City of Austin's National Pollution Discharge Elimination System (NPDES) permit program as a Reasonable and Prudent Measure (RPM) activity. Additional documentation is available in the Environmental Integrity Index Methodology Report.

The goal of the developers of the EII was to produce a quantifiable method for assessing the water quality condition of Austin's urban and non-urban streams and to provide a baseline from which to evaluate our water resources in order to target protective measures. The scoring system is listed below.

EII Scoring System		
Narrative Score	**EII Score Range**	
	Lower	Upper
Excellent	89	100
Very Good	76	88
Good	64	75
Fair	51	63
Marginal	39	50
Poor	26	38
Bad	13	25
Very Bad	0	12

The EII consists of 6 sub-indices. Watersheds will be divided into homogeneous reaches on the basis of existing GIS data and field experience, and one EII site will be selected and sampled to represent conditions within that reach. Methodology for the collection and calculation of the water quality and contact recreation sub-indices are presented in this QAPP.

Project Management

1. Who is the project manager?
   Mateo Scoggins

2. Who is the WMA team representative?
   Chris Herrington

3. What other WPDRD staff are on the committee for this project?
   Andrew Clamann, Martha Turner

4. When will the annual WMA review be completed?
   January

5. When will the project begin/end?
   The project began in 1994, with the first complete sampling of phase I watersheds in 1996. The project is on-going.

Data Objectives

6. What are the study objective(s)?
   Monitor watershed health with a comprehensive index to identify watersheds with decreasing health and isolate probable causes of degradation (in compliance with current fiscal year business plan).

7. In addition to the project committee, who else is interested in the data?
   WP&DRD administration.

8. What decision(s) will be made from the information obtained? When will the decision(s) be made?
   Impaired watersheds will be identified, and recommendations will be made to other groups for corrective action:
   - Reaches with degrading NO3 or OP component scores of at least one EII category without a substantial decrease in bacteria scores will be referred to Kathy Shay's education group as areas possibly impacted by residential fertilizer use.
   - Reaches with degrading nutrient component scores and bacteria of at least one EII category will be referred to the Austin Clean Water Program as areas possibly impacted by leaking wastewater lines.

   Decisions will be made annually in January for current phase, or as soon as all data is available.

9. What has been done in the past? Describe project history, list previous related reports or available data.
   Prior to 2006, EII scores were reported on a site basis, but are currently reported on a reach basis.

   Prior to 2004, fecal coliform bacteria was used for the contact recreation and the bacteriological component of the water quality sub-index. In 2004, e coli was used as the new indicator bacteria in compliance with shifts in TCEQ monitoring and assessment protocol.

   Previous Reports:
   Annual reports (Water Watchdog, etc)

Online watershed fact sheets (http://www.ci.austin.tx.us/watershed/learn_ws.htm)
SR-03-06: Change in EII values in Austin (1996-2002)
COA-ERM 1999-05: Environmental Integrity Index Methodology.
COA-ERM/WRE 1997-03: Environmental Integrity Index Water Quality Assessment Methodology

10. What could be done in the future? List and prioritize potential special studies.
No current WRE routine baseflow program is monitoring total phosphorus except for the EII sampling conducted at the USGS gage sites. If total phosphorus or total orthophosphorus becomes problematic (one of samples per year at any gage site exceed TCEQ screening criteria), then additional sampling may be conducted within that watershed for total or dissolved orthophosphorus.

Sulfate will be added to the routine EII parameters. Chloride will not be added at this time. Both parameters are correlated with each other and conductivity. Although most watersheds show a decrease in chloride over time, recent analysis indicates that sulfate levels are generally constant or are slightly increasing temporally. If sulfate or conductivity become problematic relative to TCEQ water quality standards, additional sampling for chloride within that watershed may be undertaken.

Data generation

11. Describe the sampling. What sites will be sampled? In addition to the core parameter list in the SOP manual, what other parameters will be collected? When will sampling occur?
Reaches will be sampled at a single site on a rotating 3-year cycle. Sediment will be sampled from the most downstream EII reach in each watershed once per year. Water quality will be sampled at every site quarterly (March, June, September, December).

Water Quality Parameters

Parameter	Analysis Lab	Method	Cost
Nitrate as N	ERM	InQuest Rapid Assay Zinc Reduction	
Orthophosphorus as P	ERM	HACH DR2000 - 8048	
TSS	ERM	SM 2540 D	
E coli	ERM	Colilert	
Ammonia as N	LCRA	SM 4500-NH3 D	10.00
*Sulfate	LCRA	EPA 300	12.00
Conductivity	Field	Hydrolab or Quanta	

Water Quality Bottles Needed
- One 1-L Plastic (TSS)
- One 500-mL Plastic preserved with H_2SO_4 at lab (NH_3)
- One glass Bac-T (E coli)
- One 250-mL Plastic (SO_4)
- Two whirlpack bags (OP, NO_3)

Phase I - (sites monitored in Year 2003, 2006, 2009, etc)

Highlighted sites are sediment sites

Watershed	Reach	Site Name	FSDB #
Barton	BAR1	Barton Creek Between Dams Above Pool	879
	BAR2	Barton Creek Downstream of Lost Creek Blvd	51
	BAR3	Barton Creek @ Leif Johnson	50
	BAR4	Barton Creek @ Hwy 71 Below Little Barton (BC0)	48
Blunn	BLU1	Blunn Creek @ Riverside Drive	180
	BLU2	Blunn Creek Above Stacy Pool	364
	BLU3	Blunn Creek @ Long Bow (Preserve at Little Bridge)	362
North Boggy	BOG1	North Boggy Creek @ Delwau Dr.	493
	BOG2	North Boggy Creek @ Nile Road	837
	BOG3	North Boggy Creek @ Manor Road	2754
Buttermilk	BMK1	Buttermilk Creek @ Little Walnut Creek	851
	BMK2	Buttermilk Creek @ Providence Ave	782
	BMK3	Buttermilk Creek @ Victory Christian Center	3861
E. Country Club	ECC1	East Country Club @ ACC	1475
W. Country Club	WCC1	West Country Club @ Kreig Field	1474
	WCC2	West Country Club Creek @ East Oltorf	850
East Bouldin	EBO1	East Bouldin Creek @ Post Oak	1338
	EBO2	East Bouldin Creek @ Elizabeth St	119
	EBO3	East Bouldin Creek Dwnstrm of Alpine Rd	121
Fort Branch	FOR1	Fort Branch Creek @ North Boggy Creek	123
	FOR2	Fort Branch Creek @ Carson Hill Rd	898
	FOR3	Fort Branch Creek Above Manor Rd	125
	FOR4	Fort Branch @ Glencrest	126
Harper's Branch	HRP1	Harper's Branch @ Woodland	844
Johnson Creek	JOH1	Johnson Creek @ Woodmont	897
Little Walnut	LWA1	Little Walnut Creek @ US183	634
	LWA2	Little Walnut Creek @ Cameron Rd	3857
	LWA3	Little Walnut Upstream of IH35	3860
	LWA4	Little Walnut Creek @ Golden Meadow Rd	838
Shoal	SHL1	Shoal Creek Above 1st St.	122
	SHL2	Shoal Creek @ 24th Street	116
	SHL3	Shoal Creek @ Shoal Edge Court (EII)	117
	SHL4	Shoal downstream of Cross Creek	118
Tannehill	TAN1	Tannehill Creek @ Desirable Drive	1476
	TAN2	Tannehill Creek @ Lovell Drive	843
	TAN3	Tannehill Creek @ Berkman Dr	3858
Waller	WLR1	Waller Creek Below Cesar Chavez	38
	WLR2	Waller Creek @ 23rd St. (USGS)	624
	WLR3	Waller Creek @ 51st Street	780
Walnut	WLN1	Walnut Creek @ SP Railroad Bridge	503
	WLN2	Walnut Creek @ Old Manor	502
	WLN3	Walnut Creek Below IH35	464
	WLN4	Walnut Creek @ Metric	895
	WLN5	Wells Branch @ Walnut Metro Park	463
West Bouldin	WBO1	West Bouldin Creek @ Post Oak	2794
	WBO2	West Bouldin Creek @ Oltorf	3854

	WBO3	West Bouldin Creek @ Cardinal & Locke	3856
Williamson	WMS1	Williamson Creek @ McKinney Falls (Will1)	223
	WMS2	Williamson Creek @ IH35 (EII)	491
	WMS3	Williamson Creek @ Hwy 71 (EII)	490

Phase II - (sites monitored in Year 2004, 2007, 2010, etc)

Watershed	Reach	Site Name	FSDB #
Bear Creek	BER1	Bear Creek @ Twin Creeks Road	1087
	BER2	Bear Creek @ Escondido	3935
	BER3	Bear Creek @ Bear Creek Pass	4112
Bee Creek	BEE1	Bee Creek @ Lake Austin	319
	BEE2	Bee Creek @ Road Runner Road	322
	BEE3	Bee Creek @ Loop 360	1104
Bull Creek	BULL1	Bull Creek Above West Bull Creek	347
	BULL2	Bull Creek @ St. Edwards Park above dam	920
	BULL3	Bull Creek Above Trib 7 (Franklin)	349
Carson Creek	CAR1	Carson Creek @ Shady Spring Subdivision	1094
	CAR2	Carson Creek @ Hoecke Lane	1096
Dry Creek (North)	DRN1	Dry Creek (North) @ Mt Bonnel Rd	1108
	DRN2	Dry Creek (North) @ FM 2222	1109
Eanes Creek	EAN1	*no flow, no sampling in reach*	
	EAN2	Eanes Creek @ Camp Craft Road	1106
Lake Creek	LKC1	Lake Creek @ Sugar Berry Cove	1098
	LKC2	Lake Creek @ Shadowbrook Club	3978
	LKC3	Lake Creek Below Meadowheath Drive	1100
Little Barton Creek	LBA1	Little Barton Creek @ Barton Creek (LBC)	77
	LBA2	Little Barton Creek @ Great Divide Dr	1114
	LBA3	Little Barton Creek @ Hamilton Pool Rd	1115
Little Bear Creek	LBR1	Little Bear Creek @ Bear Creek	1101
	LBR2	Little Bear @ Ashmun Property	3374
Little Bee Creek	LBE1	Little Bee Creek @ Red Bud Trail	1105
Onion Creek	ONI1	Onion Creek @ South Austin Regional WWTP (SAR)	1366
	ONI2	Onion Creek @ McKinney Falls Below Lower Falls	255
	ONI3	Onion Creek Above Footbridge (OC3)	241
	ONI4	Onion Creek @ Twin Creeks Road (OC1)	236
	ONI4a	*no flow, no sampling in reach*	
	ONI5	Onion Creek near Driftwood (Hwy 150)	612
	ONI6	Onion Creek at Pfulman Ranch	1365
Rattan Creek	RAT1	Rattan Creek @ Shadowbrook Circle	1097
	RAT2	Rattan Creek Above Parmer Lane	1009
Slaughter Creek	SLA1	Slaughter Creek @ Pine Valley Drive	1082
	SLA2	*no flow, no sampling in reach*	
	SLA3	Slaughter Creek @ FM 1826 (USGS)	623
South Boggy Creek	SBO1	South Boggy Creek @ Bluff Springs Road (BO1)	227
	SBO2	South Boggy Creek @ W. Dittmar Rd	1081
Taylor Slough (North)	TSN1	Taylor Slough North @ Mayfield Park	3969
Taylor Slough (South)	TSS1	Taylor Slough South @ Reed Park (TSS)	318
West Bull Creek	WBL1	West Bull Creek Above Bull Creek (EK)	343

	WBL2	West Bull Creek @ Bell Mt. Road (ED)	148

Phase III - (sites monitored in Year 2002, 2005, 2008, etc)

Watershed	Reach	Site Name	FSDB #
Cottonmouth Creek	CTM1	Cottonmouth Creek @ Dee Gabriel-Collins Rd.	1206
Decker Creek	DKR1	Decker Creek @ Gilbert	1974
	DKR2	Decker Lake—NO SAMPLING	
	DKR3	Decker Creek @ Lindell Lane	1196
Dry Creek (South)	DRE1	Dry Creek (South) @ Wolf Lane	1210
	DRE2	Dry Creek (South) @ Pearce Rd.	1211
Elm	ELM1	Elm Creek @ Austin Colony	3614
	ELM2	Elm Creek @ FM 973	1204
Gilleland	GIL1	Gilleland Creek @ FM 969	886
	GIL2	Gilleland Creek @ FM 973	1192
	GIL3	Gilleland Creek @ West Parsons St.	1191
	GIL4	West Gilleland Creek @ Cameron Rd.	1194
	GIL5	Gilleland Creek @ Cameron Road	1914
	GIL6	Gilleland Creek @ South Railroad Ave.	1193
Harris	HRS1	Harris Branch Creek @ Boyce Ln.	1201
	HRS2	Harris Branch Creek @ Crystal Bend Dr.	1199
Lake Austin	LKA1	Turkey Creek @ City Park Road	1221
	LKA2	Cuernavaca Creek @ River Hills Road	1222
	LKA3	Panther Hollow Creek @ Big View Road	1223
	LKA4	Common Ford Trib. in Common Ford Metro Park	1048
	LKA5	Unnamed Trib. @ Running Deer Trail (AST)	316
	LKA6	Bear Creek (West) @ Fritz Hughes Park Rd.	1224
Marble	MAR1	Marble Creek above Onion Creek (M1)	231
	MAR2	Marble Creek @ Thaxton (M2)	232
North Fork Dry	NFD1	North Fork Dry Creek @ FM 812	1217
South Fork Dry	SFD1	South Fork Dry Creek @ FM 812	1216
	SFD2	South Fork Dry Creek @ US 183	1215
Rinard	RIN1	Rinard Creek @ Bradshaw	233
	RIN2	Rinard Creek @ FM 1327	1220
	RIN3	Rinard Creek @ FM 1327 & Bradshaw Rd.	1219

12. Describe special sample conditions. List only deviations from routine non-storm conditions as described in the SOP manual.
Samples will be collected under non-storm conditions as defined by the SOP manual. Average rainfall totals will be calculated using current FEWS data, available at:
http://162.89.0.110/rptprec.html?

Average rainfall totals will be calculated from the 24-hour period preceding 08:00am on the day of the EII sampling event, and compared to the criteria in Table 1 to determine if baseflow conditions exist and sampling may occur. Non-baseflow (storm-influenced) flow conditions exist if the average rainfall is within or exceeds the ranges during the antecedent periods specified in Table 1. Field personnel will note the flow condition on field sheets, and input the flow type into the FSDB along with field and ERM lab data.

Table 1. Rainfall totals within antecedent time periods used to determine storm-influenced flow conditions.

Average Rainfall in 24-Hour Period* Prior to Sampling (Inches)	Time to Wait until Baseflow Conditions Return (Hours)
≥0.10	24
≥0.25	48
>1.00	72

*24-hour period ends at 08:00am on the day of sampling.

For each EII sampling phase, the rainfall totals from 6 FEWS gages (with the exception of Phase III) will be used to estimate the average total rainfall (Table 1a). If data from one of the gages is missing, it will simply not be included in the average.

Table 1a. FEWS gages used in determining rainfall totals by EII phase.

Phase I	**Phase II**	**Phase III**
FEWS 2500	FEWS 2600	FEWS 1600
FEWS 3310	FEWS 1160	FEWS 1500
FEWS 1140	FEWS 3500	FEWS 2030
FEWS 0910	FEWS 0700	FEWS 1900
FEWS 0850	FEWS 3610	
FEWS 2050	FEWS 1810	

13. Describe special collection methods. List only deviations from routine sample collection methods as listed in the SOP manual.
N/A

14. List special laboratory analytical methods. Include details on CRP requirements, non-EPA approved methods and in-house analyses (Ohmicron).
N/A

15. Where will the samples be analyzed?
In-house (ERM), W/WW and the field as specified in item #11

16. How much will samples cost?
    Each water quality sample submitted to the Walnut Creek lab will cost $22.00 per site.

EII Phase	Annual W/WW Cost (Water)
I	$1,540.00
II	$1,886.50
III	$1,270.50

17. What possible problems may arise in sample collection and what actions can be taken to mitigate their impact?
    Sites may be dry at time of sample collection. If dry, the site will not be sampled. If site is dry for all events during a collection year, the site may be dropped or moved within the reach as determined during the annual review.

Validation

18. What type, how often and where will QA/QC samples will be collected? Include QA/QC samples names in the FSDB if applicable.
    One field replicate sample will be collected by each team during each quarterly water quality sampling event. One blank sample (for W/WW lab only--no field blanks for ERM lab) will be collected by each sampling team once per sampling year. Blank samples should be staggered so that team one collects a blank in the first quarter, team two in the second quarter, and so on. Only one blank is necessary per sampling event, yielding a total of four blank samples per year. Blank and replicate sample names, along with the real sample site location at which the blank and replicate should be generated are presented.

    List of QA/QC Sample Names and Associated Sample Sites by Phase

Phase	Sample Location		Replicate Identifier		Blank Identifier	
1	3854	West Bouldin @ Oltorf	280	E. Bouldin @ Gillis park	133	Blunn @ Almeda
1	879	Above Dams Between Pool	2974	Barton @ Upper Barton	333	Barton @ Aracuana Pass
1	38	Waller @ Caesar Chavez	70	Waller @ Franklin Rd	640	Waller @ Harris Ave
1	464	Walnut @ IH 35	1940	Walnut @ TCEQ	740	Walnut @ Samsung
2	1365	Onion Creek @ Pfulman Ranch	982	Onion @ Brandt Rd	251	Onion @ County Line
2	319	Bee Creek @ Lake Austin	309	Bee @ Hidden Cv	1063	Little Bee @ Double Fork Rd
2	151	Collapsed bridge trib 6	1465	Bull Bedrock Trib	1155	White Trib @ Maiden Fern
2	1084	Slaughter Branch @ Hwy 45 West	1061	Slaughter @ Wildwood	566	Little Bear @ Chapparal Rd
3	1224	Bear (West) @ Fritz Hughes Park Rd	963	Bear (West) @ Medina Way	1062	Elm @ Imperial Rd
3	886	Gilleland Creek @ FM 969	1065	Gilleland @ Glass Rd	901	Harris Branch @ Gregg Ln
3	1207	Cottonmouth Creek @ Colton Road	2993	Cottonmouth @ Hillmoore Dr	1153	Marble @ Yarrabee Bend
3	1210	Dry Creek @ Wolf Lane	1225	Dry @ Kalinda Rd	1250	Dry @ Man O War Ave

19. In addition to the automated data flagging process, how will QA/QC results be used to validate data quality?
    N/A

20. In case of QA/QC failure, what corrective action will be taken?
    <INSERT TEXT>

Assessment

21. By what specific methods will the data be analyzed?
Scores will be calculated on a 100-point scale using SAS, and stored as integer values in the Field Sampling Database. Measured values will be compared to q-curves for each component of the sub-indices to generate a score from 0 to 100. Weighted component scores will be combined to generate the individual sub-index scores for each site. Values of the six sub-indices for each site will be averaged to generate a total site EII score for a given sampling year. The individual sub-index scores for each watershed will be averaged to generate the total sub-index scores for each watershed in a given sampling year. Values of the watershed sub-index scores will be averaged to generate the total watershed EII score for each watershed in a given sampling year. Average site scores will NOT be averaged to generate the total watershed score. More information on calculation methodology can be found in the EII Methodology Report.

Overall Sediment Quality Sub-index scores are calculated by a slightly different method than other sub-indices. Although individual parameters have unique q-curves, the values for each of the parameters are combined into three groups by parameter type (metals, pesticides, PAHs) which are then averaged equally to generate the total Sediment Quality Sub-index score.

Q-curve values for water quality, contact recreation and sediment parameters are presented below.

Table a. Q-curve value breakpoints for Water Quality Sub-index parameters.

Parameter	Weight	100	75	50	25	0
E coli (col/100mL)	0.2	1	41	72	490	89460
Conductivity (µS/cm)	0.2	0	537	674	796	2330
Nitrate (mg/L)	0.2	0.06	0.10	0.30	0.70	19.5
TSS (mg/L)	0.2	0.5	1.1	1.7	5.7	890
Ammonia (mg/L)	0.1	0.01	0.015	0.020	0.050	2.75
Orthophosphorus (mg/L)	0.1	0.01	0.02	0.05	0.08	3.1

Table b. Q-curve value breakpoints for E Coli.

Parameter	100	75	50	25	0
E coli (col/100mL)	1	41	72	490	89460

22. What hypotheses will be tested?
All individual component, sub-index or index scores for every site and watershed have not changed from previous scores by more than one EII category.

23. When and/or how often will the data be analyzed?
Data will be analyzed annually in January, or as soon as all data has been received from laboratory.

24. How will it be determined that the study objectives have been met?
<INSERT TEXT>

Reporting

25. When and what type of reports will be generated? Who will generate the report?
    Data will be included in annual State of the Environment Report.

    A major review will be conducted once every third year (2006) by WMA representative.

    Annual data reports will be completed by Andrew Clamann.

26. Who will review the reports prior to publication?
    Mateo Scoggins, Ed Peacock, Martha Turner

References

<INSERT TEXT>