Livestock Nutrient and Sediment Monitoring for Total Maximum Daily Load Development on Pedee Creek, Tributary to the Luckiamute River Near Independence, Oregon

Conducted by
Volunteers from the
Pedee/Ritner Creeks Watershed Council

In Conjunction With:
Polk Soil and Water Conservation District

Oregon Department of Environmental Quality

Funded By:

US Environmental Protection Agency 319 grant #13-01
And
Oregon Watershed Enhancement Board Grant 201-161

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Photo 1. Pedee Creek Road Bridge Looking East on Hwy 223

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Project Summary: Pedee Creek, a sixth field watershed in the mid-Willamette basin, appears to contribute non-point source pollution to a 303d listed segment of the Luckiamute River. The Pedee/ Ritner Creeks Watershed Council implemented a preliminary water quality monitoring program, during the fall and winter of 2001/2002. Council goals included: collecting baseline water quality data, determining if differences in water quality existed upstream and downstream of agricultural areas on Pedee Creek and assisting the Oregon Department of Environmental Quality in collecting data throughout the entire Luckiamute Basin for Total Maximum Daily Load (TMDL) development. Water quality parameters sampled included: bacteria (*Escherichia coli*), total suspended solids, pH, turbidity, conductivity and current water temperature. Streamflow was also measured to correlate flow to pollution concentration. Additionally, council volunteers visually estimated acreage of denuded livestock pasture, within the Pedee Creek 100 year floodplain, to evaluate a link between increased areas of denuded pastures and increases in water pollutants downstream.

Weekly sampling of sites throughout the Luckiamute basin began during the third week of November, 2001 and ended eight weeks later. Sampling indicated that bacteria levels did not exceed the single event threshold of 406 colonies per 100 milliliters or the geometric mean standard of 126 colonies per milliliter for 30 days during the 8 week sampling period. Water turbidity was the only parameter that showed a strong relationship between increased flow and increased detection levels.

Storm Sampling on Pedee Creek began with the first significant storm in November of 2001 to create significant run-off and ended in March of 2002. Sampling indicated that Pedee Creek, downstream of agricultural areas exceeded the legal standard for *E.coli* bacteria 4 times including once when it violated the standard by 3 times the legal limit. As with the Weekly sampling, only turbidity showed a strong correlation with streamflow. Statistical analysis of water quality parameters upstream and downstream of agricultural areas indicated a significant difference for both bacteria and turbidity $p=0.002$ and $p=0.0253$ respectively. Amount of acreage denuded by cattle did not correlate with increased pollution however only two samples were taken, limiting the statistical use of the data.

A lack of storms sufficient to raise Pedee Creek flows to sampling levels, during the third sampling period, led to a second change in the project plan. After discussions with DEQ personnel, storm sampling was discontinued in favor of reinitiating weekly sampling of sites throughout the Luckiamute basin. This data indicated that the geometric mean standard for bacteria was exceeded at the Little Luckiamute at Elkins road ($x=155.95$) for 2 samples. No other sites exceeded water quality standards.

Comparisons of water quality parameters did not show any obvious relationships between increases in one with another. This seemed unusual since it is assumed that most pollutants would increase at nearly the same rate as run-off increases. Turbidity was the only variable that correlated directly with increases in flow. Variability of other parameters remains unexplained.

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Acknowledgements

Several people and organizations deserve credit for this project. First, the Pedee/Ritner Watershed Council deserves recognition for initiating this project despite the possibility of finding water quality violations that will lead to increased regulation. Norm Baldwin, a Pedee Creek volunteer deserves special mention due to his willingness to assist in sampling throughout the entire project. Other council members who volunteered time include Harold Skidmore, Christi Shaw of Weyerhauser corp and Erin McCabe of the Luckiamute Watershed Council. The rest of the council was helpful in reviewing data, making suggestions and working to create solutions to the problems this study uncovered.

State agency personnel played critical roles in planning, sampling and reviewing the draft data and documents. Karen Font-Williams, former DEQ volunteer monitoring coordinator deserves special commendation for making presentations to the Watershed Council, assisting in site selection, making sampling recommendations, training volunteers, answering inquiries, and reviewing data. Steve Mrazic, DEQ mid-Willamette monitoring coordinator, was helpful in developing project plans, choosing sampling sites and reviewing information. Alan Hamel also of the DEQ was helpful in assisting volunteers in split sampling and adjusting his schedule around unpredictable stormflows. Jared Rubin, DEQ project officer, deserves special recognition for ensuring that the grant timeline was met and for finding creative solutions to solve grant problems. Bill Ferber, Oregon Department of Water Resources, District 16 watermaster, was extremely helpful in donating equipment and labor in measuring streamflows. Mike Good and Don Angermeyer of the Oregon Department of transportation, assisted by waiving permit fees and assisting in attachment of a permanent streamflow gage to the abutments of the Highway 223 Pedee Creek Bridge.

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<u>Photo 2 Bill Ferber (OWRD) measuring stream velocities from the Pedee Creek Bridge.</u>

Introduction

Section 303(d) of the federal Clean Water Act mandates that the states identify water bodies that do not meet pollution standards for various beneficial uses. (DEQ 2000) In Oregon, the state Department of Environmental Quality (DEQ) initiated a program for developing total maximum daily loads (TMDL's) for non-point source pollution in water bodies exceeding the federal standards under section 319 of the Clean Water Act. These TMDL's use computer models to evaluate concentrations or "loads" of pollutants contributed by tributaries to 303(d) listed water bodies and set limits so that listed segments can come into compliance. These TMDL models depend upon baseline data to quantify background levels of pollutants. Funding problems within state governments, often limits water quality monitoring programs. Fortunately, many watershed councils and other interested groups have volunteered to assist by developing water quality monitoring programs for their basins. Volunteers throughout the state of Oregon are assisting in developing TMDL's for their watersheds by conducting water quality monitoring projects to collect the baseline data.

In addition to volunteer efforts, state agencies have begun implementing Area Water Quality Management Plans (WQMP's) to control pollution from non-point sources. The Oregon Department of Forestry has mandated forest practices that maintain water quality. Additionally the Oregon Department of Agriculture is in the process of developing WQMP's for lands zoned for agriculture through the Senate Bill 1010 process. These plans are developed with local input from interested landowners and interest groups, however these plans also depend on water quality monitoring to identify problems in the basins. Best Management Practices are then mandated through locally developed administrative rules for each WQMP. The BMP's are developed using the best available science. Some of these practices; while protecting land productivity; may only marginally protect water quality.

Current accepted practices, promoted by state agriculture experts, involve wintering livestock on "sacrifice" pastures to avoid compaction and overgrazing of other wetter pastures. (NRCS 1998) This practice, while protecting the productivity of adjacent pastures, often results in large patches of bare soil and concentrations of waste nutrients and other Non-Point Source pollutants that are susceptible to transport into the stream through overland runoff during storm events. These non-point source pollutants are difficult to regulate due to the diffuse nature of source areas and the economic impracticality of sampling them all

Surface water contaminants from livestock operations include bacteria, usually ***E. coli***, nutrients; including nitrogen and phosphorus, and eroded soil particles. These pollutants can degrade the beneficial uses of the water such as domestic water supplies, direct skin contact such as swimming and fisheries resources. Additionally, the compacted soils of sacrifice pastures reduce soil infiltration rates of rainfall, which increase surface run-off and subsequent stream flows and pollution contributions. Current research is being conducted to evaluate the pollution contributions from such areas.

The Pedee/Ritner Creeks Watershed Council was formed in 1999 by a coalition of concerned residents in southern Polk County. The council consists of several timber interests, farmers, ranchers and watershed residents, including 2 who were also members of the Local Advisory Committee for the Mid-Willamette Ag Water Quality Management Plan. The council began a water quality monitoring project during the autumn of 2001, to collect baseline watershed data and to determine the extent agricultural operations in the Pedee Creek watershed contributed pollutants into the Luckiamute River watershed. Grant funds were solicited from the Federal EPA (319 funds) and from the Oregon watershed enhancement board. Federal funds were allocated for a 2 year study during the 2000 biennium, however, matching funds from OWEB were not allocated until 2001. Due to the different funding periods, the council was forced to consolidate all sampling into a one-year project. Guidance from DEQ personnel determined that the best use of the available funding would follow the outline of the original upstream/downstream sampling study of agricultural areas in the Pedee Creek watershed and use the remaining funding to conduct weekly sampling throughout the Luckiamute basin. This would develop baseline data for those areas for TMDL development and provide a context with which to compare the Pedee Basin data.

Site Location

The Luckiamute River is a 4th field tributary to the Willamette River located in Polk and Benton Counties (Figure 1). The watershed covers an area of 209,000 acres and is mostly rural in nature. Falls City, population 1,045, is the only incorporated municipality in the basin. The upper basin consists primarily of industrial forest lands interspersed with sections of federal land administered by the US Bureau of land Management. The lower portion of the watershed, downstream of the confluence with Pedee Creek, is almost entirely agricultural. The Luckiamute, from the confluence of Pedee Creek to its mouth, is listed on the federal 303(d) water quality limited list for exceeding temperature and bacteria standards. Listing data were collected prior to 1994 during a fall/winter/spring sampling schedule.

Sampling sites on the Luckiamute were all located downstream of agricultural operations. Additional sources of Point Source pollution include the Falls City waste water treatment plant. Sampling sites are listed in table 1. and mapped in figure 1.

Table 1. Weekly Sampling Sites for the Luckiamute Basin to be Sampled During Winter 2001.

Site	LASAR ID #	Lat.	Long
Pedee Creek at Kings Hwy	25481	N 44 74 450	W 123 43 915
Luckiamute River U/S Pedee Creek at Ritner	26734	N 44 73 567	W 123 43 384
Luckiamute at Hoskins	11111	N 44 68 170	W 123 46 775
Luckiamute River at Airlie Rd.	25477	N 44 77 610	W 123 34 322
Little Luckiamute at Elkins Rd.	11114	N 44 79 720	W 123 29 150
Luckiamute River at Helmick St. Park	10659	N 44 78 280	W 123 23 533

Pedee Creek is a sixth field tributary of the Luckiamute River in Southwestern Polk County. The Pedee Creek Watershed covers approximately 9,600 acres, and has a southern aspect. The watershed elevation ranges from 300 feet on the valley floor to over 2,000 feet. The majority of the basin is industrial forestland however approximately 10% of the watershed is actively involved in agriculture, primarily in the lower valley portion of the basin. Most of the operations involve livestock management and hay production although there is approximately 20 acres of production field crops. The number and type of livestock are listed in table 2

Table 2 Types and numbers of livestock in the Pedee Creek Valley during winter 2001/2002

Species	Number	Approximate acres of land used for wintering within the 100 year floodplain
Cattle	91	18
Sheep	94	0
Horses	15	10
Llamas	9	3
Hogs	3	<1
	Total Acres	39

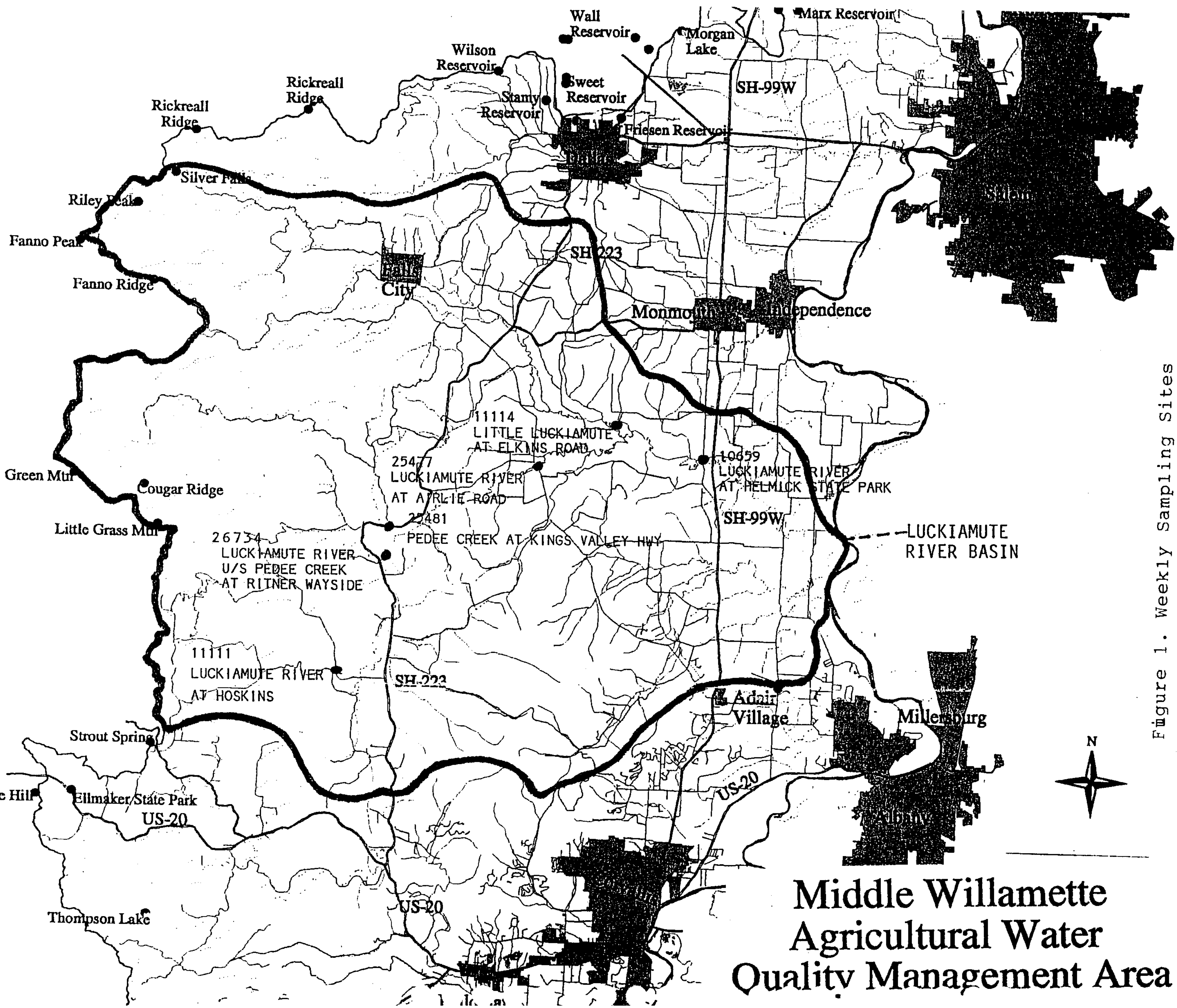

Figure 1. Weekly Sampling Sites

Sample sites on Pedee Creek include: mainstem Pedee Creek at the Highway 223 bridge, near the mouth of South Fork Pedee Creek at the Pedee Creek Road Bridge (MP 2.1), and the North Fork of Pedee Creek at the second Ronco Road Bridge (MP4.2) The sample sites are listed in table 3 including lat/long coordinates. The sites are mapped in figure 2.

Table 3. Storm Sampling Sites for Pedee Creek to be Sampled During Winter 2001.

Site	LASAR ID #	Lat.	Long
Pedee Creek at Kings Hwy	25481	N 44 74 450	W 123 43 915
South Fork Pedee Creek at Pedee Creek Rd.		N 44 77 107	W 123 44 792
North Fork Pedee Creek at Headwaters	26733	N 44 78 293	W 123 45 436

These sites were chosen due to their proximity to agricultural operations. The mainstem Pedee Creek site is located within 1 mile of the confluence with the Luckiamute and is downstream of all livestock operations in the watershed. The North Fork site is located within the forested portion of the watershed upstream of all agricultural operations. It was chosen as the undisturbed control site. The South Fork of Pedee Creek was monitored because it was a significant tributary, providing approximately 10% of the flow, and was located between the upper and lower sampling sites. A small livestock operation raised a few cattle approximately 1 mile upstream of the South Fork site however, the animals were sold prior to sampling.

Data Quality Objectives

Data from this project was planned for several uses. First, the council determined a need for baseline water quality data, as recommended in the Senate Bill 1010 Mid Willamette Water Quality Management Plan. This fill this criteria, the council decided to monitor pH, conductivity and current water temperature. This data was collected to meet data quality level B however most of it met A level data requirements.

Additional sampling objectives included determination of the pollutant contribution of agricultural practices in the Pedee basin. Discussions with DEQ personnel indicated the parameters determined to be most useful in fulfilling the objective included Bacteria (specifically *E. coli*), Total Suspended Solids and turbidity. This required a change in the original sampling plan, which proposed measuring total nitrogen, phosphorus and sodium. Quality assurance protocols were developed (appendix D) to ensure data met A level quality requirements.

Requirements to consolidate the original 2 year timeline into a 1 year sampling plan, due to grant limitations, caused additional changes to the original project plan. Instead of sampling Pedee Creek for a second year as originally proposed, DEQ personnel suggested a weekly sampling plan at sites throughout the Luckiamute basin. Project objectives included collecting additional data to assist in TMDL development and providing data from sites outside the Pedee Creek basin for comparison. Sampling protocols were the same as for Pedee Creek sampling and met the A level data standards required for use in developing TMDLs.

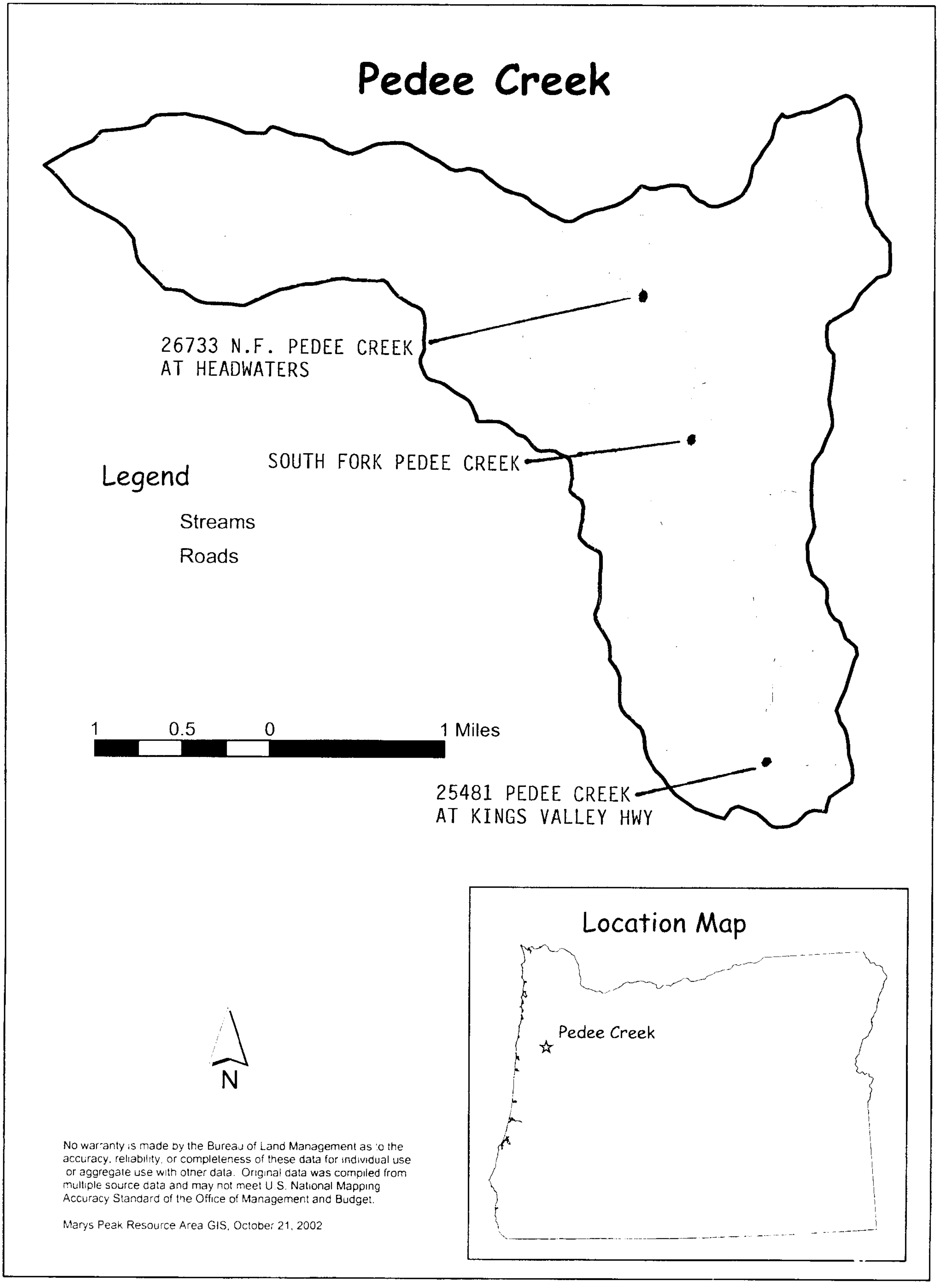

FIGURE 2. STORM SAMPLING SITES ON PEDEE CREEK

Methods

All methods and protocols used in this project are outlined in the Quality Assurance Project Plan attached to this report (appendix D). DEQ staff trained volunteer watershed council personnel on water quality monitoring procedures on November 8, 2001. Volunteers learned how to operate pH, turbidity and conductivity meters. Training also included proper sample collection protocols for lab analysis and QA/QC requirements for accuracy and precision. Additional discussions involved the project design, sampling sites and additional scheduling needs.

Sampling for pH was conducted using an Orion 210 A Electrode pH Meter. A YSI Model 30 Conductivity meter measured current temperature and conductivity, and a Hach 2100 A tubridimeter measured turbidity. All equipment was on loan from DEQ and had been calibrated and checked by DEQ staff prior to November. Watershed council volunteers conducted additional lab checks and calibrations during the sampling period. These parameters were measured by trained volunteers following proper QA/QC protocols, including start and end accuracy checks and calibration of the equipment on appropriate schedules.

Bacteria (*Escherichia. coli)* and total suspended solids (TSS) were measured by Waterlab, a state certified analytical lab. (Waterlab Corp. 2603 12th st. SE Salem, OR 97302 (503) 363-0473) The Pedee/Ritner Watershed council contracted with this lab due to its proximity to the sample location allowing samples to be delivered within the 24 hour holding deadline. *E. coli* were sampled using the Quantitray Most Probable Number test outlined in Standard Methods9221F. TSS were sampled using USEPA standard methods. Waterlab conducted all sampling within QA/QC requirements however no blank or spiked samples were sent to the lab as a control due to limited funds and the fact that the lab is state certified and therefore must adhere to proper quality assurance procedures. No additional tests were made to test the probable origins of the *E. coli*.

Water quality parameters were correlated to streamflow when possible. Two existing streamflow gaging sites on the mainstem Luckiamute were used to determine streamflow for weekly flow sampling. One site at Ira Hooker road, just downstream from the confluence of Pedee Creek was no longer maintained as an active gaging station. The staff plates located at the Ira Hooker site were only used for determining low flow minimums and were not visible during high flows. Additionally, no high flows measurements were recorded recently for accurate rating curve development. No usable data was recorded from the Ira Hooker gage. A USGS continuous recording streamflow gage operated on the Luckiamute at Helmick state park. Discharge was recorded from the OWRD realtime surface water website the day after sampling (USGS 2002) The Helmick State Park site was the lowest sampling site in the basin and was located downstream of the Little Luckiamute confluence, which is a significant tributary to the Luckiamute. Attempts were made to estimate flows at other sites based on drainage area calculations based on regional flow equations (Dunne 1978), but testing of the equations on sites with known flows gave erratic predictions so the process was abandoned. This development meant only two of the six weekly sampling sites were adequately gauged. Two additional staff plate flow gages were established on Pedee Creek. Stage heights of up to 10 feet could be read from the gage on Pedee Creek at Highway 223. An additional staff plate was installed on South Fork Pedee Creek near the confluence with the mainstem, however due to flood damage the gage was moved to the Pedee Creek road bridge abutment. This site was usable only during high flows and the data collected was of limited use. Volunteers recorded water elevation based on stage heights each time Pedee Creek was sampled. Stage levels were then correlated to flow by developing a rating curve from actual measured flows. Flows were measured using a Rickly AA current meter and a OWRD bridge mounted velocity meter..

Weekly sampling of sites in the Luckiamute Basin began in late November 2001 after the first significant storms sufficiently saturated the soils and began generating significant levels of run-off. Sampling continued weekly for 8 weeks until the middle of January. Sites were sampled on Monday mornings except in cases when Waterlab was closed due to holidays or other scheduling conflicts that would not meet the 24 hour maximum holding requirements for bacteria samples.

Standard operating procedures required 2 volunteers to meet at Mr. C. Vandenberg's, the designated project manager's, home to gather equipment and discuss protocols and QA/QC data requirements. Volunteers then drove a set route to each site that maximized safety, travel efficiency and allowed sampling to be completed before noon. All sites except the Luckiamute downstream of Ritner Creek allowed sampling from a public road bridge. Bridge samples were taken using rope and a stainless steel sampling bucket that was rinsed with distilled water between uses. The Ritner creek site was sampled at the water's edge by dipping the sample bottles into the flow. Bacteria was sampled using DEQ sampling jars and a sterile glass tube and stopper. Samples for TSS were poured directly from the stainless bucket into a 500 mL plastic bottle supplied by Waterlab. Following removal of the TSS sample the YSI conductivity meter was rinsed and inserted into the bucket. After taking the temperature and conductivity readings the remaining water sample was transferred to rinsed 1 Liter nalgene bottles for transport and later measurement of turbidity and pH. All samples were labeled and transported in a secure cooler. *E. coli* and TSS samples were transported directly to the Salem Waterlab office at the conclusion of the days sampling. Turbidity and pH were measured upon returning to Mr. Vandenberg's home where equipment was arranged.

Duplicate samples were collected in accordance with the QA/AC plan (appendix D) A duplication rate of 16% was achieved exceeding the required 10%. The limited volume of the stainless steel bucket required two buckets to be filled to attain the desired amount of sample. Bacteria and TSS sample and duplicate were pulled from the first bucket. Turbidity and pH sample and duplicate were pulled from the second bucket. Temperature and conductivity were recorded from both buckets. Additionally, DEQ staff accompanied watershed council volunteers during a weekly sampling event to verify proper protocol usage and provide a precision check.

Phase 2 storm sampling on Pedee Creek involved monitoring upstream and downstream of agricultural operations in the Pedee watershed. These sampling sites were chosen due to the proximity of active grazing operations. South Fork Pedee Creek was monitored separately because it contributed at least 10% of Pedee Creek flow and its confluence was downstream of the upper sampling site. Volunteers sampled the same water quality parameters monitored during weekly sampling and followed the same standard operating proceedures.

Storm sampling was initiated when the project manager determined enough rain had fallen to create significant runoff in ditches and fields. The 3 Pedee Creek sites were each sampled 3 times at 4 hour intervals. Discussions with DEQ personnel indicated that each storm and not each sampling interval would be considered 1 event. This allowed volunteers to make only 1 duplicate sample per storm and still remain within the minimum 10% duplication requirement for A level quality data. The null hypothesis predicted no difference between upstream and downstream samples. Water samples were taken in conjunction with water stage height elevations taken simultaneously with sampling and compared with rating curves developed from streamflow measurements taken on subsequent days. Staff gages were established at the Highway 223 bridge and on the South Fork Pedee Creek. It was assumed that flow on the North Fork could be reasonably calculated by subtracting the South Fork contribution from the flow measured downstream at the Hwy 223 site. Unfortunately, an additional significant tributary was discovered after initiating sampling due to a map reading error. No accurate prediction of flows from the North Fork could be made. A rating curve was developed for a range of flows at the downstream monitoring site. A single flow measurement was made on the South Fork Pedee Creek site however, a storm damaged the temporary staff gage, and no rating curve was developed. Flows at the downstream site were compared to water quality parameters sampled.

Concurrent to water sampling, estimates of acres of disturbed or exposed soils within the 100 year floodplain were determined from public roads, which allowed viewing of the majority of the Pedee Creek basin. Floodplain boundaries were determined from the Polk County flood hazard assessment map (Figure 3). These estimates were made to test whether changes in acres of disturbed areas correlated to changes in water quality parameters.

Due to minimal stormflow events during April and May 2002, watershed volunteers and DEQ staff agreed to alter the sampling plan to allow for more effective use of funding. The final

Pedee Creek storm sampling was canceled in favor of two additional weeks of sampling at sites on the Luckiamute. The same sites sampled during autumn 2001 were again sampled during Spring 2002 with the exception that Luckiamute Downstream of Ritner Creek was dropped due to the likelihood that the sample site was not well mixed and was influenced by Ritner Creek flows. The volunteers sampled using the same protocols used during the autumn sampling. The duplication rate for the remaining 5 sites was 20%.

DEQ collected data at the same sites as volunteer monitoring, during storm events in February and March of 2002 (Appendix B). Parameters sampled were the same as council monitoring and used the same equipment and protocols to allow data comparability. Additional sites throughout the Luckiamute were also sampled to collect baseline data from a wide variety of sites. The data indicate the duplication rates for the sampling appear to be below 10%. It is also not obvious from the data if split sampling occurred. The data do not include streamflow data although the Luckiamute Bacteria Monitoring Plan does indicate that only gages at Helmick state park and a possible gage on the Little Luckiamute would be used for flow data. It is unfortunate that water elevation levels were not recorded from the Pedee Creek at Hwy 223 site, so that better data comparisons could be made Additionally, no observations were made of disturbed soils within the 100 year floodplain during DEQ sampling, which was unfortunate because increased sampling size may have increased the usefulness of the data. Better coordination between DEQ sampling teams and Pedee/Ritner watershed council volunteers should be a significant goal to increase data collection efficiency.

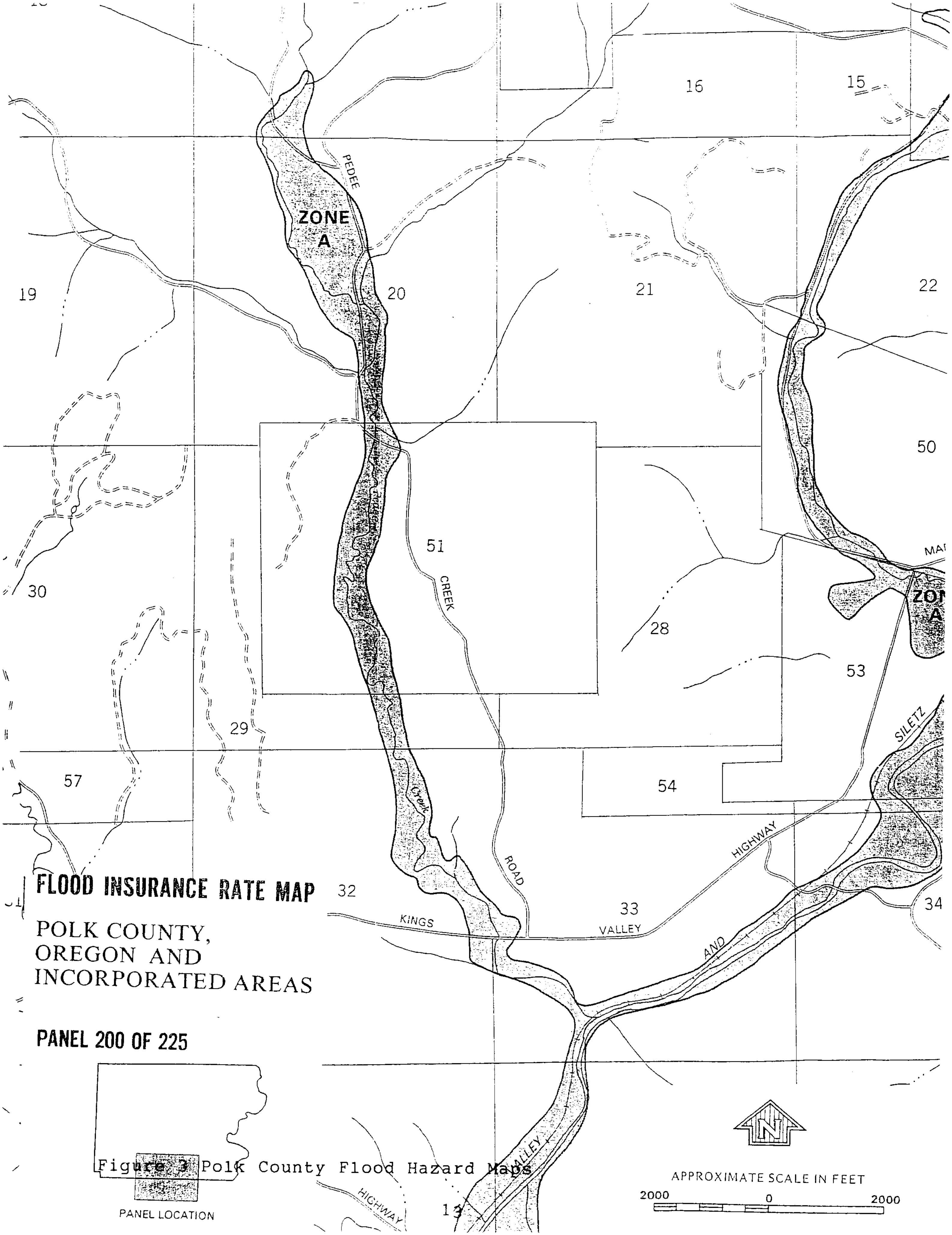

Figure 3 Polk County Flood Hazard Maps

Results

Stream flow measurements at the Hwy 223 bridge over Pedee Creek resulted in a rating curve for the newly installed staff gage. Only one large storm flow was measured due to scheduling conflicts with OWRD personnel. The rating curve is shown in figure 4.

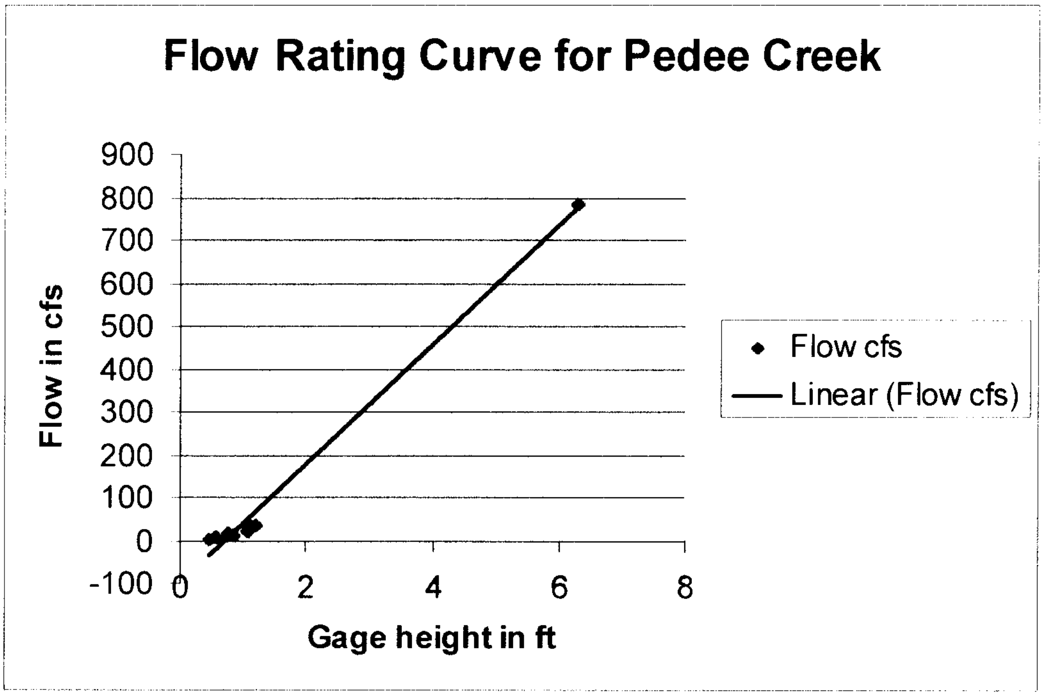

Figure 4. Rating Curve for gage on lower Pedee Creek at the Highway 223 Bridge.

The equation for the line was Y=138.716X-98.63. The R^2 =0.9956, however the standard deviation of the data set is 270.13 which indicates possible error in the line equation. The observation of negative value flows when readings are below 1 foot on the gage is oddly correct. Silt has settled around the lower portion of the gage, giving the impression that flows can not be read when flows expose the silt, which happened once during the May weekly sampling. The lack of data for large storm flows is the most likely factor limiting the usefulness of this rating curve. Future sampling plans include additional flow sampling at a wide range of flows and recalculation of the rating curve.

Flows on South Fork Pedee Creek were measured once before the gage had to be moved due to storm damage. The original gage was attached to a steel fence post pounded into the gravel near the Pedee Creek Road Bridge. The gage was knocked down during the first storm sampling period likely by wood debris floating downstream. The gage was reinstalled and attached to the bridge however the gage was out of water during all but the highest flows making its usefulness questionable. The inability to determine stream discharge at the upper Pedee Creek sites was not a significant loss since the mean and median values for all the parameters were close despite wide flow variations indicating no pattern existed in the data. Future sampling should include gages at both the upper Pedee Creek sites to better understand storm flow dynamics in the basin.

Flows on the Luckiamute River at Helmick State Park were determined from the USGS gage at Suver. Flows during the weekly sampling ranged from981 cfs to 4,986 cfs. The flow summary is attached in Appendix C.

Weekly storm sampling from November through January resulted in 56 samples taken for each parameter. No weekly *E. coli* samples exceeded the single event (406 colonies/100 ml)or the monthly log mean standard (126 colonies/100 ml) more than twice in one month criteria. Turbidity values taken during weekly sampling did show a correlation with flow for Pedee Creek at the Hwy 223 bridge($r2=0.752$) (figure 5).

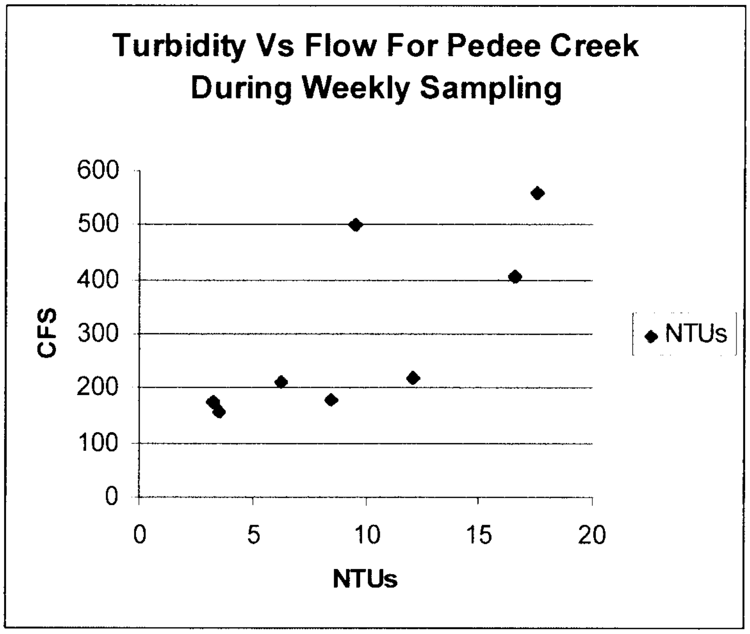

Figure 5. Turbidity vs flow for Pedee Creek during weekly sampling, winter 2001/2002

Turbidity did not show as direct a relationship for the Luckiamute site $r2=0.595$ (figure 6)

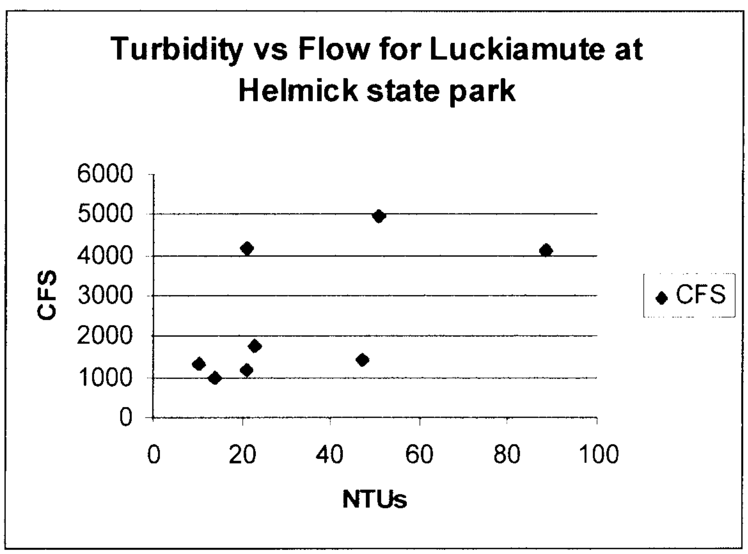

Figure 6. Turbidity vs flow for the Luckiamute at Helmick State Park

Weekly sampling data for each parameter is attached to the back of this report (Appendix A) Other parameters sampled did not show any obvious correlation to each other or to streamflow.

One storm event was sampled during the autumn 2001 season. Storm event 1 began on November 25, 2001 and was significant enough to create visible run-off in ditches. Volunteers sampled the storm three times at 4-hour intervals during the rising limb of the hydrograph. Observation of stage heights indicated that streamflow increased from 227 cfs to 560 cfs at the end of the sampling period 8 hours later. *E.coli* bacteria levels increased with stormflow form a starting sample of 387 colonies/ml to 1553 colonies/ml which is over 3 times over the legal standard of 406 colonies/ml. No definitive relationship existed between the other parameters and streamflow.

A second storm event was sampled on March 6, 2002. The long interval between storm samples was caused when several January storms were either snow events, that DEQ personnel requested not be sampled because cold temperatures reduce bacteria levels, or insufficient to create runoff. A lack of storms adequate to create significant runoff limited sampling in February. Volunteer frustration was shared by DEQ personnel who faced the same limitations on sampling and who only partially sampled a February 2002 storm due to inaccurate weather predictions. The second storm event was measured for a range of flows at the Lower Pedee Creek site from 151 cfs to 299 cfs. Bacteria levels did not exceed the legal standard. Storm sampling data is attached to this Report in Appendix A2

Pedee Creek, downstream of agricultural intensive operations, demonstrated a general increase in *E. coli* colonies with increasing stream discharge during the first storm event. The relatively few data points, however, did not allow adequate statistical analysis and combination with data from the second storm sampling resulted in no obvious trend with streamflows.

Statistical evaluation of Pedee Creek was more difficult than anticipated due to the relatively large range of the data set and the small number of data points. Due to the small sample size, data from both storms was combined into one data set for each parameter and South Fork and North Fork Pedee Creek data were combined on the opinion that both sites represented sites upstream of active agriculture. Due to the large standard deviation of the data from the mean and the irregular distribution of the data set, regular Analysis of variance was determined to be inadequate. Non-parametric statistical evaluation of the data was attempted at the suggestion of various reviewers. Wilcoxan/Kruskal-Wallis tests (Rank Sums) were calculated using statistical software. Conductivity, total suspended solids and current temperature were determined not to be statistically different upstream and downstream of ag. operations in the valley. Turbidity (figure 7)and *E coli* bacteria levels (figure 8) were determined to be statistically different at the 95% probability level ($p=0.0273$) and ($p=0.002$) respectively. Median values were used to calculate the test for bacteria due to the large standard deviation from the mean. (SD=378.24)

The final storm sampling was discontinued in May 2002 due to a lack of storms sufficient to provide adequate run-off. Discussions with DEQ sampling coordinators indicated the remaining grant funds could be better spent on weekly sampling. On May 14, 2002 weekly sampling of sites throughout the Luckiamute was reinitiated. Sampling determined that the geometric mean standard for bacteria was violated for the Little Luckiamute at Elkins road site however only 2 samples were taken, limiting the completeness of the data set.

DEQ personnel, working on the Luckiamute River Bacteria Monitoring project, sampled several of the sites in the basin during storm events. These data are attached in Appendix B. Sampling occurred during storms on February 21, 2002 and March 12, 2002. Unfortunately, the DEQ sampling did not coincide with Watershed Council storm sampling to provide a split sample for comparison of data. Watershed Council volunteer sampling was limited to weekdays when the contracted lab was open and available to analyze bacteria samples within the holding time requirements. In addition to the sites, the watershed council sampled, DEQ teams monitored several other sites throughout the Luckiamute basin. This included a drainage ditch near the town of Pedee but not within the Pedee Creek watershed that had *E. coli* values of over 12,000 colonies/ml. This is 32 times the legal standard. Additional bacteria violations occurred at the Luckiamute at Helmick

State Park site and at several sites within the Soap Creek sub-watershed. These results are interesting however no flow data accompanied the data so comparison to Pedee Creek data was not possible.

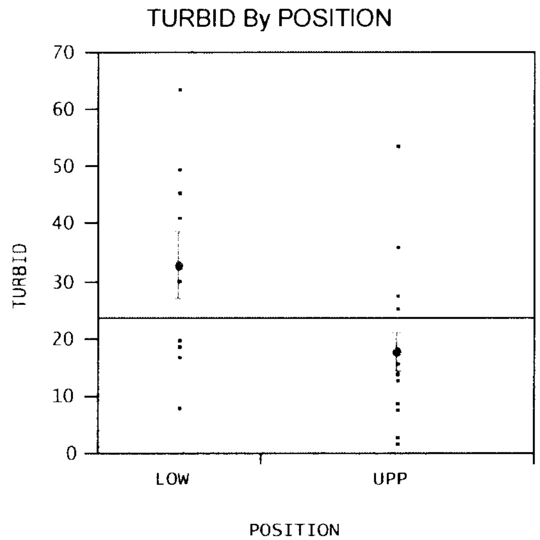

Figure 7. Statistical analysis of turbidity data for Pedee Creek storm sampling

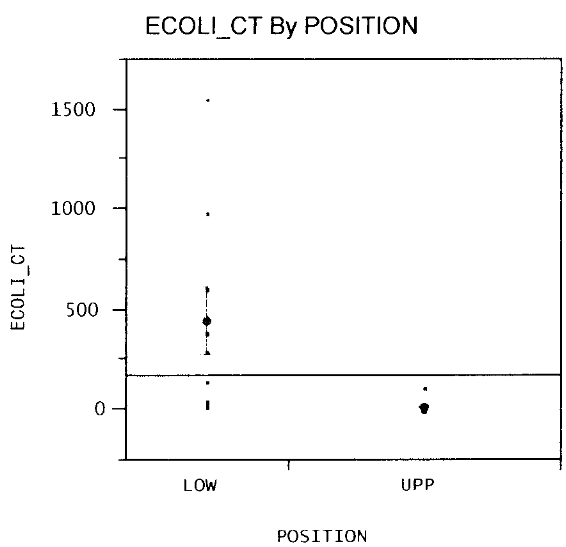

Figure 8 Statistical Analysis of *E. coli* data for Pedee Creek storm sampling

Visual estimates of soil disturbance were made on November 27, 2001 and March 6 2002. Volunteers drove along Pedee Creek Road, Ronco Road, the 1400 line Road and Kings Valley Highway within the Pedee Creek watershed and made acreage determinations of bare soil within the 100 year floodplain caused by livestock. Floodplain boundaries were difficult to ascertain, despite the map, because there are no definitive terraces or other geomorphic features to correspond to the floodplain width. Volunteers estimated only 4 acres of disturbed soils and 1 barn within the 100 year floodplain, however an additional 8 acres outside of the floodplain but adjacent to seasonal ditches were also observed within the agricultural portion of Pedee Creek during the first storm sample. Areas denuded of soil had increased by approximately 2 acres during the second storm sample. These estimates were compared to pollution data. The results are shown in table 4. No obvious connection exists between areas of denuded soil and bacteria concentrations however the relatively small sample size makes interpretation difficult. A barn and recently vacated 2-acre sacrifice pasture was observed adjacent to the South Fork of Pedee Creek but were not located on the 100 year flood hazard map, likely due to an oversight by mapmakers. Additional sacrifice pasture acreage was observed outside the 100year floodplain boundaries. These pastures were located adjacent to flowing ditches that could transport pollution to Pedee Creek in a matter of minutes. Although combining these sites with floodplain data did not change the results, it is possible these areas are contributing pollution. This issue was not sampled to avoid a point source determination, however, the issue is also not addressed in the Mid-Willamette Ag. Water Quality Management Plan.

Table 4. Visual estimates of disturbed soils within the 100 year floodplain and median *E. coli* concentrations downstream of agricultural areas on Pedee Creek.

Date Observed	Acres denuded	Median *E. coli* at Hwy 223 site
November 29,2001	4	613
March 7, 2002	6	146

Photo 3 includes an example of denuded pasture within the 100 year floodplain

Precision and Accuracy Analysis

Starting and ending lab checks and calibrations were completed as outlined in the Quality Assurance Project Plan (Appendix D) Accuracy requirements required for level A data were met for all samples (Table 5)

Table 5 Equipment and accuracy for Water Quality Monitoring Parameters for 2001 Sampling

Parameter	Equipment	Accuracy	# samples exceeding limit
pH	Orion 210 A Electrode pH meter	+/- 0.2 units	0
Turbidty ntu	Hach 2100 A turbidity meter	+/-5% of standard	0
Conductivity uS/cm	YSI Model 30 conductance meter	+/- 5% of standard	0
Temperature	YSI Model 30 conductance meter	+/- 1°C	0
E. coli bacteria	Most Probable Number Standard Meth (Water Lab of Salem)		State Cert.
Total Susp. Solids	USEPA Methods for Chemical Analysis (Water Lab of Salem)		State Cert.

Photocopies of equipment logbook pages are included in Appendix E.

Precision checks of the data based on duplicate samples indicate all parameters except for pH meeting the A level data quality requirements (table 6). Percent difference was calculated the relative percent different method.

Table 6. Precision Requirements for Duplicate Field Samples to Achieve A Quality Data

Parameter	Precision requirement	# Duplicates Exceeding range
pH	+/- 0.3	1
Turbidity	+/- 5%	0
Conductivity 25°C	+/- 2%	0
Temperature	+/- 1.0°C	0
E. coli bacteria	>+/- 0.5 log	0
Total Suspended Solids		0

Split sampling with DEQ personnel indicated possible problems with pH and turbidity measurements. Only 1 turbidity measurement met the relative percent change standard of less than 5%. The remaining values ranged from 14% to over 94% difference. The turbidity meter had been re-calibrated by the project manager on 12-17-2001. Discussions with DEQ personnel indicated a possible trouble with the equipment however it was not determined if the faulty meter was used by the volunteers or the GEQ staff. The data was recommended downgraded to B level data quality so that analysis could continue but the data would not be accepted for TMDL development.

Values for pH from all sampling sites are suspect based on poor precision relating DEQ staff measurements compared to watershed volunteer measurements despite valid accuracy checks. Buffer reading accuracy was likely attributed to the strong ionic strength of the buffer solution. Possible explanations for the low pH results are likely sample preparation error. Discussions with DEQ staff identified a possible problem with low sample conductivity despite the addition of ionic strength adjuster. A poorly performing meter electrode may have been unable to accurately read the samples correctly due to low conductivity of the samples. The pH data were downgraded to educational (E) confidence level until further sampling confirms the data.

All other data including *E. coli* bacteria data met required minimums for A level data. DEQ should be able to use this data for TMDL development

Discussion

The violations of *E. coli* bacteria single event legal standards surprised and concerned many members of the Pedee/Ritner Creeks Watershed Council. Most residents considered Pedee Creek to be relatively clean. The revelation that agricultural operations may be influencing water quality caused several operators to reconsider their livestock management programs.

Members of the Pedee/Ritner Creeks watershed council initiated voluntary changes in an attempt to limit contribution of pollutants. All livestock producers reduced the numbers of animals they wintered in the valley. Sheep numbers were reduced by ½ and cattle numbers were reduced by 30% of 2001 levels. Additionally, some livestock producers took immediate steps to limit livestock access to riparian zones, created buffer strips, set out erosion control straw bales, planted buffer zones and made sure they conformed to incoming Agricultural Water Quality Management Plan rules. Other producers took additional interest in federal programs to create buffer zones and other water quality improvement projects. Additional livestock management changes have included designing manure storage sheds to avoid run-off from outside manure piles, moving livestock feeding locations away from waterways, placing rock to control mud production and building interior pasture fences that limit livestock access to ditches. These actions have been undertaken in order to reduce the pollution contributions and to demonstrate proactive measures in case regulatory agencies investigate. As one council members stated, "we let the cards fall where they may, now we need to play the hand."

Photo 4 demonstrates some of the immediate fencing work livestock producers completed to limit livestock access to streamside areas. Note the new planting of conifer trees behind the fence

photo 4.jpg

The lack of flow measurements throughout most of the Luckiamute is a serious limitation to water quality data collection in the Luckiamute Basin. TMDL development requires accurate estimation of flows to calculate loading factors. The limitation of only one active gauging station within the entire watershed and an apparent inability for regional streamflow equations to accurately predict flows suggest difficulty in modeling accurate TMDL's for the Luckiamute Basin. The measurements of most of the high bacteria levels in portions of streams and ditches with relatively low discharge, compared with mainstem flow may indicate that streamflow has a diluting effect in mainstem sections. This observation has caused consternation among resident of smaller tributaries to the Luckiamute because they fear that models and resulting regulations developed using this data will unfairly target their properties.

Conclusions

Water Quality sampling by DEQ and the Pedee/Ritner Creeks Watershed Council indicates that *E. coli* bacteria levels, measured downstream of agricultural areas on Pedee Creek, have exceeded the legal single event standard several. Non-parametric analysis indicates a statistical difference between bacteria and turbidity measurements upstream and downstream of those agricultural areas. It appears likely that agricultural operations in the Pedee Valley are contributing pollution to surface waters however, no direct correlation between winter sacrifice pasture area and water quality likely attributed to small sample size.

In reaction, members of Pedee/Ritner Creeks watershed council have initiated voluntary measures to reduce possible pollution inputs into the Creek. An education effort is also underway to alert non-council members of the situation and to work to get voluntary compliance with regulations outlined in the Mid-Willamette Agricultural Water Quality Management Plan.

The Pedee/Ritner Creeks Watershed Council has resolved to recommend specific actions to state agencies. These include:

A) Further monitoring to increase the data set for other areas of the Luckiamute basin.

B) More active measurement of stream discharge over a wider area of the Luckiamute Basin

C) A statistical analysis of the dilution capabilities of larger river segments compared to small streams and ditches

D) Independent review of TMDL's and models developed for the Luckiamute Basin to avoid unfair attention created by the Pedee Creek volunteer sampling project.

References Cited

Dunne T. and Leopold L. 1978 Water in Environmental Planning 799 pp.

Oregon Department of Agriculture. 2002. Mid Willamette Agricultural Water Quality Management Plan. 65 pp

Oregon Department of Environmental Quality. 2001. Upper Willamette Subbasin TMDLs Luckiamute River Bacteria Monitoring Plan (Draft)

Oregon Department of Environmental Quality . 2000 Oregon's Water Quality Nonpoint Source Program Plan 2000 update

Oregon Department of Environmental Quality. 2001 Source Water Assessment Report Falls City Water Department, Oregon PWS #4100297 17pp

Oregon Plan for salmon and watersheds monitoring guidebook

USDA Forest Service General Technical Report RM-245 Stream Channel Reference Sites: An illustrated guide book to field techniques. P42-49

USDA Natural Resources Conservation Service 1998. Pasture Management for small acreage animal owners. Pamphlet 4.pp.

US EPA 1996-EPA 841-B-96-003 The Volunteer Monitors Guide to Quality Assurance Plans 59 pp.

United States Geological Service. 2001 unpublished streamflow data for the Luckiamute River Near Suver, Or.

Appendix A 1

Luckiamute River Weekly Sampling

Parameter
E.coli col/100mls

Site	LASAR ID #	26-Nov	3-Dec	10-Dec	17-Dec	26-Dec	2-Jan	7-Jan	14-Jan
Pedee Creek at Kings Highway	25481	27	30	13	26	11	46	42	10
Duplicate			35						5
Luckiamute U/S of Pedee Creek at Ritner	N/A	20	17	38	18	12	52	35	7
Duplicate				36					
Luckiamute at Hoskins	11111	20	15	21	15	14	21	58	18
Duplicate					12				
Luckiamute at Airlie Road Bridge	25477	68	52	32	47	14	84	91	26
Duplicate						20			
Little Luckiamute at Elkins Rd	11114	77	54	21	101	19	47	209	16
Duplicate							26		
Luckiamute at Helmick State Park	10659	82	120	40	132	22	55	298	39
Duplicate		102						298	

Parameter
Total Dissolved Solids

Site	LASAR ID #	26-Nov	3-Dec	10-Dec	17-Dec	26-Dec	2-Jan	7-Jan	14-Jan
Pedee Creek at Kings Highway	25481	3.3	4	7	24.3	4	3.6	47.3	7
Duplicate			3.6						6.3
Luckiamute U/S of Pedee Creek at Ritner	N/A	3.6	1.3	15.3	35	6.3	4.3	46.3	6.3
Duplicate				15.6					
Luckiamute at Hoskins	11111	5.6	1.6	278.6	48	4	5	69.2	5.6
Duplicate					12				
Luckiamute at Airlie Road Bridge	25477	11.6	20.3	37	54.6	7	7.6	89.5	9.6
Duplicate						9.6			
Little Luckiamute at Elkins Rd	11114	13	10	1.3	52.3	10.6	18	47.6	18.6
Duplicate							17.3		
Luckiamute at Helmick State Park	10659	26.3	25	36.6	57.6	22.6	21.6	122	17.3
Duplicate		23.6						95.2	

Parameter
Conductivity

Site	LASAR ID #	26-Nov	3-Dec	10-Dec	17-Dec	26-Dec	2-Jan	7-Jan	14-Jan
Pedee Creek at Kings Highway	25481	38.6	40.8	42.6	39.9	46.2	45.7	38.4	42.8
Duplicate			40.8						42.6
Luckiamute U/S of Pedee Creek at Ritner	N/A	42.2	44.2	45.1	43.9	53	53.4	42.5	45.9
Duplicate				45.1					
Luckiamute at Hoskins	11111	46.6	46.1	44.5	43.4	50.9	50.7	41.5	41.6
Duplicate					43.2				
Luckiamute at Airlie Road Bridge	25477	51.8	52.9	54.8	49.7	59.2	62.3	48	52.4
Duplicate						59.2			
Little Luckiamute at Elkins Rd	11114	47.4	49.2	50.2	39.3	53.2	53	41.8	46.3
Duplicate							53		
Luckiamute at Helmick State Park	10659	52.6	56.4	57.2	46.4	60.4	62.7	46.8	55.4
Duplicate		51.3						46.2	

Parameter
Temperature

Site	LASAR ID #	26-Nov	3-Dec	10-Dec	17-Dec	26-Dec	2-Jan	7-Jan	14-Jan
		Date							
Pedee Creek at Kings Highway	25481	7	8.3	7.1	8	6.1	7.9	10	7.2
Duplicate			8.3						7.1
Luckiamute U/S of Pedee Creek at Ritner	N/A	6.9	8.4	7.4	8.1	5.6	7.6	9.8	7.1
Duplicate				7.4					
Luckiamute at Hoskins	11111	7.2	7.9	6.9	7.7	5.2	7.6	9.8	6.5
Duplicate					7.7				
Luckiamute at Airlie Road Bridge	25477	7.3	8.4	7.3	8.1	5.5	7.6	10	6.8
Duplicate						5.6			
Little Luckiamute at Elkins Rd	11114	7	7.9	7.1	7.9	5.5	7.6	10.1	6.6
Duplicate							7.5		
Luckiamute at Helmick State Park	10659	7.6	8.2	7.4	8.3	5.8	7.4	10.2	6.9
Duplicate		7.6						10.3	

Parameter
pH

Site	LASAR ID #	26-Nov	3-Dec	10-Dec	17-Dec	26-Dec	2-Jan	7-Jan	14-Jan
		Date							
Pedee Creek at Kings Highway	25481	6.9	6.9	6.9	6.8	7.5	7.5	6.5	6.9
Duplicate			6.9						6.8
Luckiamute U/S of Pedee Creek at Ritner	N/A	6.8	6.8	6.5	6.8	7.4	7.2	6.6	6.6
Duplicate				6.4					
Luckiamute at Hoskins	11111	6.9	6.8	6.5	6.8	7.4	7.1	6.5	6.8
Duplicate					6.8				
Luckiamute at Airlie Road Bridge	25477	6.8	6.7	6.6	6.2	7	7	6.6	6.9
Duplicate						7			
Little Luckiamute at Elkins Rd	11114	6.5	6.7	6.5	6.4	6.9	7	6.5	6.6
Duplicate							7		
Luckiamute at Helmick State Park	10659	6.8	6.8	6.7	6.5	6.9	7	6.5	6.9
Duplicate		6.8						6.5	

Parameter
turbidity

Site	LASAR ID #	26-Nov	3-Dec	10-Dec	17-Dec	26-Dec	2-Jan	7-Jan	14-Jan
		Date							
Pedee Creek at Kings Highway	25481	8.5	16.6	6.2	9.5	3.3	3.6	17.5	12.1
Duplicate			16.1						12.4
Luckiamute U/S of Pedee Creek at Ritner	N/A	7.5	13	7	18.8	4.2	5.6	26.8	19.9
Duplicate				6.8					
Luckiamute at Hoskins	11111	8.9	8.5	17	24.7	3.4	2.5	40.7	27.3
Duplicate					24.4				
Luckiamute at Airlie Road Bridge	25477	9.2	14.8	20.1	37.2	7.9	8.4	64.1	31.5
Duplicate						7.8			
Little Luckiamute at Elkins Rd	11114	7.7	28.6	18.3	42.9	8.4	15.9	71.5	39.5
Duplicate							15.8		
Luckiamute at Helmick State Park	10659	10.3	21.2	22.7	50.6	13.9	20.9	96.2	47
Duplicate		10.5						88.2	

Parameter
E.coli col/100mls

Date

Site	LASAR ID #	14-May	21-May
Pedee Creek at Kings Highway	25481	35	53
Duplicate			
Luckiamute U/S of Pedee Creek at Ritner	N/A	N/S	N/S
Duplicate			
Luckiamute at Hoskins	11111	60	28
Duplicate		56	
Luckiamute at Airlie Road Bridge	25477	39	108
Duplicate			
Little Luckiamute at Elkins Rd	11114	121	201
Duplicate			
Luckiamute at Helmick State Park	10659	68	196
Duplicate			308

Parameter
Total Dissolved Solids

Date

Site	LASAR ID #	14-May	21-May
Pedee Creek at Kings Highway	25481	1.3	0
Duplicate			
Luckiamute U/S of Pedee Creek at Ritner	N/A	N/S	N/S
Duplicate			
Luckiamute at Hoskins	11111	0	1
Duplicate		0	
Luckiamute at Airlie Road Bridge	25477	4	1.6
Duplicate			
Little Luckiamute at Elkins Rd	11114	3.3	2.3
Duplicate			
Luckiamute at Helmick State Park	10659	3.3	8
Duplicate			9.6

Parameter
Conductivity

Date

Site	LASAR ID #	14-May	21-May
Pedee Creek at Kings Highway	25481	49.5	57.7
Duplicate			
Luckiamute U/S of Pedee Creek at Ritner	N/A	N/S	N/S
Duplicate			
Luckiamute at Hoskins	11111	30.3	52.3
Duplicate		50.7	
Luckiamute at Airlie Road Bridge	25477	60.7	60.4
Duplicate			
Little Luckiamute at Elkins Rd	11114	51.3	50.5
Duplicate			
Luckiamute at Helmick State Park	10659	62.5	61
Duplicate			61.1

Parameter
Temperature

Date

Site	LASAR ID #	14-May	21-May
Pedee Creek at Kings Highway	25481	9.3	9.4
Duplicate			
Luckiamute U/S of Pedee Creek at Ritner	N/A	N/S	N/S
Duplicate			
Luckiamute at Hoskins	11111	10.6	10.4
Duplicate		10.6	
Luckiamute at Airlie Road Bridge	25477	11.9	12
Duplicate			
Little Luckiamute at Elkins Rd	11114	11.6	12
Duplicate			
Luckiamute at Helmick State Park	10659	13	13.3
Duplicate			13.3

Parameter
pH

Date

Site	LASAR ID #	14-May	21-May
Pedee Creek at Kings Highway	25481	6.82	6.88
Duplicate			
Luckiamute U/S of Pedee Creek at Ritner	N/A	N/S	N/S
Duplicate			
Luckiamute at Hoskins	11111	6.94	6.84
Duplicate		6.9	
Luckiamute at Airlie Road Bridge	25477	6.91	6.92
Duplicate			
Little Luckiamute at Elkins Rd	11114	6.74	6.94
Duplicate			
Luckiamute at Helmick State Park	10659	6.85	6.81
Duplicate			6.83

Appendix A 2 Pedee Storm Sampling

Storm 1

Parameter
E.coli col/100mls

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	2.35	387	3.44	613	4.75	1553
Duplicate				3.44	183		
South Fork Pedee Creek		1.96	29	2.14	20	2	11
Duplicate							
North Fork Pedee Creek			14.6		16		9
Duplicate							

Parameter
Total Suspended Solids

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	2.35	95.6	3.44	70	4.75	118.6
Duplicate				3.44	71		
South Fork Pedee Creek		1.96	28.3	2.14	17.6	2	14
Duplicate							
North Fork Pedee Creek			31		23.6		16.3
Duplicate							

Parameter
Conductivity

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	2.35	39.5	3.44	39.6	4.75	40.5
Duplicate				3.44	39.5		
South Fork Pedee Creek		1.96	33.4	2.14	33.1	2	33.9
Duplicate							
North Fork Pedee Creek			41.1		39.2		41.2
Duplicate							

Parameter
Temperature

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	2.35	9.9	3.44	10.7	4.75	9
Duplicate				3.44	10.8		
South Fork Pedee Creek		1.96	9.6	2.14	11.4	2	9.2
Duplicate							
North Fork Pedee Creek			9.7		11.7		9.9
Duplicate							

Parameter
pH

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	2.35	6.41	3.44	6.4	4.75	6.4
Duplicate				3.44	6.4		
South Fork Pedee Creek		1.96	6.24	2.14	6.4	2	6.5
Duplicate							
North Fork Pedee Creek			6.6		6.6		6.6
Duplicate							

Parameter
Turbidity

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	2.35	41.3	3.44	30.4	4.75	46
Duplicate				3.44	46.8		
South Fork Pedee Creek		1.96	14.2	2.14	18.6	2	9
Duplicate							
North Fork Pedee Creek			16.1		25.6		13
Duplicate							

ppendix A 2 Storm Sampling

Storm 2

Parameter
E.coli col/100mls

Time

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	1.8	47	2.28	291	2.87	146
Duplicate							
South Fork Pedee Creek			9		111		7
Duplicate							
North Fork Pedee Creek			2		13		4.3
Duplicate							11

Parameter
Total Suspended Solids

time

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	1.8	2.6	2.28	26	2.87	13.2
Duplicate							
South Fork Pedee Creek			0		7.6		2
Duplicate							
North Fork Pedee Creek			3.3		14.6		4.3
Duplicate							4

Parameter
Conductivity

time

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	1.8	54.2	2.28	43.5	2.87	36.1
Duplicate							
South Fork Pedee Creek			47.1		27.8		30.6
Duplicate							
North Fork Pedee Creek			41.5		29.9		29.4
Duplicate							29.5

Parameter
Temperature

time

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	1.8	7.4	2.28	7.2	2.87	7.5
Duplicate							
South Fork Pedee Creek			7.2		6.9		7.2
Duplicate							
North Fork Pedee Creek			7		7		7.2
Duplicate							7.2

Parameter
pH

time

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	1.8	6.74	2.28	6.6	2.87	6.72
Duplicate							
South Fork Pedee Creek			6.81		6.84		6.88
Duplicate							
North Fork Pedee Creek			6.92		6.84		6.88
Duplicate							6.89

Parameter
Turbidity

time

Site	LASAR ID #	gage	X	gage	X+4	gage	X+8
Pedee Creek at Kings Highway	25481	1.8	8.2	2.28	20.1	2.78	64.1
Duplicate							
South Fork Pedee Creek			2.08		16.2		36.4
Duplicate							
North Fork Pedee Creek			3.06		18.6		27.8
Duplicate							29

Appendix B
DEQ Storm Sampling Data for the Luckiamute River Basin

LUCKIAMUTE BACTERIA DATA COLLECTION FALL/WINTER/SPRING 2001-2002

MAINSTEM LUCKIAMUTE and Minor Tribs

SITE NAME:	Luckiamute River at Lower Bridge (Buena Vista)						
LASAR NUMBER:	10658 DEQ	DEQ	DEQ	DEQ	DEQ QA	DEQ	DEQ
SAMPLE DATE:	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	5:50	12:05	17:55	16:14	16:15	21:35	16:00
E Coli(MPN - Colilert):	20	31	121	402	465	175	209
TSS (mg/L):	12	9	40	114	113	94	43
Conductance (umhos/cm):	79	85	61	47	46	47	55
Temperature (°C):	8.6	9.4	8.2	8.1	8.1	7.6	7.8
Turbidity (NTU):	14	12	36	118	144	89	52

SITE NAME:	Luckiamute River at Helmick State Park					
LASAR NUMBER:	10659 DEQ	DEQ	DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	6:50	13:00	17:17	15:40	20:55	15:15
E Coli(MPN - Colilert):	<10	20	132	158	109	86
TSS (mg/L):	12	13	52	66	54	36
Conductance (umhos/cm):	54	55	52	46	48	52
Temperature (°C):	8.8	9.5	8.1	7.7	7.6	7.2
Turbidity (NTU):	13	11	48	74	60	48
pH(SU)						

SITE NAME:	Luckiamute River at Airlie Road					
LASAR NUMBER:	25477 DEQ	DEQ	DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	9:30	15:10	15:20	14:00	18:10	13:25
E Coli(MPN - Colilert):	20	73	135	20	41	97
TSS (mg/L):	6	6	39	49	43	28
Conductance (umhos/cm):	57	58	54	50	50	52
Temperature (°C):	9.2	10	8.6	8	8	7.3
Turbidity (NTU):	6	9	31	50	42	31
pH(SU)						

SITE NAME:	RUNOFF d/s Ira Hooker Road				
LASAR NUMBER:	28548	DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:		3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:		14:59	13:45	17:50	13:05
E Coli(MPN - Colilert):		12997	30	1236	5794
TSS (mg/L):		558	26	8	10
Conductance (umhos/cm):		35	43	42	39
Temperature (°C):		8.9	9.1	8.1	8.3
Turbidity (NTU):		902	55	30	34

SITE NAME:	Luckiamute River at Ira Hooker Road						
LASAR NUMBER:	25480 DEQ	DEQ	DEQ QA	DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	9:46	15:30		14:55	13:40	17:36	13:00
E Coli(MPN - Colilert):	<10	<10		278	41	41	52
TSS (mg/L):	4	4		47	40	38	18
Conductance (umhos/cm):	54	54		50	48	49	50
Temperature (°C):	9	10.1		8.6	7.9	7.9	7.4
Turbidity (NTU):	10	7		36	39	37	23

SITE NAME:	Pedee Creek at Kings Highway						
LASAR NUMBER:	25481 DEQ	DEQ	DEQ QA	DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	11:25	16:15		14:20	13:05	17:25	12:20
E Coli(MPN - Colilert):	10	<10		987	41	20	31
TSS (mg/L):	6	4		73	20	20	12
Conductance (umhos/cm):	42	44		39	40	40	40
Temperature (°C):	9.8	10.1		8.7	8.3	8.1	7.5
Turbidity (NTU):	6	6		50	19	17	16

SITE NAME:	NF Pedee Creek at Headwaters						
LASAR NUMBER:	26733 DEQ	DEQ	DEQ QA	DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	10:35	15:55		14:32	13:20	17:10	12:35
E Coli(MPN - Colilert):	<10	<10		10	<10	<10	10
TSS (mg/L):	4	3		76	10	8	5
Conductance (umhos/cm):	44	46		39	41	42	42
Temperature (°C):	9.5	10.4		8.5	8	7.7	7.4
Turbidity (NTU):	3	5		54	8	8	6

SITE NAME:	Luckiamute River u/s Ritner Creek at Grant Road.							
LASAR NUMBER:	25483 DEQ	DEQ QA	DEQ	DEQ QA	DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	2/21/2002	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	11:45	11:46	16:30	16:31	14:05	12:47	16:32	12:05
E Coli(MPN - Colilert):	52	20	31	10	121	31	52	62
TSS (mg/L):	3	3	5	5	35	48	39	20
Conductance (umhos/cm):	56	56	55	55	55	51	51	55
Temperature (°C):	9.5	9.4	10	9.9	8.4	7.7	7.8	7.1
Turbidity (NTU):	4	4	9	8	29	40	40	25

SITE NAME:	Luckiamute River at Hoskins						
LASAR NUMBER:	11111 DEQ	DEQ	DEQ	DEQ	DEQ	DEQ	DEQ QA
SAMPLE DATE:	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002	3/13/2002
SAMPLE TIME:	12:05	16:52	13:55	12:30	16:05	11:45	11:46
E Coli(MPN - Colilert):	20	10	52	31	<10	10	10
TSS (mg/L):	8	8	32	41	37	17	18
Conductance (umhos/cm):	46	45	43	41	42	43	43
Temperature (°C):	9	10.2	8.3	8.3	7.9	7	7
Turbidity (NTU):	7	11	20	36	26	15	15
pH(SU)							

LUCKIAMUTE BACTERIA DATA COLLECTION FALL/WINTER/SPRING 2001-2002

LITTLE LUCKIAMUTE and Tribs

SITE NAME: **Little Luckiamute River at Elkins Road**

LASAR NUMBER :	11114 DEQ	DEQ	DEQ	DEQ	DEQ	DEQ QA	DEQ
SAMPLE DATE:	2/21/1999	2/21/1999	3/11/2002	3/12/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	7:15	13:20	17:00	15:20	20:25	20:26	15:00
E Coli(MPN - Colilert):	73	120	350	160	85	97	187
TSS (mg/L):	14	32	97	44	40	34	33
Conductance (umhos/cm):	8.6	41	40	41	42	42	46
Temperature (°C):	45	9.3	8.2	7.2	7.7	7.7	7.1
Turbidity (NTU):	11	21	76	53	47	49	42
pH(SU)							

SITE NAME: **Little Luckiamute River at Bridgeport Road**

LASAR NUMBER : 26736	DEQ	DEQ QA	DEQ	DEQ	DEQ	DEQ QA
SAMPLE DATE:	3/11/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002	3/13/2002
SAMPLE TIME:	16:25	16:26	14:55	19:50	14:30	14:31
E Coli(MPN - Colilert):	305	389	10	10	<10	<10
TSS (mg/L):	112	105	16	12	9	8
Conductance (umhos/cm):	29	29	36	36	31	38
Temperature (°C):	7.3	7.3	7.7	7	7.6	7.5
Turbidity (NTU):	108	107	16	16	12	12

SITE NAME: **Teal Creek at Gardner Road**

LASAR NUMBER : 11118	DEQ	DEQ	DEQ
SAMPLE DATE:	3/11/2002	3/12/2002	3/13/2002
SAMPLE TIME:	16:30	15:10	14:45
E Coli(MPN - Colilert):	288	20	31
TSS (mg/L):	139	5	26
Conductance (umhos/cm):	32	33	35
Temperature (°C):	8.6	7.9	7.6
Turbidity (NTU):	135	37	31

SITE NAME: **Fall City WWTP Final Effluent**

LASAR NUMBER : 28500	DEQ	DEQ	DEQ QA	DEQ
SAMPLE DATE:	Not Discharging	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	Not Discharging	14:25	14:26	14:00
E Coli(MPN - Colilert):	Not Discharging	<10	<10	<10
TSS (mg/L):	Not Discharging	2	2	2
Conductance (umhos/cm):	Not Discharging	244	245	225
Temperature (°C):	Not Discharging	10.9	11	11
Turbidity (NTU):	Not Discharging	4	4	3

SITE NAME: **Little Luckiamute River at Fall City Gage**

LASAR NUMBER :	26735 DEQ	DEQ	DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	7:55	13:53	16:25	14:40	18:45	14:10
E Coli(MPN - Colilert):	20	<10	305	<10	10	<10
TSS (mg/L):	20	6	112	11	8	5
Conductance (umhos/cm):	29	28	29	31	31	34
Temperature (°C):	7.5	8.3	7.3	7.9	6.4	7.1
Turbidity (NTU):	15	9	108	12	10	6

LUCKIAMUTE BACTERIA DATA COLLECTION FALL/WINTER/SPRING 2001-2002

SOAP CREEK and Tribs

SITE NAME:	Soap Creek at Corvallis Road					
LASAR NUMBER:	11113 DEQ	DEQ	DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	6:25	12:25	17:35	16:00	21:20	15:40
E Coli(MPN - Colilert):	20	31	341	121	51	556
TSS (mg/L):	6	6	76	26	25	29
Conductance (umhos/cm):	126	131	111	108	108	102
Temperature (°C):	9.5	10.2	9.5	8.1	9	7.5
Turbidity (NTU):	12	11	95	57	50	62

SITE NAME:	Unnamed Trib to Soap Creek at Corvallis Road			
LASAR NUMBER:	26738 DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	3/11/2002	3/12/2002	3/13/2002
SAMPLE TIME:	6:15	17:40	16:05	13:50
E Coli(MPN - Colilert):	<10	455	677	906
TSS (mg/L):	3	32	13	9
Conductance (umhos/cm):	125	84	110	101
Temperature (°C):	9.7	9.6	94	8.8
Turbidity (NTU):	9	68	24	31

SITE NAME:	Soap Creek at Hwy. 99W			
LASAR NUMBER:	26739 DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	3/11/2002	3/12/2002	3/13/2002
SAMPLE TIME:	14:25	13:20	12:05	11:15
E Coli(MPN - Colilert):	10	246	145	388
TSS (mg/L):	4	16	21	25
Conductance (umhos/cm):	114	116	103	98
Temperature (°C):	10.3	9.2	7.7	7
Turbidity (NTU):	10	37	61	67

SITE NAME:	Berry Creek at DeArmond Road			
LASAR NUMBER:	26743 DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	3/11/2002	3/12/2002	3/13/2002
SAMPLE TIME:	14:15	13:05	11:40	10:50
E Coli(MPN - Colilert):	86	130	743	120
TSS (mg/L):	13	78	23	20
Conductance (umhos/cm):	96	94	94	86
Temperature (°C):	10.9	9.6	8.8	7.4
Turbidity (NTU):	15	124	62	57

SITE NAME:	Soap Creek at Robison Road				
LASAR NUMBER:	26740 DEQ	DEQ	DEQ	DEQ QA	DEQ
SAMPLE DATE:	2/21/2002	3/11/2002	3/12/2002	3/12/2002	3/13/2002
SAMPLE TIME:	14:00	13:00	11:50	11:51	11:05
E Coli(MPN - Colilert):	31	609	206	246	1236
TSS (mg/L):	3	44	26	29	22
Conductance (umhos/cm):	126	115	110	110	103
Temperature (°C):	10.1	8.9	7.4	7.5	6.8
Turbidity (NTU):	7	53	42	43	44

SITE NAME:	Soap Creek at Beef Barn Road			
LASAR NUMBER:	26741 DEQ	DEQ	DEQ	DEQ
SAMPLE DATE:	2/21/2002	3/11/2002	3/12/2002	3/13/2002
SAMPLE TIME:	15:00	12:45	11:20	10:35
E Coli(MPN - Colilert):	86	8664	211	959
TSS (mg/L):	3	110	12	14
Conductance (umhos/cm):	130	118	113	110
Temperature (°C):	10.1	8.9	7.6	7
Turbidity (NTU):	7	202	27	34

SITE NAME:	Soap Creek at South Boundary Road		
LASAR NUMBER:	28519	DEQ	DEQ
SAMPLE DATE:		3/12/2002	3/13/2002
SAMPLE TIME:		11:10	10:15
E Coli(MPN - Colilert):		20	<10
TSS (mg/L):		9	10
Conductance (umhos/cm):		113	110
Temperature (°C):		7.6	7.1
Turbidity (NTU):		25	23

Appendix C

Hourly flows for the Luckiamute River Near Suver for weekly sampling

TIME SERIES RECORD
LUCKIAMUTE RIVER NEAR SUVER, OR

NAME	YEAR	MONTH	DAY	MINUTE	FLOW
Q14190500	2001	11	1	30	362.5332
Q14190500	2001	11	1	60	363.6544
Q14190500	2001	11	1	90	367.1249
Q14190500	2001	11	1	120	369.579
Q14190500	2001	11	1	150	370.8081
Q14190500	2001	11	1	180	373.2708
Q14190500	2001	11	1	210	374.5042
Q14190500	2001	11	1	240	376.9756
Q14190500	2001	11	1	270	378.2133
Q14190500	2001	11	1	300	378.2133
Q14190500	2001	11	1	330	379.4525
Q14190500	2001	11	1	360	378.2133
Q14190500	2001	11	1	390	378.2133
Q14190500	2001	11	1	420	376.9756
Q14190500	2001	11	1	450	375.7391
Q14190500	2001	11	1	480	373.2708
Q14190500	2001	11	1	510	370.8081
Q14190500	2001	11	1	540	368.3511
Q14190500	2001	11	1	570	364.7767
Q14190500	2001	11	1	600	362.5332
Q14190500	2001	11	1	630	359.1754
Q14190500	2001	11	1	660	354.7129
Q14190500	2001	11	1	690	351.3767
Q14190500	2001	11	1	720	348.0496
Q14190500	2001	11	1	750	344.7318
Q14190500	2001	11	1	780	340.3226
Q14190500	2001	11	1	810	337.0266
Q14190500	2001	11	1	840	332.6466
Q14190500	2001	11	1	870	329.3725
Q14190500	2001	11	1	900	326.108
Q14190500	2001	11	1	930	322.8529
Q14190500	2001	11	1	960	318.5277
Q14190500	2001	11	1	990	315.2951
Q14190500	2001	11	1	1020	312.0722
Q14190500	2001	11	1	1050	308.9019
Q14190500	2001	11	1	1080	305.7621
Q14190500	2001	11	1	1110	302.6313
Q14190500	2001	11	1	1140	299.5096
Q14190500	2001	11	1	1170	297.4333
Q14190500	2001	11	1	1200	293.2929
Q14190500	2001	11	1	1230	290.1982
Q14190500	2001	11	1	1260	288.1401
Q14190500	2001	11	1	1290	286.0861
Q14190500	2001	11	1	1320	281.9905
Q14190500	2001	11	1	1350	279.9488
Q14190500	2001	11	1	1380	277.9113
Q14190500	2001	11	1	1410	275.8779
Q14190500	2001	11	1	1440	273.8486
Q14190500	2001	11	2	30	270.8125
Q14190500	2001	11	2	60	269.8026
Q14190500	2001	11	2	90	267.7858
Q14190500	2001	11	2	120	266.779
Q14190500	2001	11	2	150	265.7733

Q14190500	2001	11	25	1290	1518.503
Q14190500	2001	11	25	1320	1510.439
Q14190500	2001	11	25	1350	1502.39
Q14190500	2001	11	25	1380	1494.356
Q14190500	2001	11	25	1410	1486.337
Q14190500	2001	11	25	1440	1478.334
Q14190500	2001	11	26	30	1472.341
Q14190500	2001	11	26	60	1464.365
Q14190500	2001	11	26	90	1458.392
Q14190500	2001	11	26	120	1450.442
Q14190500	2001	11	26	150	1444.489
Q14190500	2001	11	26	180	1436.565
Q14190500	2001	11	26	210	1430.633
Q14190500	2001	11	26	240	1424.709
Q14190500	2001	11	26	270	1418.793
Q14190500	2001	11	26	300	1412.886
Q14190500	2001	11	26	330	1406.988
Q14190500	2001	11	26	360	1401.099
Q14190500	2001	11	26	390	1397.177
Q14190500	2001	11	26	420	1391.302
Q14190500	2001	11	26	450	1385.436
Q14190500	2001	11	26	480	1381.53
Q14190500	2001	11	26	510	1375.678
Q14190500	2001	11	26	540	1369.836
Q14190500	2001	11	26	570	1365.945
Q14190500	2001	11	26	600	1360.116
Q14190500	2001	11	26	630	1352.358
Q14190500	2001	11	26	660	1346.55
Q14190500	2001	11	26	690	1340.751
Q14190500	2001	11	26	720	1334.961
Q14190500	2001	11	26	750	1329.179
Q14190500	2001	11	26	780	1323.405
Q14190500	2001	11	26	810	1315.722
Q14190500	2001	11	26	840	1308.055
Q14190500	2001	11	26	870	1300.403
Q14190500	2001	11	26	900	1294.673
Q14190500	2001	11	26	930	1287.049
Q14190500	2001	11	26	960	1279.44
Q14190500	2001	11	26	990	1273.745
Q14190500	2001	11	26	1020	1266.163
Q14190500	2001	11	26	1050	1258.598
Q14190500	2001	11	26	1080	1252.934
Q14190500	2001	11	26	1110	1245.398
Q14190500	2001	11	26	1140	1237.876
Q14190500	2001	11	26	1170	1232.245
Q14190500	2001	11	26	1200	1224.753
Q14190500	2001	11	26	1230	1217.276
Q14190500	2001	11	26	1260	1211.678
Q14190500	2001	11	26	1290	1204.229
Q14190500	2001	11	26	1320	1198.653
Q14190500	2001	11	26	1350	1193.086
Q14190500	2001	11	26	1380	1187.528
Q14190500	2001	11	26	1410	1181.979
Q14190500	2001	11	26	1440	1176.439
Q14190500	2001	11	27	30	1170.908
Q14190500	2001	11	27	60	1165.387
Q14190500	2001	11	27	90	1159.874

Q14190500	2001	12	3	30	4900.265
Q14190500	2001	12	3	60	4865.614
Q14190500	2001	12	3	90	4836.026
Q14190500	2001	12	3	120	4811.447
Q14190500	2001	12	3	150	4772.27
Q14190500	2001	12	3	180	4738.149
Q14190500	2001	12	3	210	4709.012
Q14190500	2001	12	3	240	4675.152
Q14190500	2001	12	3	270	4641.429
Q14190500	2001	12	3	300	4612.637
Q14190500	2001	12	3	330	4579.181
Q14190500	2001	12	3	360	4550.61
Q14190500	2001	12	3	390	4517.415
Q14190500	2001	12	3	420	4489.07
Q14190500	2001	12	3	450	4460.832
Q14190500	2001	12	3	480	4428.017
Q14190500	2001	12	3	510	4399.999
Q14190500	2001	12	3	540	4372.241
Q14190500	2001	12	3	570	4344.571
Q14190500	2001	12	3	600	4316.99
Q14190500	2001	12	3	630	4293.419
Q14190500	2001	12	3	660	4262.096
Q14190500	2001	12	3	690	4234.78
Q14190500	2001	12	3	720	4199.79
Q14190500	2001	12	3	750	4168.815
Q14190500	2001	12	3	780	4141.801
Q14190500	2001	12	3	810	4107.203
Q14190500	2001	12	3	840	4072.754
Q14190500	2001	12	3	870	4038.447
Q14190500	2001	12	3	900	4000.506
Q14190500	2001	12	3	930	3966.513
Q14190500	2001	12	3	960	3928.91
Q14190500	2001	12	3	990	3895.225
Q14190500	2001	12	3	1020	3857.97
Q14190500	2001	12	3	1050	3817.197
Q14190500	2001	12	3	1080	3780.321
Q14190500	2001	12	3	1110	3739.965
Q14190500	2001	12	3	1140	3699.828
Q14190500	2001	12	3	1170	3663.53
Q14190500	2001	12	3	1200	3623.809
Q14190500	2001	12	3	1230	3584.311
Q14190500	2001	12	3	1260	3550.957
Q14190500	2001	12	3	1290	3518.391
Q14190500	2001	12	3	1320	3488.631
Q14190500	2001	12	3	1350	3456.267
Q14190500	2001	12	3	1380	3426.696
Q14190500	2001	12	3	1410	3397.213
Q14190500	2001	12	3	1440	3370.486
Q14190500	2001	12	4	30	3343.833
Q14190500	2001	12	4	60	3314.601
Q14190500	2001	12	4	90	3285.461
Q14190500	2001	12	4	120	3259.048
Q14190500	2001	12	4	150	3232.709
Q14190500	2001	12	4	180	3206.444
Q14190500	2001	12	4	210	3180.257
Q14190500	2001	12	4	240	3156.751
Q14190500	2001	12	4	270	3133.308

Q14190500	2001	12	10	210	1866.152
Q14190500	2001	12	10	240	1857.483
Q14190500	2001	12	10	270	1846.665
Q14190500	2001	12	10	300	1838.028
Q14190500	2001	12	10	330	1829.404
Q14190500	2001	12	10	360	1818.645
Q14190500	2001	12	10	390	1810.054
Q14190500	2001	12	10	420	1803.62
Q14190500	2001	12	10	450	1795.054
Q14190500	2001	12	10	480	1788.638
Q14190500	2001	12	10	510	1782.231
Q14190500	2001	12	10	540	1773.7
Q14190500	2001	12	10	570	1767.312
Q14190500	2001	12	10	600	1760.931
Q14190500	2001	12	10	630	1756.682
Q14190500	2001	12	10	660	1752.437
Q14190500	2001	12	10	690	1750.315
Q14190500	2001	12	10	720	1748.195
Q14190500	2001	12	10	750	1746.076
Q14190500	2001	12	10	780	1746.076
Q14190500	2001	12	10	810	1746.076
Q14190500	2001	12	10	840	1743.957
Q14190500	2001	12	10	870	1741.839
Q14190500	2001	12	10	900	1739.722
Q14190500	2001	12	10	930	1739.722
Q14190500	2001	12	10	960	1739.722
Q14190500	2001	12	10	990	1741.839
Q14190500	2001	12	10	1020	1741.839
Q14190500	2001	12	10	1050	1741.839
Q14190500	2001	12	10	1080	1741.839
Q14190500	2001	12	10	1110	1739.722
Q14190500	2001	12	10	1140	1739.722
Q14190500	2001	12	10	1170	1735.491
Q14190500	2001	12	10	1200	1733.377
Q14190500	2001	12	10	1230	1731.264
Q14190500	2001	12	10	1260	1729.152
Q14190500	2001	12	10	1290	1727.04
Q14190500	2001	12	10	1320	1720.711
Q14190500	2001	12	10	1350	1718.603
Q14190500	2001	12	10	1380	1714.39
Q14190500	2001	12	10	1410	1710.18
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Q14190500	2002	1	14	960	1403.061
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Q14190500	2002	1	14	1050	1395.218
Q14190500	2002	1	14	1080	1391.302

Quality Assurance Project Plan for the Livestock Nutrient and Sediment Monitoring for TMDL development on Pedee Creek, Tributary to the Luckiamute River.
November 2001

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OWEB Grant 201-161

Submitted by: Pedee/Ritner Creeks Watershed Council, Polk Soil and Water Conservation Dist.

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Table of Contents

Background

Pedee Creek , a tributary of the Luckiamute River, is a 6th field watershed in the Mid-Willamette basin. The basin has an area of approximately 7,000 acres and is influenced primarily by rain induced run-off events. Primary land use in the basin is industrial timber production in the upper watershed and agriculture in the lower valley areas. Agriculture in the basin is primarily livestock and forage hay production. Livestock producers in the basin raise 56 head of beef cattle, 92 sheep, 13 horses, and approximately 20 incidental llamas, alpacas, hogs and goats. Most livestock operations in the basin have riparian fencing and riparian zones are generally intact to approximately 15 feet on both sides of the channel, however several drainage ditches and channelized seasonal streams bisect livestock pastures with little or no buffer.

Most ranchers in the basin utilize the recommended practice of confining livestock to a "sacrifice pasture" (winter paddock) during wet winter months to avoid overgrazing and compaction of wet soils on adjacent pasturelands (Washington County SWCD 1998). No farmers in the Pedee basin currently qualify as confined animal feeding operations (cafo) under current state and federal rules however, the sacrifice pasture areas usually become bare of vegetation and have high concentrations of livestock wastes including: *Escheria coli* (E. coli) bacteria. These sacrifice pastures are susceptible to run-off and erosion due to a lack of vegetation and limited infiltration caused by soil compaction.

The Luckiamute River flows into the Willamette river approximately 10 miles south of Independence, OR. The Luckiamute is listed on the 303d water quality limited water body list for bacteria during the fall winter and spring. The listed segment of the Luckiamute (reach ID 22E-Lucko) stretches from the mouth to the Pedee Creek confluence. Requirements of the Federal Clean Water Act require states to remedy water quality problems. The state of Oregon has chosen to correct water quality deficiencies by instituting Total Maximum Daily Loads (TMDL's) for listed basins. These TMDLs need accurate baseline data to develop accurate computer models for load allocation.

In 1998 concerned citizens in the Pedee and adjacent Ritner Creek basins formed the Pedee/Ritner Creeks watershed council to address issues of concern regarding regulation and management of the watershed. One major concern was the water quality limited section of the Luckiamute River just downstream of the confluence with Pedee Creek. After visits from state water and environmental agency personnel, the Pedee /Ritner Creeks council voted to apply for grants to study water quality in the Pedee basin. In 2000 grants requests were submitted to the DEQ for EPA 319 funds and the Oregon Watershed Enhancement Board for a 2 year study of Pedee Creek. The 319 funds were approved however the OWEB funds were not available for project implementation . In July of 2001 OWEB funds became available, however due to the biennial nature of federal 319 funds the original study design needed to be changed to effectively utilize funds in a compressed sampling timeline. The Watershed Council Project Manager in conjunction with DEQ staff altered the original study design to allow for the funding deadlines while gathering effective water quality baseline data for the entire Luckiamute basin. Changes included reducing the sampling period to one year and choosing other sites outside of the Pedee Creek basin. The Pedee/Ritner Creeks council in conjunction with volunteers from the Luckiamute Watershed Council will collect data to aid DEQ staff in developing TMDLs for the Luckiamute basin. Pedee/Ritner Creeks council volunteers will collect data on Pedee Creek to determine if there is a statistical difference in water quality parameters upstream and downstream of agricultural areas on Pedee Creek This data will be used to help agricultural producers in the Pedee basin determine if their practices are harming water quality and will provide baseline data to DEQ personnel to model TMDLs.

Project/Task Description

The original grant involved multi-year sampling of Pedee Creek to determine pollution contribution from agricultural operations in the basin. The change to a 1 year sampling period altered the aims and methods of the project. The project manager met with DEQ staff and agreed to development of a more basin wide approach that would help model more of the basin for TMDL development. The parameters sampled were also changed from the original proposal to better represent likely pollutants that would be detectable and to make comparison with data collected by DEQ personnel. The new sampling plan is developed into 2 phases. The 1st phase will be to collect baseline data throughout the basin on a weekly basis. Parameters sampled will include: pH, turbidity, conductivity and instantaneous temperature., which will be measured in the field by watershed council volunteers using equipment on loan from the DEQ volunteer sampling program. Additionally, water samples will be collected for delivery to a state certified lab where the samples will be tested for E.coli bacteria and total suspended solids. The most important parameters sampled for this study are bacteria, total suspended solids and turbidity since those are most likely affected by agricultural operations. Conductivity, pH and instantaneous temperature will be recorded only as baseline data collection Locations for sampling were developed in conjunction with DEQ staff and are listed in Table 1. Stream discharge will be estimated from gages throughout the watershed including: Pedee Creek at Kings Valley Hwy, South Fork Pedee Creek, the Luckiamute downstream of Pedee Creek at the Ira Hooker Bridge and the Luckiamute River USGS gauging station at Helmick State Park. Sampling parameters will be compared with flows to determine any correlation of flow and pollutant concentration.

Table 1. Weekly Sampling Sites for the Luckiamute Basin to be Sampled During Winter 2001.

Site	LASAR ID #	Lat.	Long
Pedee Creek at Kings Hwy	25481	N 44 74 450	W 123 43 915
Luckiamute River U/S Pedee Creek at Ritner	26734	N 44 73 567	W 123 43 384
Luckiamute at Hoskins	11111	N 44 68 170	W 123 46 775
Luckiamute River at Airlie Rd.	25477	N 44 77 610	W 123 34 322
Little Luckiamute at Elkins Rd.	11114	N 44 79 720	W 123 29 150
Luckiamute River at Helmick St. Park	10659	N 44 78 280	W 123 23 533

These sites are mapped in Figure 1

Sampling will occur from the second week of November and continue for 8 weeks until the first week of January. Sampling will occur every Monday Morning to ensure that bacteria samples will be processed within the 24 hour holding time limit. These data will be used to provide baseline data for TMDL development and to determine if any streams are exceeding state water quality standards.

The second phase of the project involves storm sampling on Pedee Creek both upstream and downstream of agricultural operations. Three locations on Pedee Creek will be sampled (Table 2). The site downstream of agricultural operations is at the Kings Valley Hwy bridge. This site was chosen because it is only 800 meters from the mouth of Pedee Creek and downstream of all agricultural operations in the valley. The site was also chosen because of its accessibility for sampling. Private property and a lack of roads precluded sampling at the mouth. The South Fork Pedee Creek site was chosen after discussions with DEQ staff of the importance of monitoring all possible sources of bacteria and turbidity contributed. South Fork Pedee Creek, while providing approximately 10% of the flow to Pedee Creek has 1 agricultural operation upstream of the confluence and therefore needs to be sampled to rule out contamination. The North Fork Pedee Creek site is located upstream of all agricultural activities and provides the control for the project.

Table 2. Storm Sampling Sites for Pedee Creek to be Sampled During Winter 2001.

Site	LASAR ID #	Lat.	Long
Pedee Creek at Kings Hwy	25481	N 44 74 450	W 123 43 915
South Fork Pedee Creek at Pedee Creek Rd.		N 44 77 107	W 123 44 792
North Fork Pedee Creek at Headwaters	26733	N 44 78 293	W 123 45 436

Sampling will occur during storm events significant enough to generate run-off and raise stream flows. Parameters to be sampled will be the same as during the weekly sampling regimen. Storm discharges will be sampled 3 times per storm event to measure parameters over a range of flows on the rising limb of the hydrograph. Storms will be sampled at time X near the beginning of the event, at time X+ 4 hours and at time X+ 8 hours. Three storms will be sampled over the season to allow for fall winter spring sampling. The first storm sample will be the first high water event in November or December. The second storm event will be

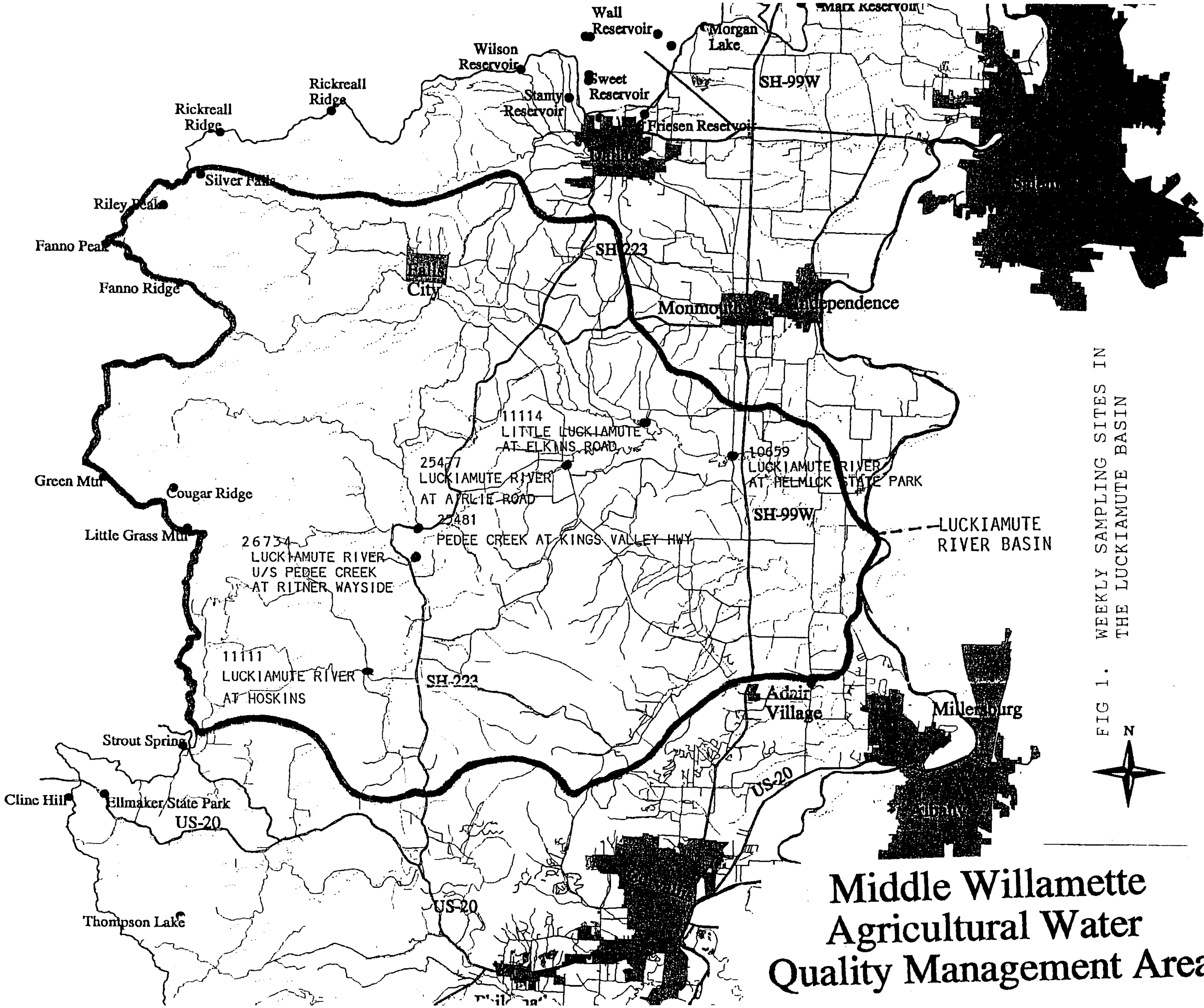

FIG 1. WEEKLY SAMPLING SITES IN THE LUCKIAMUTE BASIN

sampled during late January or early February and the subsequent third sampling will occur in the spring during an April or May storm event. Concurrent to each storm sample, Watershed Volunteers will make visual estimates of acreage of bare soil in sacrifice pastures within the 100 year floodplain as estimated from county flood risk maps.

Stream discharge will be estimated from staff plate gages at the lower Kings Valley Hwy site and at a gage to be established at the South Fork of Pedee Creek sampling site. Rating curves will be developed for these sites by watershed council volunteers and Oregon Water Resources personnel. No gage will be established at the North Fork Pedee Creek site since discharge can be estimated by subtracting the flow of South Fork Pedee Creek (the only major tributary downstream from the North Fork sampling site) from the Kings Valley Highway gage. Flow estimates will be compared to sampling parameters to determine any correlation of flow and pollutant concentration.

The time line for this project follows in Table 3.

Table 3. Major task categories by month for winter 2001/2002

Month Task	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Volunteer training	X								
Weekly basin wide sampling	X	X	X						
Storm Sampling for Pedee Cr	X		X			X			
Data processing			X	X	X	X	X		
Report writing								X	X

The watershed council project manager will be responsible for data entry, storage and analysis. Eventual post project data storage will include the STORET data base if data quality meets requirements. Reports will be written by the project manager with input from DEQ and OWRD staff. Fiscal management of the project will be undertaken by the Polk Soil and Water Conservation District (contact Jackie Hastings 503 623 9680 ext 110)

Data Quality Objectives

Precision and Accuracy

Data collected in this project will be used to develop baseline data for TMDL development, evaluate the contribution of agriculture to pollution concentration levels in Pedee Creek and identify any water quality standard violations. Data quality should conform to DEQ level A standards so that data can be used for TMDL development. To conform to the accuracy requirements the samples for bacteria and TSS will be tested at a state certified lab. The other parameters will be sampled by trained volunteers who will follow SOP for equipment calibration and pre and post sampling lab checks. Accuracy measurements will conform to the equipment manufacturer's specifications (Table 4).

Table 4 Equipment and Methods for Water Quality Monitoring Parameters for 2001 Sampling

Parameter	Equipment	Accuracy	Measurement Range
pH	Orion 210 A Electrode pH meter	+/- 0.2 units	0.0 to 14.0
Turbidty	Hach 2100 A turbidity meter	+/-5% of standard	0 to 1000 ntu
Conductivity	YSI Model 30 conductance meter	+/- 5% of standard	0 to 499.9 uS/cm
Temperature	YSI Model 30 conductance meter	+/- 1'C	-5 to95'C
E. coli bacteria	Most Probable Number Standard Meth (Water Lab of Salem)		
Total Susp. Solids	USEPA Methods for Chemical Analysis (Water Lab of Salem)		

To ensure precision of field samples duplicate samples in excess of 10% will be taken for each sampling event. A stratified random sampling method will be used to ensure that samples are collected from each sampling location as prescribed in the DEQ Water Quality Monitoring Guidebook. (1999). For weekly sampling each site is assigned a number from 1 to 6 starting at Pedee Creek at Kings Highway and following the order listed in table 1. A random number generator will be used to determine the first location for collecting the duplicate samples based on the first number that is generated between 1 and 6. During subsequent weeks the duplicate sampling location will rotate in the order of sampling sites to the next sampling location. Since there are only six sampling locations during the projected 8 week sampling period, 2 sampling sites will be duplicate sampled twice. This gives a duplication rate of 16%. A duplicate sample for each parameter will be sampled at the same time, using the same methods as the regular sample. Precision requirements for A quality data are listed in table 5. Additionally, a split sampling in conjunction with DEQ staff will be conducted at least one time during the weekly sampling period. Relative Percent Difference will be calculated for each parameter to determine if precision requirements are met.

Table 5. Precision Requirements for Duplicate Field Samples to Achieve A Quality Data

Parameter	Precision requirement	Method
pH	+/- 0.3	Calibrated pH electrode
Turbidity	+/- 5%	Mephlometric Turbidity Meter
Conductivity	+/- 2%	Meter Temperature corrected to 25'C
Temperature	+/- 1.0'C	Thermometor
E. coli bacteria	>+/- 0.5 log	Most Probable Number
Total Suspended Solids		

For storm sampling on Pedee Creek, the same accuracy and precision criteria apply as with weekly sampling. Each sampling site will be assigned a number with the order shown in table 2. Since each site will be sampled 3 times per storm event the sampling sites will acquire a new number for each sampling interval. Therefore sites 1 through 3 will be sampled at time X. Samples 4 through 6 (sites 1 through 3 in the same order) will be sampled at time X+4 hours and samples 7 through 9 will be sampled at time X + 8 hours. As with the weekly sampling, a random number generator will be used to determine which site is chosen for a duplicate sample. Due to funding limitations, precluding taking bacteria and TSS duplicates at each sampling time interval, duplicate sampling will only occur at a one site per storm event. After discussions with DEQ personnel it was decided that each storm and not each sampling interval would qualify as 1 sampling event and therefor duplication frequency of 1 in 9 (11 %) would be sufficient for precision requirements.

Representativeness

The weekly sampling sites chosen with DEQ staff were chosen due to the easy access of bridge crossings. The sites were not chosen using random reach selections however they are distributed throughout the basin and likely reflect different characteristics of different reaches. Sites on Pedee Creek were chosen based on their upstream and downstream nature of agricultural treatments. Originally only the upper and lower sites were expected to be sampled, however the addition of the South Fork Pedee Creek sampling site allows for an additional comparison of data within the treatment area. The South Fork addition however requires a change from the original proposal due to increased costs of lab analysis for the site. The increased cost of six additional lab samples for bacteria and TSS reduces the number of duplicate samples that can be taken at the upper and lower Pedee Creek sites. This also results in an inability to duplicate sample at each location causing duplicate sampling to be randomly selected from the sites as in the weekly sampling.

Comparability

Sampling methods and sites were chosen with DEQ personnel to maximize the usefulness of the data to be collected. Additionally, split sampling will occur where DEQ crews sample side by side with volunteer crews to assure accurate data collection and usefulness. Watershed council volunteers will use the same types of equipment and sampling procedures as DEQ staff to ensure compatibility of the data. The data will be considered complete when all objectives set out in tasks portion of this document are achieved.

Training Requirement/Certification

Volunteers were trained on the proper use of DEQ equipment, which had been lab checked for accuracy before transfer to the council. A 5 hour training session occurred on November 9, 2001 where 8 volunteers were trained on equipment calibration, lab checks and sample collection. Training was provided by Karen Font-Williams, DEQ volunteer monitoring coordinator, and included hands on practice with each piece of equipment to be used. Volunteers with the council were expected to demonstrate proficiency on each piece of equipment to the project manager before being allowed to participate in sampling. Additionally, the project manager intends to be present for all sampling sessions to ensure data is collected according to the standard operating procedures.

Documentation and Records

Data on each sampling site will be collected in a write in the rain notebook. Data collected at each site will include: site location, date, time sample is collected, volunteers present, weather, stream gage height (where applicable), and any miscellaneous comments the samplers notice. Parameters recorded in the field will include: current water temperature and conductivity. Space will be left on the sampling sheet to record pH and turbidity after the samples are analyzed at the project manager's home. Daily results will be copied and kept in a file. Original field sheets will remain in the sampling notebook. Original data copies will be held for a period of 2 years or until after TMDL's are implemented throughout the basin. Additional documentation for equipment accuracy will be recorded in the equipment notebooks that remain with the equipment. Data collected for these notebooks include: dates the equipment was calibrated and lab checked, name of volunteers conducting checks, standards and buffers tested, and relative difference from the expected value to determine accuracy of equipment. The original log books will remain with the equipment and are DEQ property. Photocopies of each page will remain with the project manager for the same period of time as the data sheets.

Sampling Process and Design

Sampling on Pedee Creek will occur upstream of agricutlural areas at the Second Bridge on Ronco Road, at the mouth of the South Fork Pedee Creek and downstream of agricultural areas at the Hwy 223 bridge. These sites were chosen due to their accessibility. The addition of the South Fork Pedee Creek site to the original project plan was developed in conjunction with DEQ personnel in order to account for a significant tributary that enters between the upper and lower sites. A staff gage will be established at the South Fork site and a rating curve will be developed. Flows will also be measured at a gage at the lower Pedee Creek site. It is assumed that the upper Pedee Creek site will have a discharge that will approximate the lower site discharge minus the South Fork flow. No gage will be established at the upstream site due to a lack of suitable strata to attach a gage.

Storm sampling will begin on Pedee Creek with the first large storm event in early winter 2001. Storms will be sampled 3 times at 4 hour intervals. Sampling will begin at time X when the project manager notes sufficient rainfall to produce runoff from fields and ditches. Volunteers will then sample each of the Pedee Creek sites in an upstream fashion. At times X+4 hours and X+8 hours, volunteers will again sample each site in the same order. Conductivity and current water temperature will be sampled in the field. Volunteers will conduct testing for pH and turbidity between sampling intervals at the project manager's home. Samples for bacteria and TSS will be collected and stored in a cooler until they can be transported to the state certified lab. Additionally, observation of stream elevation based on staff gages will be made with each sample.

Changes in funding period for the Pedee Creek water quality grant, that limits sampling to 1 year instead of the original 2 years, required changes to the original grant proposal to effectively spend allocated money. The watershed council, in conjunction with DEQ personnel, developed a new sampling plan to collect data from sites throughout the Luckiamute basin. Several additional sites, throughout the Luckiamute watershed, were chosen by DEQ personnel, to provide data from a wide area. These sites are considered representative of the watershed and will be used to develop basin TMDL's and will serve as references to compare Pedee Creek data. Volunteers will be conducting weekly sampling at these sites for a period of 8 weeks beginning in late November of 2001 and ending in January 2002. Sampling sites have been assigned numbers in the Lasar database. Water quality parameters will be the same as with the storm sampling. Stream discharge data will be collected from the USGS gage on the Luckiamute at Suver, the OWRD gage on the Luckiamute at the Ira Hooker road bridge and at the lower Pedee Creek gage.

Volunteer safety will be a major concern in sampling. During pre-sampling reconnaissance of sampling sites, the project manager determined there was sufficient room to park off the road at each of the sites. Standard operating procedure will require volunteers to drive to each site and park off the roadway. Vehicle hazard flashers are to be turned on when volunteers are outside the vehicle. Volunteers are required to wear orange safety vests while sampling. One volunteer is detailed to be safety lookout while the other conducts the sampling. Since most sampling will take place from bridges, sampling will halt while traffic is crossing. Volunteers will need to face oncoming traffic and be aware of any obvious hazards. If required to sample during darkness, one volunteer will hold a flashlight or blinking bicycle light. The project manager is responsible for determining safety escape routes to avoid traffic dangers. In addition volunteer will follow a specified driving route to each site, determined to increase safety and efficiency of driving. Volunteers will work in teams of a minimum of 2 and all volunteers will have signed a state volunteer liability form.

Sampling Method Requirements

Sampling parameters to be monitored are: instantaneous water temperature, conductivity, turbidity, pH, total suspended solids, and bacteria. Samples will be collected for TSS and bacteria in sterile bottles provided by the state certified Salem Waterlab. Samples for pH and turbidity will be taken in clean sample bottles provided by DEQ and cleaned and washed between samples. Current water temperature and conductivity will be sampled in the field using a YSI model 30 conductivity meter. Table 6 describes the sampling methods and equipment. All samples are to be collected by hand from a well-mixed portion of the stream.

Table 6 Equipment and Methods for Water Quality Monitoring Parameters for 2001 Sampling

Parameter	Equipment	Matrix	Container	Max Holding time
pH	Orion 210 A Electrode pH meter	water	Screw top glass bottle	36 hours
Turbidty	Hach 2100 A turbidity meter	water	Screw top glass bottle	48 hours
Conductivity	YSI Model 30 conductance meter	water	none	Immediately
Temperature	YSI Model 30 conductance meter	water	none	Immediately
E. coli bacteria	Most Probable Number Standard Meth	water	Autoclaved plastic	24 hours
TSS Susp. Solids	USEPA Methods for Chemical Analysis	water	Screw top plastic	24 hours
Stream velocity	Rickly AA current Meter	water	none	immediately

Bottles for pH and turbidity will be cleaned between samples with a 10% bleach solution followed by thorough rinses with distilled water. Distilled water used for rinsing sample glassware and equipment will be Bonneaus distilled drinking water purchased at Bi-Mart stores. This brand was chosen because conductivity testing indicated it was nearly completely free of conducting ions. Distilled water will be carried into the field in order to rinse the conductivity probe between samples.

Bacteria and total suspended solids samples will be placed in a cooler and transported to Waterlab of Salem 2603 12th St Se. Salem, OR 97302 (503) 363-0473 at the end of the days sampling. Sampling can only occur when the lab will be open and able to analyze the samples within the 24 hour holding limits. This will require changes in scheduled sampling dates to avoid holidays and other days when the lab is unable to process samples. It is the responsibility of the project manager to verify that the lab will be able to analyze the samples before volunteers begin the day's sampling.

Turbidity and pH samples will be collected in clean glass jars and will be held in a cooler until the end of the day's sampling. Turbidity and pH will then be checked at the home of the project manager in accordance with the Oregon Plan Water Quality Guidebook protocols.

Sample Handling and Custody

All sampling jars are to be marked in the field. The bacteria and TSS bottles have labels provided by waterlab, that include sample description, test to be run, time collected, date collected and name of the sampler. Duplicate samples will only be marked as duplicate and not by sampling location so that the lab is not biased in its analysis. Certified lab samples will be transported to the lab by the project manager, who will then sign over custody to lab personnel. Lab results will be mailed to the project manager's home address. Turbidity and pH jars will be permanently marked with the sampling site name so that the jar will always be used for that site to avoid labeling errors. Time, date, and sampler name will be included in the write in the rain sampling notebook. Excess samples will be poured into a sanitary sewer system since there are no hazardous chemicals added to the samples.

Analytical Methods

The sample analysis protocols for pH, turbidity, and conductivity are outlined in the Oregon Plan Water Quality Monitoring Guidebook and were practiced during the November 9, 2001 training session. The bacteria samples will be analyzed in a state certified lab utilizing the Most Probable Number test as outlined in Standard Methods for the Examination of Water and Wastewater 20th ed. 1998. Total Suspended solids will be analyzed using protocols outlined in US EPA Methods for Chemical Analysis for Water and Wastes. (Waterlab of Salem, OR (503) 363-0473)

Stream velocity measurements will be made using a Rickley AA current meter and will be analyzed using protocols outlined in Techniques of Water Resource Investigations. Staff gages will be placed in accordance with USDA Forest Service Stream Channel Reference Sites: An Illustrated Guide to Field Technique.

Quality Control Requirements

Volunteer sampling procedures and QC protocols should ensure that this data meets requirements for A level quality data which is necessary for TMDL use. Project plan requirements includes taking and analyzing duplicate samples for precision checks. Both phases of sampling exceed the 10% duplicate sample requirements for A level data. Phase 1, weekly sampling data employs a stratified random sampling matrix to ensure a duplicate sample is taken from each of the 6 sampling sites at least once during the 8 week sampling period. The sites are numbered 1through 6 based on their order in the driving route. Before sampling during week 1 the project manager will use a random number generator to determine which site, 1 through 6 will be the first duplicate sample site. During subsequent weeks the duplicate sample site will rotate to the next site in ascending order until all sites are duplicated. The 8 week sampling time frame means that the 2 sites will be sampled for duplicates twice. This procedure gives a 1 in 6 (16%) duplication frequency for each site

Duplicates samples for all parameters will be taken concurrent to the regular sample at the duplicate site. A separate entry in the data notebook will be recorded for the duplicate that includes the same relevant information taken for the regular sample. Bacteria and TSS bottles will be marked "duplicate" without a site, before transport to the state certified lab, to ensure no bias during analysis. Sampling jars for pH and turbidity will also be marked duplicate and will be used for all duplicate samples. Duplication of conductivity and current water temperature will be taken by removing and rinsing the sampling probe and reinserting the probe for sampling. All parameters will be duplicated sampled at the same site to limit confusion in data recording.

To further ensure precision of the data, DEQ personnel will accompany council volunteers on a weekly sampling trip to collect split samples and verify that volunteers are following proper procedures. Since DEQ equipment and protocols are to be followed by council volunteers, the data should give comparable readings and be usable to determine if data meet level A precision requirements.

Duplicate sampling during phase 2 storm sampling, differs slightly from phase 1 sampling. Sampling is to occur 3 times, on 4 hour intervals, at three sites for a total of 9 samples. Discussions with DEQ personnel indicated that each storm event and not each sampling interval could be considered as one event. This allowed a more efficient use of project funds since duplicate samples at each interval would increase costs and reduce the number of storms that could be sampled. The duplicate sampling rate for storm sampling will be 1 in 9 (11%). The duplicate sampling site will be determined using a random number generator by the project manager before sampling begins. As with weekly sampling, all parameters will be duplicated at the same site to reduce confusion during data recording. DEQ crews will likely also be sampling the same storms as council volunteers, which should allow for additional precision checks.

Bacteria and TSS samples will be transported to a state certified lab. Turbidity and pH sample analysis will be conducted by council volunteers at the home of the project manager, who will supervise the analysis to ensure that proper procedures are followed. Additionally, DEQ personnel will be invited to observe sample analysis during the split sampling session. Start and end lab checks of equipment will be followed as outlined by equipment specifications. The project manager will be responsible for calibration of all instruments according to schedule. Extra sample material will be disposed of in a sanitary sewer system. No samples will be held for reference since holding time requirements make such samples useless.

Equipment Maintenance and Calibration

Sampling equipment will be stored at the project manager's home. Equipment maintenance and inspection are the responsibility of the project manager. Before each day's sampling, the project manager will visually inspect the equipment and ensure it is working properly. This includes turning the equipment on, calibrating the equipment or conducting a starting lab check. Any equipment that does not meet accuracy requirements using known standards will not be used for sample analysis. The project manager will contact the DEQ volunteer monitoring coordinator for problem solving advice or equipment exchanges. Equipment will be checked upon completion of each days sampling, for cleanliness and proper working condition. Additionally, the project manager will conduct end lab checks for equipment accuracy at the completion of each days sampling.

Any required calibration of equipment will be performed by the project manager according to equipment schedules. Lab check and calibration records will be kept in the logbooks accompanying the equipment. Copies of the records will be kept when the equipment is returned to DEQ personnel.

Supply requirements

All supplies except for distilled water will be supplied by the DEQ volunteer monitoring program. This includes pH standard solutions, Thorazine blanks for turbidity calibration, ion solution for conductivity meter calibration and a hard thermometer for temperature calibration. Grant funds will be used to purchase distilled water for equipment and glassware rinsing and blank production. Boneaus distilled drinking water will be purchased from Bi-mart stores because of the low conductivity of the product, confirmed by volunteer testing. Bacteria and TSS sample bottles will be acquired from the state certified testing lab who will provide sterile sample containers. Bottles are autoclaved at the testing lab.

Other Data Acquisition Requirements

Possible site locations for weekly and storm sampling areas were originally identified using USGS 7.5 minute topographic maps provided by the Pedee/Ritner Watershed council. Pre-planning reconnaissance trips with DEQ personnel helped determine final sampling sites. An additional component of phase 2 storm sampling includes observations of disturbed areas, in the Pedee Valley, caused by livestock disturbance within the 100 year floodplain. Evaluation of the 100 year floodplain will be based on FEMA county flood risk maps. Evaluation will be estimated acreage of vegetative denuded soils within the confines of the 100 year flood plains as indicated on the flood maps. These observations will be made from public roads, which allow observation of the nearly all of the floodplain throughout the basin. This data is limited because it is estimated based on the interpretation of the observer of what areas are completely denuded and how many acres lie within the 100 year floodplain delineation. These observations will be made to determine if acreage of denuded soils through time correlate with increased pollution levels. Observations will coincide with storm sampling to ensure that data are comparable. A more accurate measurement of denuded areas would require air photo passes of known scale that coincide with storm sampling. Funding limitations preclude that option.

Additional data requirements will include flow data from the USGS stream gage on the Luckiamute at Suver, the rating curve data for the OWRD gage at Ira Hooker Road and the OWRD low flow data for the Pedee Creek staff gage at Hwy 223 bridge. Additional streamflow data for Pedee Creek will need to be developed using OWRD bridge mounted velocity meters.

Split sampling data will need to be sent from DEQ to the project manager to determine sampling precision. Additional water quality sampling site data will be used to compare results from Pedee Creek with the rest of the basin.

Data Management

Data collected in the field will be recorded in a single write in the rain notebook. Each days records will be photocopied for safe storage and record keeping however all original pages will be left in the notebook. Data for temperature and conductivity will be recorded in the field. The analysis of pH and turbidity samples will also be written in the notebook after sampling is complete. Bacteria and TSS samples, which are analyzed at a state certified lab, will mail 2 copies of the data to the project manager. The project manager will forward 1 copy to DEQ/EPA staff and retain the other copy for council records.

Data will be transcribed from the original data notebook to the project managers computer located at his home at 12503 Pedee Creek Rd Monmouth , OR 97361. The computer used to store and analyze the data is a gateway 06-400 using windows 98 operating system and office 97 software package. Data will be transferred to a spreadsheet created in Excel. Data will be saved on both the Hard drive and backed up on a 3.5 inch hard disk. The data will be transferred by the project manager from the original data book to the spreadsheet as soon as possible after the end of the days sampling. This will also allow the project manager to review the data, look for obvious outliers in the data and ask questions of the volunteer samplers, if applicable, while the information is still fresh in their minds. Bacteria and TSS data can not be entered until the project manager receives the data by mail. This has been promised to take less than 1 week from receipt of the samples.

Data will be checked for obvious outliers. Split samples will be compared to ensure that duplicates are within the precision requirements for level A data. The spreadsheets will be printed and reviewed periodically at Pedee/Ritner Creek watershed council meetings where additional QC checks will be made by council volunteers.

Statistics will be calculated using the tools portion of the Excel program. Since the statistics in this project are relatively straightforward, no additional statistical software needs are anticipated. All reports will be written on the Project manager's computer. It can then be e-mailed for peer review to DEQ personnel.

Assessment and Response Actions

Volunteer performance will be evaluated by observation of the project manager to verify proper protocols are followed. If it is determined that proper procedures were not followed, the data will be rechecked by the Project manager and questions of data quality will be referred to the DEQ volunteer monitoring coordinator. If the data does not meet proper QA/QC requirements for A level data it will be transferred to a second spreadsheet to keep it separate until the usefulness of the data can be evaluated. Volunteer and project manager performance will be evaluated during DEQ split sampling when DEQ personnel can evaluate the volunteers.

Problems with accuracy of equipment will be the responsibility of the project manager. If lab checks and calibrations do not meet accuracy requirements of level A data, the project manager will request assistance from DEQ personnel. This will include performing maintenance on equipment or switching malfunctioning equipment. Data taken with malfunctioning equipment will be transferred out of the main spreadsheet until its reliability can be confirmed.

Reports

All reports will be written by the project manager on his home computer. Mid season progress reports are due to DEQ in April 2002. Sampling should be complete by early May 2002. Data analysis should be complete by the end of June 2002 and a draft report should be complete by July 2002. Pedee/ Ritner Watershed Council members will have the first draft to review and approve. DEQ staff will then review the report and make edits. Final approval of edits by the watershed council will then take place. A final draft should be ready by August of 2002. In accordance with OWEB public distribution rules, this report will be placed in archives at the Monmouth, Oregon library and a copy will be given to the Pedee Women's Club for display at the clubhouse/community center. Final report questions and after project reports are due to DEQ and OWEB after the final report is produced.

Data Review and Verification

The project manager will be responsible for initial review of the data to ensure it meets a level requirements. Initial review will include comparing entered data to original data books. Outliers and data where possible errors in sampling occurred will be kept separate from the other data. DEQ personnel will be consulted to help determine the validity of the data. Since most statistical analysis will be done on computer, it is unlikely that there will be errors. The members of the Pedee/Ritner Watershed Council will have first and final review of the data. Data will be sent to DEQ staff periodically for review. Obvious problems will be discussed with DEQ staff.

Reconciliation with Data Quality Objectives

Data quality will be determined at the end of the project in conjunction with DEQ personnel. The project manager will calculate precision and accuracy of the data to ensure it meets A level data requirements. Any data that does not meet A quality standards will be downgraded to the next appropriate level of data requirements. Any limitations of the data will be detailed in the final report.

References

Oregon Plan for Salmon and Watersheds: Water Quality Monitoring Guidebook

USDA General Technical Report RM-245 Stream Channel Reference Sites: An Illustrated Guide to Field Techniques. Pp42-49

USEPA 1996-EPA 841-B-96-003 The Volunteer Monitors Guide to Quality Assurance Project Plans. 59pg

Project Approval Page

This project meets Department of Environmental Quality requirements for quality assurance/ quality control. The project stands approved on this _______day of_________in the year__________.

Quality Assurance Officer____________________________.

Project Manager ______________________________.

Addendum
April 2002

Due to a lack of storms adequate to cause significant rise in streamflow the original project plan for phase 2 was altered. At the request of DEQ personnel, storm sampling on Pedee Creek was discontinued in favor of a resumption of weekly sampling at five of the original six sites on the Luckiamute River. The site at the Ritner Covered Bridge Wayside was discontinued due to DEQ concern that the mixing of Luckiamute River and Ritner Creek inflow was insufficient to provide significant data. This site was droped in favor of a site at the Grant Road Bridge approximately 2 miles upstream. This would give DEQ personnel information on spring conditions in the Luckiamute basin. The same methods and parameters were used as during the original weekly sampling with the exception of turbidity because DEQ had taken the turbidity meter back for a different project. The data was required to meet the same QA/QC requirements of level A data however no split sampling was scheduled due to lack of available DEQ personnel. The data was included in the final report.

Additionally, the project manager determined, at a DEQ sponsored data management seminar, the availability of permanent data base storage sites where the project data could be shared with other users. The project manager is currently checking into the possibility of storing this data in the Storet data base system.

Lab Checks for YSI model 30 Conductivity Meter #51055

National Brand 43-571 in USA

1

11/7/01	Std	T°C	Rdg	% Δ	
KFW Lab check	140.8	16.6	140.9	<1	

11/8/01	Std	T°C	Rdg	% Δ	
CV Access	148.7	15.8	142.5	4.2 (620/145)	This was demo meter 51067
Well Water		15.3	2900		
Lab Check	148.7	16.5	143.0		

34

11/26/01 CV	Std	T°C	Rdg	% Δ	
Start Lab check	148.7	12.0	145.8	2.0	290/147.25
End Lab Check	148.7	17.4	147	1.1	170/147.8

stopped reading in tenths

Storm Sampling

11/28/01 CV	Std	T°C	Rdg	% Δ
Start lab Check	148.7	20°C	148.5	<1

11/29/01	Std	T°C	Rdg	% Δ	
CV End lab check	148.7	22	147.0	1.1	170/147.8

12/2/01	Std	T°C	Rdg	% Δ	
CV start labcheck	148.7	16.2	152.2	2.3	350/150
End Check	148.7	25.2	149.8	<1%	110/149.2

12/ 10/01

		Std	Rdg	T	% Δ	
CV	Start Lab check	148.7	147.0	12.6	1%	170 / 147.85
	End Lab Check	148.7	148.2	15.0	<1%	50

12-17-01

		Std	Rdg	T	%	40
CV	Start lab check	148.7	148.3	15.3	<1%	148.5
	End lab	148.7	148.3	16.0	<1%	

12-26-01

		Std	Rdg	T	% Δ	50
CV	Start Lab Check	148.7	149.2	17.4	<1%	148.95
	End Lab check	148.7	149.3	17.8	<1%	

CV 1-2-02

	Std	Rdg	T	% Δ
Start check	148.7	147.9	18.9	<1%
	148.7	148.0	20.1	<1%

1-7-02

Std	Rdg		% Δ
148.7	148.1	20.1	<1%
148.7	148.0	20.1	<1%

1-14-02

	Std	Rdg	T	% Δ
Start	148.7	146.8	20.5	1.3% 190 / 147.75
End	148.7	147.7	20.1	<1%

	3-5-02	Std	Rdg	T	%Δ	
CV	Start lab check	146.5	145.5	16.0	<1%	$\frac{100}{146}$ = 0.60
3-6-02	End Lab Check	146.5	146.2	19.0	<1%	

	5-14-02	Std	Rdg	T	%Δ	
CV	Start lab check	146.5	147.0	20	<1%	$\frac{50}{146.75}$ 0.34
	End lab check	146.5	146.7	18	<1%	

	5-[illegible]-02	Std	Rdg	T	%Δ
CV	Start	146.5	146.2	17	<1%
	End	146.5	147.0	19	<1%

Lab Checks for Hach model 2100 P turbidimeter # 52000

Calibration Pay:

8/28/01 MAT 5.32, 52.4, 509

11-8-01 CCU	Gelex Standard	Rdg	Δ%
	509	510	1<
	52.4	52.5	1<
	5.32	5.34	1<
Well water		<1.0	

Lab Check

11-26-01	Gelex Std	Rdg	Δ%
CCV	5.32	5.36	<1
	52.4	52.4	<1
	509	507	<1

	Gelex Std	Rdg	Δ%
End Lab	5.32	5.34	<1
Check	52.4	52.3	<1
	509	506	<1

17:20 Storm Sampling

11-28-01	Gelex std	Rdg	Δ
CCV	5.32	5.36	<1%
	52.4	52.2	<1%
	509	505	<1%

11-29-01	Gelex		Δ
CCV		5.36	<1
		52.3	<1
		507	<1

11/2001

459

3339

ECS

Daisy Comers

Sound

20 tooolc

[illegible]

[illegible]:00

12-3-01	Gelex Std	Rdg	% Δ
CV Start lab check	5.32	5.34	<1%
	52.4	52.3	<1%
	509.	507	<1%

End Lab Check	Gelex Std	Rdg	% Δ
	5.32	5.35	<1%
	52.4	52.2	<1%
	509	506	<1%

12-10-01	Gelex Std	Rdg	% Δ
	5.32	5.35	% <1
	52.4	52.4	<1
	509	507	<1

End lab check	Gelex Std	Rdg	% Δ
	5.32	5.37	<1
	52.4	52.6	<1
	509	508	<1

Calibration 12-17-01 Using StablCal Amplitude Kit for 2100

CV

	Gelex Std
<0.1 NTU	5.51
20 NTU	53.1
100 NTU	510
800 NTU	

12-1[redacted]-01 CV	Gelex Std	Rdg	% Δ
	5.32	5.35	<1
	52.4	52.3	<1
	509	508	<1
End Check	5.32	5.36	<1
	52.4	52.3	<1
	509	506	<1

12-26-01	Gelex Std	Rdg	% Δ
	5.51	5.48	
	53.1	53.2	
	510	511	
End Check	5.51	5.50	<1
	53.1	53.4	<1
	510	514	<1

1-2-02 CV	Gelex	Rdg	% Δ
	5.51	5.49	<1
	53.1	53.1	<1
	510	511	<1
End Check	5.51	5.49	<1
	53.1	53.5	
	510	512	

1-7-02 CV	Gelex	Rdg	% Δ
	5.51	5.48	<1
	53.1	53.2	<1
	510	512	<1

Calibration and lab che..s for Orion model 210 A p .meter #50991

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11-8-01	Buffer	T°C	Rdg	
CV	7	18	7.02	
Calibration	10	18	10.09	
				Slp 95.3
Water Sample 1		18	8.3	
Accuracy Check	7	18	7.02	
	10	18	10.09	

11-26-01	Buffer	T°C	Rdg	Buffer
CV	7	17	7.02	20°C 7.01
Calibration	10	17	10.09	20°C 10.06
			Slp 98.2	
Lab Check	Buffer	T°C	Rdg	
	7	20	7.04	
	10	20	10.08	

11-28-01 Storm Sampling

CV	Buffer	T°C	Rdg	Buffer
Calibration	7	20	7.01	7.01 ~ 20
	10	20	10.06	10.06 ~ 20°
			Slp 96.0	

11-29-01	Buffer	T°C	Rdg	Buffer
CV End lab Check	7	21	7.0	7.01 ~ 20°
	10	21	10.1	10.06 ~ 20°

12-3-01	Buffer	T°C	Rdg	Buffer	
CV	7	17	7.01	7 ~	7.01 ~ 20°C
Calibration	10	17	10.04	10 ~	10.06 ~ 20°C
		SLP 99.0			

12-3-01	Buffer	Temp	Rdg	Buffer
CV	7	22	7.01	7.01 ~ 20°C
End lab check	10	23	10.02	10.06 ~ 20°C

12-10-01	Buffer	Temp	Rdg	Buffer
CV	7	19	7.04	7.01 ~ 20°C
Calibration	10	19	10.12	10.06 ~ 20°C
	SLP 98.0			
	Buffer	Temp	Rdg	Buffer
End lab	7	16	7.04	7.01 ~ 20°C
Check	10	17	10.11	10.06 ~ 20°C

12-17-01	Buffer	Temp	Rdg	Buffer
CV	7	19	7.02	7.01 ~ 20°C
Calibration	10	19	10.08	10.06 ~ 20°C
		Slp 97.9		
End Check	7	18	7.03	7.01 ~ 20°C
	10	18	10.09	10.06 ~ 20°C

12-26-01	Buffer	Temp	Rdg	Buffer
CV	7	20	7.02	7.01 ~ 20°C
Calibration	10	20	10.07	10.06 ~ 20°C
		SlP 98.6		
End check	7	21	7.09	~ 7.01 ~ 20°C
	10	21	10.10	10.06 ~ 20°C

	Buffer	Temp	Rdg	Buffer
1-2-02	7	28	7.00	7.01 ~ 20°C
CV	10	28	10.01	10.06 ~ 20°C
Calibration				
	SLP 98.0			
		Temp	Rdg	
End Check	7	29	7.02	7.01 ~ 20°C
	10	29	10.03	10.06 ~ 20°C
	Buffer	Temp	Rdg	
1-7-02	7	22	7.01	7.01 ~ 20°C
Calibration	10	22	10.05	10.06 ~ 20°C
CV		SLP 98.6		
End Check	7	21	7.04	7.01 ~ 20°C
	10	21	10.08	10.06 ~ 20°C
1-14-02	Buffer	Temp	Rd	
Calibration	7	20.5	7.02	7.01 ~ 20°C
CV	10	20.5	10.06	10.06 ~ 20°C
		SLP 98.2		
End	7	20.1	7.04	7.01 ~ 20°C
Check	10	20.1	10.01	10.06 ~ 20°C

Second Storm Sample

		Buffer	Temp	Rdg	Buffer
CV					
3-6-02	Calibration	7	17.0	7.05	7.01 ~ 20°C
		10	17.5	10.06	10.06 ~ 20°C
			SLP	97.9	
	End Check	7	19.0	7.02	7.01 ~ 20°C
		10	19.0	10.08	10.06 ~ 20°C

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Spring weekly Sampling

5-14-02	Buffer	Temp	Rdg	Buffer
CV	7	20	7.03	7.01 ~ 20°C
Calibration	10	20	10.07	10.06 ~ 20°C
			SLP 98.0	
End lab Check	7	18	7.04	7.01 ~ 20°C
	10	18	10.05	10.06 ~ 20°C

	Buffer	Temp	Rdg	Buffer
5-21-02	7	17	7.04	7.01 ~ 20°C
CV calibration	10	17.	10.09	10.06 ~ 20°C
	7	19	7.06	7.01 ~ 20°C
End Check	10	19	10.09	10.06 ~ 20°C