Pesticide Monitoring Results for Tule Lake, California, 2007

U.S. Department of the Interior
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Prepared in cooperation with the U.S Fish and Wildlife Service

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Introduction

Background
Tule Lake is located in north-central California and is the historic terminus of the Lost River watershed. Beginning in 1910, Tule Lake was dewatered and subsequently homesteaded between 1917 and 1949 for agricultural production (Reclamation 2000). To protect against flooding, areas at lower elevations were designated as sump areas and reserved for flood control. In addition to providing flood control, the sump areas also preserved some of the existing marsh habitat, which has been incorporated within the Klamath Basin's national wildlife refuges. Some of the marginal sump acreage subject to less frequent flooding was made available for leasing, but retained in federal ownership (Reclamation 2000). During 2007, the Bureau of Reclamation Klamath Basin Area Office (KBAO) administered lease contracts for crop production on approximately 16,170 acres of these lands, which are within Tule Lake National Wildlife Refuge.

KBAO is responsible for ensuring that farming practices within the Tule Lake Lease Lands (Lease Lands), including herbicide, fungicide, and insecticide (pesticide) application, meet all applicable regulations. Proper pesticide application on the Lease Lands and private lands surrounding Tule Lake is of particular concern since two fish species reside in Tule Lake that are listed as endangered under the Endangered Species Act (ESA), the Lost River (*Deltistes luxatus*) and shortnose (*Chasmistes brevirostris*) suckers.

Purpose and Objectives
The purpose of this pesticide monitoring program (Program) is to identify if pesticides are present in Tule Lake and provide information on the potential for pesticides applied within the Lease Lands to reach the waters of Tule Lake.

The objectives of the Program are to determine if pesticides are present in Tule Lake, determine if detected pesticides could have originated from the Lease Lands, and determine if pesticide concentrations in Tule Lake are at levels great enough to be harmful to ESA listed suckers. To accomplish these objectives, samples were collected from Tule Lake and analyzed for a suite of pesticides (and degradates). The selected analyses are for pesticides that are used on lands surrounding Tule Lake, known to persist in water, may be harmful to ESA listed suckers, and/or are of concern to management agencies. Reported pesticide concentrations are then compared with levels known to cause harm to fish to determine if pesticide concentrations within Tule Lake are great enough to be of concern for ESA listed suckers. Also, the dates of confirmed pesticide detections are compared to the dates and locations of pesticide application within the Lease Lands to determine if the pesticides could have originated from the Lease Lands. This program is not intended to pinpoint the origin of detected pesticides, rather to provide insight on the potential for pesticides used in the Lease Lands to reach the waters of Tule Lake.

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Methods

Study Design
The study design as well as selected pesticide analyses were developed and selected in coordination with the U.S. Fish and Wildlife Service, Klamath Basin National Wildlife Refuge Complex.

Four locations were sampled every two weeks during the pesticide application season, from April 2007 through October 2007. Three of the sampling sites are located within the lake and one located in the Lost River immediately upstream of Tule Lake. Table 1 lists the site locations and coordinates. See Figure 1 for a map of the sampling locations. The sampling locations were selected in close proximity to the Lease Lands, to target areas previously known to be utilized by suckers, to obtain sufficient spatial coverage of Tule Lake, and to identify possible pesticide inputs from the Lost River.

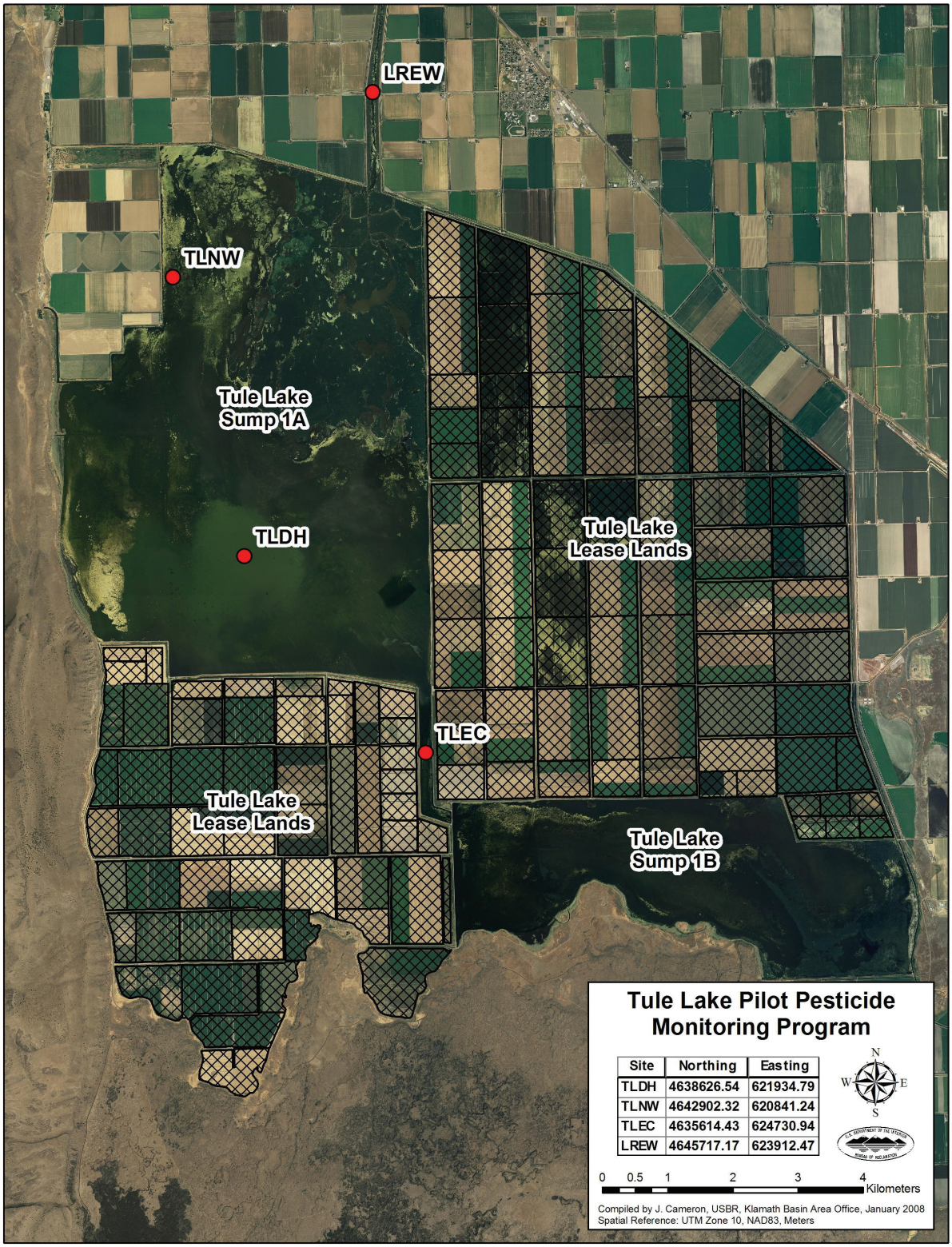
Table 1. Sample Sites and Locations

Site ID	Site Location	UTM (Easting)	UTM (Northing)
TLDH	Tule Lake at the Donut Hole	621934.79	4638626.54
TLNW	Tule Lake at North West Corner	620841.24	4642902.32
TLEC	Tule Lake at the English Channel	624730.94	4635614.43
LREW	Lost River at East-West Road	623912.47	4645717.17
Spatial Reference: UTM Zone 10, NAD83, Meters			

The Program consists of two sub-programs:

- Grab Samples: Water quality grab samples were collected approximately every two weeks from April through October. Details on sample collection methodology can be found in the Sample Collection and Analysis section of this report. A full list of analyses, reporting limits, and quality assurance criteria can be found in Table A-1 and A-2 in Appendix A. Multi-probe profiles are obtained, as described below, when a grab sample is collected.

Figure 1. Map of Tule Lake and Lost River Sampling Locations



- Instantaneous Acquisition of Physical Parameters (Profile): Physical parameters were measured with multi-probe instrumentation when a grab sample is obtained. Parameters include temperature, dissolved oxygen, pH, and specific conductance. A full profile of the water column is sampled where measurements are obtained at 0.1m, 0.5m, 1.0m, and at one-meter intervals thereafter until the bottom is reached. The probes of the multi-parameter unit are approximately 0.1m above the sediment for the bottom reading. Air temperature, wind speed, wind direction, secchi disk depth, visual algal classification, and turbidity are also measured when a profile is acquired.

Grab samples were analyzed for a targeted list of pesticides for every sampling event and a full multi-residue screen, consisting of more than 160 compounds, for some of the mid-month sampling events. Table 2 lists the sampling dates and analyses conducted. A full list of analyses, reporting limits, and quality assurance criteria for the targeted list and the multi-residue screen can be found in Tables A-1 and A-2 in Appendix A. The targeted list consists of 20 compounds that are of particular concern. The compounds included in the targeted list are in pesticides that are applied on the Lease Lands and are of particular interest because they are known to persist in water, may be harmful or lethal to listed suckers, and/or are of concern to management agencies. Individual analyses were selected for these compounds since they could be detected at lower reporting limits than when the compounds are included as part of the full multi-residue screen. The full multi-residue screen was selected for analysis to provide insight on the presence or absence of a wide range of pesticides within Tule Lake, although many of the compounds are not used on the Lease Lands.

Table 2. Sampling Dates and Analyses

Date	Targeted List	Multi-Residue Screen
4/30/07	X	
5/16/07	X	X
5/29/07	X*	
6/13/07	X	X
6/25/07	X	
7/16/07	X	X
7/26/07	X	
8/9/07	X	X
8/23/07	X	
9/6/07	X	
9/24/07	X	
10/3/07	X	
10/27/07	X	

*TLNW was not sampled on 5/29/07 due to boat failure.

Sample Collection and Analysis
All water samples are collected using the grab-sample method. Specially cleaned amber glass bottles, approved for pesticide sample collection, are used to collect water from immediately below the waters surface (approximately 0.1 meters in depth). The field sampler uses a clean pair of latex or nitrile gloves at each sampling location to prevent sample contamination. All bottles are rinsed three times with environmental water prior to sample collection. Samples collected in the field are clearly labeled with a sample identification number, analyses required, date and time of sample collection, and the initials of field samplers. Upon collection in the field, water samples are placed in ice chests and covered with ice to preserve the samples.

All samples collected in the field are recorded on a Chain Of Custody (COC) form and a field data sheet. The COC and the field data sheet clearly document all samples collected during each sampling event, associated sample identification numbers, and the date and time of collection for each sample. The field copy of the COC is removed and kept at KBAO with the field records. The remaining copies of the COC are placed in the ice chest in a zip-lock plastic bag and will accompany the samples to the laboratory. A signed and dated custody seal is attached across the opening of the ice chest by the field sampler to indicate if sample tampering has occurred while in route to the laboratory. A commercial package carrier is used to transport the ice chests containing the samples. An original copy of the COC sheet is kept on file at the laboratory and the other copy returned to KBAO with the sample analysis results report.

Samples collected for pesticide analysis are sent to Pacific Agricultural Laboratory (PAL) located in Portland, Oregon. PAL employs the analytical methodologies listed in Table 3 for sample analysis. PAL performs laboratory instrument calibrations according to the procedures and frequencies as required for the analytical methods.

Table 3. Analytical Methodologies Employed by Pacific Agricultural Laboratory

Analyses	Analytical Method
Chlorinated Acid Herbicides	EPA 8151A (GC-ECD)
Organochlorine Pesticides	Modified EPA 8081A (GC-FPD)
Organophosphorous and Organosulphur Pesticides	Modified EPA 8141A (GC-MS)
Organonitrogen Pesticides	Modified EPA 8270C (GC-MS)
Phenylurea Herbicides	EPA 8321A (HPLC-MS)
Carbamate Pesticides	EPA 8321A (HPLC-MS)
Table adapted from Pacific Agricultural Laboratory Services Catalog, 2006.	

The in-situ water quality information is collected as described by the KBAO Standard Operating Procedure (SOP) for Multi-Probe Field Measurements (Appendix B). Physical water quality parameters including temperature, specific conductivity, pH, and dissolved oxygen are collected with a YSI 600XLM multi-probe instrument. Turbidity is collected with a Hach 2100-P portable turbidimeter. Air temperature, wind speed, wind direction, secchi disk depth, visual algal

density classification, and turbidity are collected as described in the KBAO SOP for Multi-Probe Field Measurements (Appendix B).

Quality Assurance of Data
The YSI 600XLM multi-probe instrument used to collect the physical water quality parameters is calibrated prior to use according to the manufactures recommended procedures. Multi-probe calibration information is recorded on calibration sheets, which are filed at KBAO. The Hach 2100-P portable turbidimeter is calibrated according to manufacturer specifications and the calibration information is recorded on forms filed at KBAO.

Field personnel incorporate two external Quality Assurance (QA) samples (one blank and one duplicate) per sampling event to check laboratory contamination and precision. Field samplers label these external QA check samples with identifications similar to production samples so they can pass as double-blind samples (samples are not identified as an external QA sample). The KBAO QA officer ensures that field personnel properly prepare external QA check samples.

Tables A-1 and A-2 in Appendix A summarize the acceptance levels for the external QA samples submitted to the laboratory with the production samples. To evaluate external QA check samples, KBAO will follow the protocol outlined in the QA SOP supplied by the MP-Reclamation Environmental Monitoring Branch in Sacramento, CA (Reclamation 2001). Part of the data assessment process involves the reanalysis of external QA check samples for project parameters or the whole project for certain parameters if external QA check sample results are not confirmed upon reanalysis. PAL also incorporates Quality Control (QC) check samples to ensure data quality. The laboratory's QC check samples must meet certain levels of acceptability when analyzed with the production samples. Part of the data verification process involves checking these laboratory QC check sample results to ensure they are within acceptable ranges. If a laboratory QC check sample fails to demonstrate an acceptable result, the anomaly is explained with a footnote or included in the case narrative section of the PAL data report. The KBAO QA officer reviews and verifies all data generated from this Program according to the MP-Reclamation QA SOP.

After each analysis report is received from PAL, calculations and determinations for precision and contamination were made immediately and corrective actions implemented when needed. If data quality indicators failed to meet the project's specifications, reanalysis was requested. The cause of failure was evaluated to determine why the QA samples failed to meet the data quality objectives of the Program. If the problem is laboratory related, the laboratory program manager was contacted and corrective actions implemented.

When external QA check samples are incorporated into a batch of production samples submitted to PAL, the laboratory must meet certain standards of acceptance for the data to be approved as reliable. For this project, the standards of acceptability for the external QA check samples are:

Duplicates: For values > 5X Reporting Limit (RL), %RPD $\leq$ 20%
For values $\leq$ 5X RL, values may vary by a range of 1 RL

Blanks: Blank concentration should be less than 10% of lowest sample concentration or less than a range of two times the RL.

Reclamation uses the following equations to validate data:

Relative percent difference: A statistic for evaluating the precision of a duplicate set. For duplicate results X1 and X2:

$$\%RPD = ((X1-X2)/(X1+X2/2)) \times 100$$

Precision: A measurement of mutual agreement (or variability) among individual measurements of the same property, usually under prescribed similar conditions. Precision is usually expressed in terms of relative percent difference, but can be expressed in terms of range.

Range: The difference between the largest and smallest numbers in a set of numbers.

Results and Discussion

Physical Water Quality Parameters
Physical parameters collected with multi-probe instrumentation including temperature, dissolved oxygen, pH, and specific conductance are summarized in Appendix C, Table C-1. The other field parameters including air temperature, wind speed, wind direction, secchi disk depth, visual algal density classification, and turbidity are summarized in Appendix D, Table D-1.

Detected Compounds
Few pesticide compounds were detected during the course of this Project. Only five out of approximately 160 compounds were detected during four of the 13 sampling events. However, some of the reported detections failed to meet the quality assurance criteria for the Project. This issue is discussed in greater detail in the Data Quality section of the report below. Table 4 summarizes the detected compounds, sampling dates, reported concentrations, and other information associated with each sample. Samples that were collected for all other sites, dates, and compounds not listed in Table 4 were reported as Not Detected (ND).

Data Quality
The compound 2,4-D was reported in the sample collected at the TLEC location during the 4/30/07 sampling event. The duplicate sample, which was collected at the same location, confirmed the analysis of the regular sample. Reanalysis was not requested for these samples since the difference between the two samples met the data quality objective for the Project.

Table 4. Summary of Detected Compounds for the 2007 Sampling Events

Date	Site	Compound	Regular Sample, µg/L	Duplicate Sample, µg/L	Regular Sample Reanalysis, µg/L	Duplicate Sample Reanalysis, µg/L	Reporting Limit, µg/L
4/30/07	TLEC	2,4-D	0.25	0.22	NR	NR	0.20
4/30/07	LREW	Pendimethalin	0.082	N/A	NR	N/A	0.060
5/16/07	TLDH	Chlorpyrifos	0.19*	ND	ND[1]	ND[1]	0.060
5/16/07	TLDH	Oxyfluorfen	0.065	ND	ND[1]	ND[1]	0.060
5/16/07	TLDH	Pendimethalin	0.070	ND	ND[1]	ND[1]	0.060
5/16/07	TLEC	Chlorpyrifos	0.11*	N/A	Disposed	N/A	0.060
5/16/07	LREW	Pendimethalin	0.074	N/A	Disposed	N/A	0.060
5/16/07	TLNW	Chlorpyrifos	0.26*	N/A	Disposed	N/A	0.060
6/13/07	TLEC	Carbaryl	0.47	N/A	NR	N/A	0.12
7/26/07	TLEC	Pendimethalin	0.079	ND	ND[1]	ND[1]	0.060

*Likely false detections due to in-lab contamination of samples.
N/A - No duplicate sample collected with regular sample.
ND - Not detected at the specified reporting limit.
ND[1] - Re-extraction and reanalysis of the sample occurred beyond the 7-day recommended hold time.
NR - Sample not reanalyzed.
Disposed - Sample disposed of by lab before reanalysis could be requested.

Chlorpyrifos was reported for samples collected on 5/16/07 at three different sampling locations; TLDH, TLEC, and TLNW. However, the duplicate sample associated with TLDH was reported as ND. This is greater than the 20% RPD data quality objective set for the Project. Therefore, reanalysis was requested for the regular and duplicate samples. Reanalysis did not confirm the initial analyses, as both the regular and duplicate samples were reported as ND. Following reanalysis of the samples, the PAL lab manager was contacted as to address the discrepancy. The PAL lab manager stated that in-lab cross contamination during the initial analysis of the TLDH, TLEC, and TLNW samples had likely occurred from another project. PAL had analyzed samples high in chlorpyrifos, from another project, in the same batch as these samples. Therefore, it's likely that the detections for chlorpyrifos on 5/16/07 at all three locations (TLDH, TLEC, and TLNW) are artificial and would have otherwise been ND. It is important to note that the sample reanalysis occurred beyond the recommended hold time of 7-days. However, with an initial concentration of 0.19 µg/L, chlorpyrifos should have been detected during reanalysis, even with potential sample degradation. Following the discovery that in-lab cross contamination had likely occurred, reanalysis for chlorpyrifos was requested on the remaining samples that had been reported with positive detection of chlorpyrifos (TLNW and TLEC) for the 5/16/07 sampling event. However, the lab had already disposed of all the samples from the 5/16/07 sampling event. Two other compounds, pendimethalin and oxyfluorfen, were also reported in some of the samples collected during the 5/16/07 sampling event. The difference between the regular and duplicate samples for these two compounds failed to meet the data quality objectives for the Project and reanalysis was requested. The reanalysis of the regular and duplicate samples were reported as ND for both pendimethalin and oxyfluorfen. The reanalysis of these samples

occurred beyond the 7-day hold time. Considering the very low concentrations reported for the initial analysis, the pendimethalin and oxyfluorfen could have degraded enough that upon reanalysis there were insufficient levels of the compounds left to detect.

Pendimethalin was reported for the sample collected at the TLEC sampling location on 7/26/07. However, the duplicate sample associated with TLEC was reported as ND. Reanalysis was requested for the samples even though the difference between the regular and duplicate samples met the data quality objective of one RL difference. Upon reanalysis both the regular and duplicate samples were reported as ND. The reanalysis of these samples occurred beyond the 7-day hold time. Considering the very low concentration reported for the initial analysis, the pendimethalin could have degraded enough that when reanalysis was conducted there was an insufficient level of pendimethalin left to detect.

Determination of the Origin of Detected Compounds

The dates and locations of pesticide detections were compared to dates and locations of pesticide application within the Lease Lands to determine if the detected pesticides may have originated from the Lease Lands or from private lands. If pesticides were detected in Tule Lake prior to the application of products containing the detected compound or if products containing the compound were not applied to the Lease Lands, then the compounds must have originated from private lands. If pesticides are detected in Tule Lake in close proximity and following pesticide application on the Lease Lands, then the pesticides may have originated from the Lease Lands. This provides insight to the likelihood of Lease Land pesticide application being responsible for pesticide detections in Tule Lake, but does not positively determine that the compound originated from the Lease Lands.

A positive detection of 2,4-D was identified on 4/30/07 in Tule Lake at the TLEC sampling location, which is located in close proximity to the Lease Lands. Weedar 64, which contains 2,4-D, was applied at several locations within the Lease Lands on 4/26/07. Considering the close proximity of the sampling location to the application sites within the Lease Lands, it's likely though not definitive, that the 2,4-D originated from the Lease Lands.

Lorsban, which contains chlorpyrifos, had been applied within the Lease Lands prior to the chlorpyrifos detections at TLDH, TLEC, and TLNW on 5/16/07. However, as discussed in the Data Quality section, it's very likely that the detections of chlorpyrifos are artificial and are due to in-lab cross contamination. In addition, it's highly unlikely that similar concentrations of chlorpyrifos would be observed across the entire lake (more than 8 KM between sampling locations), which further suggests in-lab contamination of the samples. Within the Lease Lands Lorsban is applied in granular form with seed at planting. The Lorsban and seed is then covered by a layer of soil approximately 1 inch deep (USDOI 2006). Chlorpyrifos strongly adsorbs to soil particles and has a low solubility in water (Extension Toxicology Network 1996; WHO 2004), making the probability of mobilization to Tule Lake from a soil based application extremely low. If the detections of chlorpyrifos are actual detections, and not due to in-lab contamination, it's improbable that the chlorpyrifos originated in the Lease Lands because of the

method of application and the spatial distribution of reported concentrations. Also, the highest concentration of chlorpyrifos was reported in the sample obtained farthest from the Lease Lands and the location closest to the Lease Lands had the lowest reported concentration. This, if the detections are valid, is an indication of an origin outside of the Lease Lands.

Pendimethalin was reported in four samples collected during 2007. However, the duplicates associated with three of the detections failed to meet the data quality objectives for the Project and may not have been valid detections. Regardless, products containing pendimethalin were not used on the Lease Lands in 2007. Therefore, the origin of pendimethalin, if the detections were valid, must have been from private lands outside of the Lease Lands.

Oxyfluorfen was reported in one sample collected during 2007, however the associated duplicate sample failed to meet the data quality objectives for the Project and this may not have been a valid detection. The sample reported as containing oxyfluorfen was collected on 5/16/07, which is during the typical use period for oxyfluorfen on the Lease Lands and on private lands in the Tule Lake area. Considering the close proximity of the sampling location to the Lease Lands, it's possible, though not definitive, that the oxyfluorfen originated from the Lease Lands.

Carbaryl was reported in one sample collected during the 2007 sampling season. This sample was collected at the TLEC sampling location on 6/13/07. There is no evidence to suggest that the carbaryl detection is invalid. The origin of the carbaryl must have been from private lands, as no products containing carbaryl were approved for use or applied on the Lease Lands in 2007.

Only two of the detected compounds, if the detections are valid, could have reasonably originated from the Lease Lands, 2,4-D and oxyfluorfen. However, this does not definitively confirm that the origin of the pesticides were from the Lease Lands, as these compounds are in wide use throughout the Tule Lake area and could have originated from private lands. No products containing pendimethalin or carbaryl were approved for use on the Lease Lands in 2007, and it's improbable that the chlorpyrifos detections, if valid, originated in the Lease Lands because of the method of application and the spatial distribution of reported concentrations.

Biological Significance of Detected Compounds

Listed below in Table 5 are biologically significant acute and chronic concentrations for the compounds reported in 2007 at the Tule Lake sampling locations. The aquatic life benchmarks provided in Table 5 are based on toxicity values derived from data in support of registration of the listed pesticides (USEPA 2007). Aquatic life benchmarks are estimates of the concentrations below which pesticides are not expected to have the potential for adverse effects on aquatic life (USEPA 2007).

Table 5. Aquatic Life Benchmarks for Fish

Compound	Chronic, µg/L	Acute, µg/L
2,4-D	14,200[1]	50,500[1]
Carbaryl	210[2]	125[2]
Chlorpyrifos	0.57	0.9
Oxyfluorfen	38	100
Pendimethalin	6.3	69

Table adapted from USEPA Aquatic Life Benchmarks, 2007
1 - Original toxicity values are in micrograms of acid equivalents per liter. The toxicity values selected were the lowest available values for the acid or salt forms.
2 - Although the underlying acute toxicity value is greater than the chronic toxicity value, the acute benchmark is lower than the chronic benchmark because acute and chronic toxicity values were multiplied by level of concern values of 0.5 and1, respectively.

Haas (2007) evaluated several pesticides of concern that are used in the Tule Lake area, to assess the potential for pesticide application to affect ESA listed suckers in Tule Lake. Haas (2007) developed No Observed Effect Concentrations (NOEC's) and Lowest Observed Effect Concentrations (LOEC's) for each pesticide. Other researchers have evaluated the potential for herbicides to disrupt fish reproduction and developed NOEC's and LOEC's for these compounds (Xie et al. 2005). Table 6 summarizes the NOEC's and LOEC's listed by Haas (2007) and Xie et al. (2005) for compounds detected during the course of this study.

The USEPA (2007), Haas (2007), and Xie et al. (2005) values provide a good measure of comparison with the concentrations reported during the course of this study. All of the compounds reported during the 2007 sampling events were at concentrations well below the acute and chronic exposure thresholds for fish as determined by USEPA (2007) and the NOEC and LOEC thresholds listed by Haas (2007) and Xie et al. (2005). This indicates that although some small amounts of pesticides may be reaching Tule Lake, the concentrations are low enough that they should not be adversely affecting endangered suckers and other fish within the lake.

Table 6. NOEC's and LOEC's for Detected Compounds

Compound	NOEC, µg/L	LOEC, µg/L
2,4-D[1]	16.4	164
Carbaryl[2]	200	500
Chlorpyrifos[2]	0.57	1.09
Oxyfluorfen[2]	2	20
Pendimethalin[2]	6.3	9.8

1 - Adapted from Xie et al., 2005
2 - Adapted from Haas, 2007

Summary and Conclusions

Summary

Out of 51 samples, 160 compounds, and a total of 3,260 analyses, there were only two valid pesticide detections, 2,4-D (4/30/07) and carbaryl (6/13/07). The 2,4-D detection was just above the level of laboratory detection and was only 1.43% and 0.14% of the NOEC and LOEC, respectively. The carbaryl detection is even less concerning with the reported value at 0.24% and 0.09% of the respective NOEC and LOEC. The results of the Program are encouraging considering the large number of compounds investigated over the course of the entire pesticide application season and only a couple of pesticides were detected at very low levels.

Some issues arose regarding data quality during the Project, which draws into question the validity of some of the reported data. A total five different compounds were detected. However, only two of the detections were not of questionable validity. Due to the data quality issues identified during the course of this study, the monitoring design for future sampling should be modified to address these concerns. Nevertheless, all of the detected compounds were reported at concentrations well below the acute and chronic exposure thresholds (USEPA) and the NOEC and LOEC thresholds (Xie et al. 2005; Haas 2007) for fish, regardless of the validity of the data. This is to say that even if all of the reported detections are valid, the reported concentrations are still much less than the harmful thresholds for fish. This suggests that although some pesticides may be reaching Tule Lake, the concentrations are low enough that they should not be adversely affecting endangered suckers and other fish within the lake. These findings are consistent with the evaluation conducted by Haas (2007), which determined that concentrations of the pesticides of concern applied to the Lease Lands are not likely to exceed thresholds that would negatively impact ESA listed suckers within Tule Lake.

Recommendations for Future Monitoring

Based on the results of the 2007 sampling Program and additional concerns of management agencies, sampling design modifications are warranted. The recommended sampling design for future monitoring is as follows. The future sampling plan should consist of a total of 15 sampling events with the targeted list analyses performed for every sampling event and the full screen included during every mid-month sampling event. To preserve consistency between years the established sampling locations should be maintained. Due to data quality issues that arose during the 2007 sampling Program, quality assurance should be increased. Duplicate samples should be collected and submitted for every sample to improve the confidence in the validity of detections. As with the 2007 Program, one blank should be included in each sample set. Also, arrangements should be made with the laboratory performing the pesticide analyses to ensure that reanalysis of samples will occur within the recommended hold times for the samples, which will increase the reliability of the reanalysis results.

In addition, metam sodium application is of concern to management agencies and should be investigated in the future to assess potential affects to endangered suckers within Tule Lake. Metam sodium application occurs during the early part of the agricultural season, so MITC

(degradation product of metam sodium) analyses should be included during the March through early June sampling period, in addition to the targeted list and full screen analyses (metam sodium rapidly converts to MITC following application, therefore MITC is the compound of concern). Table 7 summarizes the recommended sampling dates and analyses.

Table 7. Recommended Sampling Schedule

Sampling Event	Analyses
Mid-March	Targeted List, Full Screen, and MITC
Early April	Targeted List, and MITC
Mid-April	Targeted List, Full Screen, and MITC
Early May	Targeted List and MITC
Mid-May	Targeted List, Full Screen, and MITC
Early June	Targeted List and MITC
Mid-June	Targeted List and Full Screen
Early July	Targeted List
Mid-July	Targeted List and Full Screen
Early August	Targeted List
Mid-August	Targeted List and Full Screen
Early September	Targeted List
Mid-September	Targeted List and Full Screen
Early October	Targeted List
Mid-October	Targeted List and Full Screen

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Appendix A

Table A-1. Analytes and Data Quality Objectives for Targeted List Compounds

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Chlorinated Acid Herbicides				
2,4-D	0.20	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Dicamba	0.080	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
MCPA	20	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Organochlorine (Halogenated) Pesticides				
Chlorothalonil	0.060	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Oxyfluorfen	0.060	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Pendimethalin	0.060	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Permethrin	0.60	[>5x RL] = 0%-20% [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Organophosphorous and Organosulfur Pesticides				
Chlorpyrifos	0.060	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Disulfoton	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Malaoxon	0.30	[>5x RL] = 0%-20% [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Malathion	0.30	[>5x RL] = 0%-20% [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Organonitrogen Pesticides				
Azoxystrobin	0.030	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenoxaprop-ethyl	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Imidacloprid	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Metalaxyl-M	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Metribuzin	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Simazine	0.60	[>5x RL] = 0%-20% [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Phenylurea Herbicides				
DCPMU (Diuron degradate)	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Diuron	0.030	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Carbamate Pesticides				
Oxamyl	0.030	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

RL = Reporting Limit [ ] = If concentration of determination is...

Table A-2. Analytes and Data Quality Objectives for Multi-residue Screen Compounds

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Organochlorine (Halogenated) Pesticides				
Acetachlor	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Alachlor	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Aldrin	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Benfluralin	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Bifenthrin	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
α-BHC	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
β-BHC	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
δ-BHC	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
γ-BHC	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Captafol	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Captan	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Chlordane	1.2	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Chloroneb	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Chlorobenzilate	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Chlorothalonil	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Cyfluthrin	1.2	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Cyhalothrin	1.2	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Cypermethrin	1.2	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Dacthal	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
p,p'-DDD	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
p,p'-DDE	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
p,p'-DDT	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Deltamethrin	1.2	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Dicloran	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Dieldrin	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Endosulfan I	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Endosulfan II	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Endosulfan Sulfate	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Endrin	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Endrin aldehyde	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Esfenvalerate	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Ethalfluralin	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenarimol	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenvalerate	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Flutolanil	1.2	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Folpet	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Heptachlor	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Heptachlor epoxide	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Hexachlorobenzene	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Iprodione	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Kelthane	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Metolachlor	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Methoxychlor	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Mirex	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Norflurazon	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Ovex	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Oxyfluorfen	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
PCA	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
PCNB	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Pendimethalin	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Permethrin	1.2	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Prodiamine	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Pronamide	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Propachlor	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Propanil	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Propiconazole	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Pyrethrins	1.2	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Terbacil	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Toxaphene	6.0	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Trifloxystrobin	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Triflumazole	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Trifluralin	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Vinclozalin	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Organophosphorous and Organosulfur Pesticides				
Aspon	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Azinphos-methyl	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Bolstar	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Carbofenothion	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Chlorfenvinphos	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Chlorpyrifos	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Chlorpyrifos-methyl	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Coumaphos	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Demeton-O	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Demeton-S	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Diazinon	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Dichlorfenthion	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Dichlorvos	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Dicrotophos	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Dimethoate	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Disulfoton	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
EPN	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Ethion	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Ethoprop	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Famphur	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenitrothion	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fensulfothion	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenthion	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Malathion	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Methidathion	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Mevinphos	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Monocrotophos	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Parathion	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Parathion-methyl	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Primiphos-methyl	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Phorate	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Phosphamidon	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Phosmet	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Propargite	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Tetrachlorvinphos	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Terbufos	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Trichlorfon	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Organonitrogen Pesticides				
Amitraz	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Ametryn	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Atazine	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Azoxystrobin	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Bromacil	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Bromopropylate	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Carfentrazone-ethyl	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Cyanazine	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Diclofop-methyl	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Dimethenamid	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Ethofumesate	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenoxaprop-ethyl	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenbuconazole	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenhexamid	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fipronil	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fluazifop-P-butyl	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fludioxanil	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Flumioxazin	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fluometuron	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fluoxypyr-meptyl	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Hexazione	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Imidacloprid	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Isoxaben	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Mefenoxam	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Metalaxyl	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Metribuzin	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Myclobutanil	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Oryzalin	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Pirimicarb	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Prometon	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Prometryn	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Propazine	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Pyraclostrobin	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Pyridaben	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Sethoxydim	6.0	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Simazine	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Simetryn	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Sulfentrazone	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Tebuconazole	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Tebuthiuron	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Thiabendazole	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Triadimefon	0.60	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Phenylurea Herbicides				
Chlorpropham	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Diuron	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
DCPMU (Diuron degradate)	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenuron	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Linuron	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Monuron	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Neburon	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Propham	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Siduron	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Carbamate Pesticides				
Aldicarb	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Aldicarb sulfone	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Aldicarb sulfoxide	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Bendiocarb	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

Parameters	Reporting Limit, µg/L	Precision (Duplicate, % RPD)	Contamination (Blank)	Corrective Actions
Carbaryl	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Carbofuran	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Fenobucarb	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
3-Hydroxycarbofuran	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Methiocarb	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Methomyl	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Oxamyl	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Propoxur	0.12	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample
Thiobencarb	0.30	[>5x RL] = 0%-20%, [≤ 5x RL] difference within ± RL	<2RL or <0.1 x [lowest sample]	Re-analyze sample

RL = Reporting Limit [ ] = If concentration of determination is...

Appendix B

KBAO Standard Operating Procedure for Multi-Probe Field Measurements

Required Equipment and Supplies

- Field datasheets
- Clipboard
- List of multi-probes to retrieve
- Sharpie pens
- Rite in the Rain pens
- Multi-probe profile unit
- 2 YSI field cables
- 2 YSI 650 MDS handheld units
- Multi-probes for deployment in a protective carrying case
- Bucket for side-by-side test
- Spare batteries - AA and C cell
- Tools to replace batteries
- Turbidity water sampler
- Turbidity meter
- Secchi disk
- Thermometer/Anemometer
- Keys
- Waders
- Leather and/or rubber gloves

Multi-Probe Profile and Site Field Data Collection

A multi-probe profile of the water column is obtained during a site visit or whenever a multi-probe is deployed or retrieved for continuous data acquisition. Air temperature, wind speed and direction, secchi disk depth, visual algal classification and turbidity are measured when a multi-probe profile is acquired. All data is recorded on the Klamath Basin Area Office (KBAO) Water Quality Profile Field Datasheets using permanent black ink with either "Sharpie ultra fine tip" or "Rite in the Rain" pens. Refer to Table 1 for the significant digits recorded and examples.

- Assemble the multi-probe profile unit upon arrival to the sampling site. Remove the storage cup from the multi-probe profile unit. **Gently** place the sensor guard onto the multi-probe unit and hand tighten **(DO NOT over tighten).** Be aware of the probes

when putting the sensor guard on the multi-probe unit, as they are very fragile and can break from a light impact with the sensor guard.

- Place the multi-probe profile unit in the water body to be measured to begin the stabilization period. Use good judgment and **be aware of potential hazards** when placing the multi-probe into the water. Always obtain multi-probe profiles **downstream of bridge** structures, as the multi-probe may become entangled or impact the pilings under the bridge and cause damage to the unit. Use caution when sampling upstream of a dam or check structure, as the multi-probe can be pulled through the structure and severely damaged. The multi-probe profile unit should be set-up to **stabilize for 120 seconds** and no measurements should be obtained during this stabilization time.

- Place the field thermometer/anemometer in a **shaded location** while the multi-probe is stabilizing. The field thermometer must be exposed to the air at the sampling location for approximately 10 to 15 minutes to get an accurate temperature measurement. Leave the thermometer in the shaded location until the multi-probe profile has been completed and all other field data has been collected. Take the air temperature and wind speed measurements last, immediately prior to leaving the sampling location. This allows adequate time to get an accurate temperature measurement by allowing the thermometer to equilibrate with the air. Air temperature is recorded in centigrade and wind speed is recorded in miles per hour. If wind is less than 5 mph spin thermometer in a circle to cool it off and then take the temperature. Record the air temperature to the nearest five tenths of a degree and the wind speed to the nearest whole number.

- Using the turbidity water sampler, collect sample water from a depth of one-meter when possible. If the depth at the sampling site is too shallow to collect the sample water at one-meter, use good judgment and select an appropriate sampling depth. **Do not collect surface debris or bottom sediment in the sample.** Discard sample water and resample if surface debris or sediment is observed in the turbidity sample water. Ensure the orange filling cap is installed on the turbidity water sampler. The filling cap ensures the sampler fills at the desired depth of one-meter. Thoroughly rinse the turbidity sampler three times with sample water prior to filling. Remove the caps from three turbidity vials and discard the sample water from the previous sampling site. **Do not touch the glass surface** of the turbidity vials. Use a latex glove or the turbidity vial wiping cloth to grasp the turbidity vial and unscrew the cap. Invert the sampler to ensure the sample is uniform. Thoroughly rinse the turbidity vials three times with sample water. Invert the sampler prior to filling each vial to maintain a well mixed sample. Fill three turbidity vials to approximately 1/4" from the top. **Do not fill the vials to the very top,** as the water may leak into the turbidimeter and cause damage to the unit. Use the turbidity vial wiping cloth to wipe all water and/or debris from the outside of the vials. Ensure the vials are clean and free of streaks or scratches. If the vial is scratched, discard and use a new vial. Place a vial into the turbidimeter with the white triangle marking oriented towards the front of the meter. Ensure the turbidimeter is in the "auto-range" operating mode. Close

the lid then press the read button. Record the turbidity measurement on the field datasheet exactly as displayed by the turbididmeter. Repeat for the remaining two vials. The turbidity vials may require reanalysis if the obtained measurements are not reasonably comparable with the other turbidity measurements. **All three measurements should be within 10% of the average** of the measurements. In some instances, all of the measurements may not be within 10% of the average when there is excessive particulate material present in the sample water.

- Obtain a secchi measurement in a shaded location. Note on the field datasheet if no shade is available and the secchi measurement is obtained in direct sunlight. Lower the secchi disk into the water until it is no longer visible. Slowly raise the secchi disk until the black and white pattern is clearly visible. Record the secchi measurement to the nearest 5 hundredths of a meter (ex. 1.25 meters or 1.20 meters). Sunglasses should be removed prior to obtaining the secchi measurement.

- Obtain a visual algal classification in a representative location. Survey all of the water around the sampling site and ensure that any variation of algal density is taken into consideration. Obtain the visual algal density measurement when making the secchi measurement. The visual algal classification system ranges from zero to five and is measured as follows;

0 - Not Present: No algae is visible in the water column
1 - Scant: Present, less than 25% coverage of the white portions of the secchi disk
2 - Light: Approximately 25% coverage of the white portions of the secchi disk
3 - Moderate: Approximately 50% coverage of the white portions of the secchi disk
4 - Heavy: Approximately 75% coverage of the white portions of the secchi disk
5 - Dense: Approximately 100% coverage of the white portions of the secchi disk

- Multi-probe measurements are obtained at 0.1 m, 0.5 m, 1.0 m and at one-meter intervals thereafter until the bottom is reached. The probes of the multi-probe unit should be approximately 0.1 m above the sediment for the bottom reading. In windy conditions where large waves exist, the 0.1 m measurement may be omitted, as the probes will not be in continuous contact with the water. In this case the first measurement will be at the 0.5 m depth. **Allow at least one minute for the probes to stabilize** at each depth prior to recording the measurement. Log all measurements to the handheld unit. Record values as displayed on the handheld unit except for depth, where measurements are recorded to the nearest tenth of a meter.

Table 1. Proper field data documentation

Measurement	Recorded Value	Example
Air Temperature	Round to nearest 0.5°C	18.2 = 18.0 and 18.3 = 18.5
Wind Speed	Round to nearest whole #	3.4 = 3 and 3.5 = 4
Multi-Probe Data	Displayed values	9.46 = 9.46
Secchi Measurement	Round to nearest 0.05 m	0.42 = 0.40 and 0.43 = 0.45
Turbidity	Displayed values	9.53 = 9.53 and 10.6 = 10.6 and 103 = 103
Algal Classification	Whole #	0, 1, 2, 3, 4 or 5

Side-By-Side Test Procedure

- Perform the side-by-side test procedure prior to deploying a multi-probe. Attach the multi-probe profile unit and site deployment multi-probe to the handheld units. Remove the storage cups and place sensor guards on the units. Place both multi-probes into the bucket of fresh tap water. Record the multi-probe and handheld unit serial numbers on the datasheet marked **"Deployment."** Fill in all required fields. Turn both handhelds on at **exactly the same time**. Press enter in the run menu. Ensure the handheld units and multi-probes are both synchronized and are counting down the 120 second stabilization period. When the multi-probes start reading, push the enter button **at the same time** to enter into the logging menu. Find or enter the site name in the site name menu. Press enter to have the multi-probes record the displayed data. Exit out to the main menu and enter into the file menu. Go to view file. Select the file name. Scan down to the last recorded value. Transcribe the values onto the datasheet under the heading "In Bucket." Don't forget to record the bucket start time from the file. **Exit out of all menus and turn off the handheld units.**

- Detach the site deployment multi-probe from the field cable and replace the connector cap. The multi-probe is now ready for deployment.

- **Perform the above multi-probe profile and site field data collection**

Multi-Probe Deployment

- Using rubber or leather gloves, pull up the chain and protective housing attached to the buoy. The multi-probe will be locked inside of a protective multi-probe housing. Place the protective housing securely in the boat. Carefully remove the lock and protective housing securing pin. Place the lock and securing pin on the floor of the boat so they aren't accidentally knocked into the water. Remove the protective housing lid and place the site deployment multi-probe in the housing. Replace the protective housing lid, pin and lock. Gently place the protective housing and multi-probe in the water. Record the deployment time on the "Deployment" field sheet. **Remember, some sites have a**

surface and bottom multi-probe. You need to deploy both multi-probes at these sites.

Multi-Probe Retrieval

- **Do not pull up the buoy and multi-probe within fifteen minutes before the hour to five minutes after the hour.** Using rubber or leather gloves, pull up the chain and protective housing attached to the buoy. Place the protective housing securely in the boat. Remove the lock and protective housing securing pin. Place the lock and securing pin on the floor of the boat so they aren't accidentally knocked into the water. Remove the protective housing lid and remove the multi-probe from the protective housing. Wash the outside of the multi-probe with lake/river water by hand. Place a storage cup with water on the retrieved multi-probe. Record the retrieved multi-probe serial number on the "Retrieved" field sheet. Replace the protective housing lid, pin and lock. Gently place the protective housing in the water. Place the retrieved multi-probe into the protective carrying case. **Remember, some sites have a surface and bottom multi-probe. You need to retrieve both multi-probes at these sites.**

- **Perform the above multi-probe profile and site field data collection**

Appendix C

Table C-1. Physical Water Quality Parameters

Date	Site	Depth, m	Temp, °C	pH	Specific Conductance, µs/cm	TDS, g/L	Dissolved Oxygen, %Sat	Dissolved Oxygen, mg/L
04/30/07	TLDH	0.1	18.05	8.89	759	0.493	111.6	9.10
04/30/07	TLDH	0.5	18.19	8.88	757	0.492	110.2	8.96
04/30/07	TLDH	0.9	16.91	8.82	754	0.490	84.3	7.04
04/30/07	LREW	0.1	18.26	8.73	275	0.179	154.2	12.55
04/30/07	LREW	0.5	18.20	8.71	274	0.178	155.6	12.67
04/30/07	TLNW	0.1	20.53	9.06	696	0.452	145.3	11.28
04/30/07	TLNW	0.6	19.54	9.07	693	0.451	143.3	11.34
05/01/07	TLNW	0.1	14.93	8.10	106	0.069	101.6	8.87
05/16/07	TLDH	0.1	21.72	8.97	806	0.524	126.6	9.61
05/16/07	TLDH	0.5	18.06	8.85	816	0.530	118.0	9.63
05/16/07	TLDH	0.9	17.25	8.84	814	0.529	101.0	8.38
05/16/07	LREW	0.0	21.67	8.82	259	0.168	188.6	14.35
05/16/07	LREW	0.4	21.69	8.84	258	0.168	191.1	14.54
05/29/07	TLDH	0.1	18.86	8.95	832	0.541	109.5	8.80
05/29/07	TLDH	0.5	18.33	8.94	832	0.541	105.1	8.54
05/29/07	TLDH	1.0	16.49	8.95	829	0.539	101.4	8.56
05/29/07	LREW	0.1	21.22	8.89	277	0.180	165.4	12.70
05/29/07	LREW	0.3	21.20	8.90	277	0.180	166.7	12.81
06/13/07	TLDH	0.1	18.08	9.07	799	0.519	104.9	8.54
06/13/07	TLDH	0.5	17.93	9.06	799	0.519	103.7	8.46
06/13/07	TLDH	0.9	17.66	9.06	799	0.519	98.0	8.04

Date	Site	Depth, m	Temp, °C	pH	Specific Conductance, µs/cm	TDS, g/L	Dissolved Oxygen, %Sat	Dissolved Oxygen, mg/L
06/13/07	TLEC	0.1	19.02	8.42	854	0.555	117.6	9.38
06/13/07	TLEC	0.5	19.01	8.44	852	0.554	125.4	10.01
06/13/07	LREW	0.1	19.55	8.99	276	0.179	152.9	12.09
06/13/07	LREW	0.6	18.95	8.87	277	0.180	130.8	10.47
06/13/07	TLNW	0.1	18.03	9.39	528	0.343	142.9	11.64
06/13/07	TLNW	0.5	17.60	9.39	525	0.341	164.2	13.49
06/25/07	TLNW	0.2	17.56	9.76	454	0.295	51.2	4.22
06/25/07	TLNW	0.6	16.66	9.62	467	0.304	62.1	5.22
06/25/07	TLNW	0.7	16.85	9.47	466	0.303	59.1	4.94
06/25/07	LREW	0.7	18.62	8.35	257	0.167	109.8	8.86
06/25/07	TLEC	0.6	18.86	9.41	705	0.458	193.2	15.50
06/25/07	TLDH	0.1	20.36	9.26	831	0.540	107.2	8.34
06/25/07	TLDH	0.5	17.43	9.28	825	0.536	107.8	8.90
06/25/07	TLDH	0.9	17.13	9.23	821	0.534	109.7	9.11
07/16/07	TLDH	0.1	24.42	9.41	747	0.486	82.7	5.95
07/16/07	TLDH	0.5	23.02	9.48	778	0.506	103.0	7.61
07/16/07	TLDH	0.9	22.78	9.48	777	0.505	139.9	10.38
07/16/07	TLEC	0.1	24.77	8.96	558	0.362	159.9	11.43
07/16/07	TLEC	0.5	23.39	8.86	560	0.364	135.2	9.92
07/16/07	LREW	0.1	25.57	8.71	263	0.171	190.8	13.45
07/16/07	LREW	0.7	25.34	8.64	263	0.171	194.8	13.79
07/16/07	TLNW	0.1	25.34	9.61	299	0.194	147.0	10.41
07/16/07	TLNW	0.5	25.36	9.61	299	0.194	147.6	10.45
07/16/07	TLNW	0.7	25.36	9.61	299	0.194	148.9	10.53
07/26/07	TLDH	0.1	22.75	9.35	761	0.494	83.5	6.22

Date	Site	Depth, m	Temp, °C	pH	Specific Conductance, µs/cm	TDS, g/L	Dissolved Oxygen, %Sat	Dissolved Oxygen, mg/L
07/26/07	TLDH	0.5	22.47	9.37	759	0.494	78.2	5.86
07/26/07	TLEC	0.1	23.83	8.73	488	0.317	73.8	5.39
07/26/07	TLEC	0.5	23.41	8.39	500	0.325	65.9	4.85
07/26/07	LREW	0.1	25.47	7.36	224	0.146	113.9	8.08
07/26/07	LREW	0.5	25.01	7.10	226	0.147	106.2	7.59
07/26/07	LREW	1.0	24.71	6.90	231	0.150	89.9	6.46
07/26/07	TLNW	0.1	26.93	7.16	369	0.240	18.6	1.28
08/09/07	LREW	0.1	19.95	7.09	249	0.162	46.8	3.66
08/09/07	LREW	0.5	19.95	7.16	249	0.162	47.6	3.73
08/09/07	TLNW	0.1	20.33	9.01	428	0.278	111.3	8.64
08/09/07	TLNW	0.5	20.31	8.37	421	0.274	103.8	8.06
08/09/07	TLDH	0.1	22.25	9.18	651	0.423	101.4	7.58
08/09/07	TLDH	0.5	20.12	9.15	730	0.475	102.7	8.00
08/09/07	TLDH	0.9	19.44	9.12	753	0.490	107.9	8.52
08/09/07	TLEC	0.1	24.15	8.88	571	0.371	180.9	13.05
08/09/07	TLEC	0.5	21.10	8.72	583	0.379	135.6	10.36
08/23/07	TLDH	0.1	19.30	9.48	845	0.549	96.1	7.65
08/23/07	TLDH	0.5	19.02	9.46	846	0.550	92.2	7.39
08/23/07	TLDH	0.8	18.98	9.45	846	0.550	90.8	7.28
08/23/07	TLEC	0.1	20.37	8.81	631	0.410	98.3	7.67
08/23/07	TLEC	0.5	20.35	8.84	653	0.425	96.2	7.51
08/23/07	LREW	0.1	21.67	7.63	255	0.166	67.8	5.16
08/23/07	TLNW	0.1	23.37	8.91	428	0.278	81.4	6.00
08/23/07	TLNW	0.5	21.31	9.09	429	0.279	96.3	7.39
09/06/07	TLDH	0.1	18.78	9.52	853	0.555	78.5	6.29

Date	Site	Depth, m	Temp, °C	pH	Specific Conductance, µs/cm	TDS, g/L	Dissolved Oxygen, %Sat	Dissolved Oxygen, mg/L
09/06/07	TLDH	0.5	18.40	9.53	852	0.554	78.9	6.37
09/06/07	TLDH	1.0	18.30	9.51	852	0.554	76.5	6.19
09/06/07	TLEC	0.1	18.91	8.58	694	0.451	76.0	6.07
09/06/07	TLEC	0.5	18.86	8.60	692	0.450	78.8	6.30
09/06/07	TLEC	0.8	18.79	8.39	689	0.448	70.3	5.63
09/06/07	LREW	0.1	20.57	7.69	241	0.157	78.8	6.09
09/06/07	LREW	0.5	20.57	7.74	248	0.161	77.9	6.03
09/06/07	TLNW	0.1	21.32	9.32	439	0.286	140.4	10.70
09/06/07	TLNW	0.5	20.59	9.51	447	0.291	181.6	14.04
09/06/07	TLNW	0.7	19.79	9.38	449	0.292	157.6	12.38
09/24/07	TLDH	0.1	11.81	9.08	771	0.501	89.9	8.44
09/24/07	TLDH	0.5	11.73	9.08	772	0.501	88.9	8.36
09/24/07	TLDH	0.9	11.71	9.08	772	0.502	86.6	8.16
09/24/07	TLEC	0.6	12.37	8.88	668	0.434	74.8	6.94
09/24/07	LREW	0.2	11.55	7.67	246	0.160	72.6	6.87
09/24/07	TLNW	0.7	12.03	9.30	376	0.244	120.3	11.26
10/03/07	TLEC	0.1	11.75	9.40	706	0.459	74.1	6.96
10/03/07	TLEC	0.5	11.77	9.40	705	0.458	76.7	7.20
10/03/07	TLEC	0.7	11.77	9.39	705	0.458	76.2	7.16
10/03/07	LREW	0.1	11.57	7.55	241	0.156	68.9	6.51
10/03/07	LREW	0.3	11.57	7.51	240	0.156	68.4	6.46
10/03/07	LREW	0.5	11.59	7.49	241	0.157	68.5	6.47
10/03/07	TLNW	0.1	11.96	9.17	368	0.239	87.0	8.15
10/03/07	TLNW	0.5	11.74	9.17	373	0.242	102.8	9.68
10/03/07	TLDH	0.1	12.21	9.03	690	0.448	119.8	11.15

Date	Site	Depth, m	Temp, °C	pH	Specific Conductance, µs/cm	TDS, g/L	Dissolved Oxygen, %Sat	Dissolved Oxygen, mg/L
10/03/07	TLDH	0.5	12.22	9.03	689	0.448	120.6	11.22
10/03/07	TLDH	1.0	12.21	9.03	689	0.448	120.6	11.22
10/22/07	TLDH	0.7	6.39	8.69	641	0.417	91.2	9.90
10/22/07	TLEC	0.7	6.89	8.74	696	0.452	64.0	6.86
10/22/07	LREW	0.3	8.71	8.63	444	0.289	134.6	13.80
10/22/07	TLNW	0.7	6.72	8.23	509	0.331	65.6	7.06

Appendix D

Table D-1. Additional Field Data Collected During a Site Visit

Date	Site	Air Temp, °C	Wind, mph	Wind Direction	Secchi, m	Algae	NTU1	NTU2	NTU3
04/30/07	TLDH	17.5	3	NE	0.25	0	47.6	49.9	50.9
04/30/07	LREW	19.5	3	NW	0.60	0	11.0	9.1	12.4
04/30/07	TLNW	20.0	3	W	0.25	0	24.6	26.4	26.2
04/30/07	TLEC	20.0	9	S	0.40	0	9.68	10.4	8.92
05/16/07	TLDH	20.5	4	-	0.35	0	23.7	23.7	23.3
05/16/07	TLEC	22.5	6	-	0.80	0	7.05	7.02	6.70
05/16/07	LREW	25.0	4	-	0.50	0	8.69	13.5	8.28
05/16/07	TLNW	23.5	1	-	0.85	-	9.19	8.94	9.92
05/29/07	TLDH	20.0	7	NW	0.40	0	18.7	18.2	17.8
05/29/07	TLEC	23.0	7	SE	0.55	0	18.7	16.9	20.4
05/29/07	LREW	23.0	4	N	0.40B	1	5.58	5.75	6.35
06/13/07	TLDH	17.5	3	-	0.25	0	28.7	26.5	28.2
06/13/07	TLEC	19.0	5	-	1.00B	1	3.73	3.32	3.65
06/13/07	LREW	22.0	1	N	0.60	1	7.10	2.35	2.55
06/13/07	TLNW	20.0	5	N	0.90B	-	9.19	7.75	7.81
06/25/07	TLNW	13.5	2	E	0.65	1	9.35	9.10	9.62
06/25/07	LREW	15.0	2	SW	0.75B	2	4.72	4.56	4.82
06/25/07	TLEC	17.0	7	N	B	1	6.00	5.99	5.28
06/25/07	TLDH	22.5	0	-	0.40	0	11.2	11.3	11.1
07/16/07	TLDH	26.0	8	SW	0.65	0	11.2	11.6	11.8
07/16/07	TLEC	28.0	13	S	0.55	0	5.05	4.80	4.59

Date	Site	Air Temp, °C	Wind, mph	Wind Direction	Secchi, m	Algae	NTU1	NTU2	NTU3
07/16/07	LREW	27.0	8	S	0.80B	0	2.27	2.14	2.35
07/16/07	TLNW	27.5	17	S	0.80	0	7.96	7.35	8.03
07/26/07	TLDH	21.5	3	NW	0.60	0	14.6	14.1	14.4
07/26/07	TLEC	23.5	4	N		3	7.14	7.44	7.19
07/26/07	LREW	27.0	4	NE	0.90B	0	1.82	2.18	1.87
07/26/07	TLNW	28.0	2	N	0.35B	0	3.96	3.98	4.31
08/09/07	LREW	18.5	1	W	0.70B	0	1.78	2.03	2.16
08/09/07	TLNW	19.0	1	SE	0.50B	0	5.43	4.81	5.05
08/09/07	TLDH	23.5	4	NNW	0.75	0	16.7	19.0	18.4
08/09/07	TLEC	26.0	9	NW	0.60B	0	6.04	6.02	6.38
08/23/07	TLDH	17.5	-	-	0.60	0	18.3	17.2	18.6
08/23/07	TLEC	18.5	-	N	0.90	0	5.70	5.61	4.15
08/23/07	LREW	23.0	-	S	0.40B	0	2.90	4.52	2.69
08/23/07	TLNW	25.0	-	-	0.80	0	4.11	4.17	4.21
09/06/07	TLDH	17.0	0	-	0.50	0	22.3	21.6	22.2
09/06/07	TLEC	16.0	4	N	0.80B	0	6.36	6.57	6.93
09/06/07	LREW	21.0	2	N	0.50B	1	4.65	4.80	4.54
09/06/07	TLNW	21.0	2	SSW	0.70B	0	2.95	2.77	2.72
09/24/07	TLDH	6.0	0	-	0.25	0	51.3	52.2	53.9
09/24/07	TLEC	2.0	7	-	0.95	0	3.67	3.76	4.04
09/24/07	LREW	6.5	0	-	0.40B	1	8.08	7.63	7.42
09/24/07	TLNW	7.0	1	NE	0.65	1	8.56	8.63	8.58
10/03/07	TLEC	9.0	7	NW	0.95B	0	5.22	5.10	5.94
10/03/07	LREW	12.5	7	NW	0.50B	0	11.3	12.2	13.3
10/03/07	TLNW	12.5	9	NW	0.25	0	65.7	69.6	68.4

Date	Site	Air Temp, °C	Wind, mph	Wind Direction	Secchi, m	Algae	NTU1	NTU2	NTU3
10/03/07	TLDH	11.5	15	NW	0.15	0	11.3	11.4	11.3
10/22/07	TLDH	4.0	1	NE	0.15	0	114	114	116
10/22/07	TLEC	5.0	4	NW	0.30	0	26.7	26.2	27.2
10/22/07	LREW	10.5	1	N	0.40	1	13.0	16.0	17.5
10/22/07	TLNW	14.5	0	-	0.15	0	91.4	97.7	99.5