Consent Agreement Annual Report
2013

Report Prepared by

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Summary for 2013

Overview

The goal of the Consent Agreement is to restore and preserve the water quality of Big Platte Lake (Lake) and its watershed. This goal is being advanced by minimizing the flow and phosphorus loadings from the Platte River State Fish Hatchery (Hatchery, PRSFH) and by developing strategies to reduce other DEQ permitted and non-point phosphorus loads from the watershed.

Compliance with Consent Agreement

Figure 1 summarizes the level of compliance with the Consent Agreement. The Consent Agreement mandates that the Hatchery net annual load should be limited to a maximum of 175 lbs. of phosphorus per year. The corresponding maximum load for any consecutive three month period is 55 lbs of phosphorus, as calculated using a running average. The actual net Hatchery annual loading for 2013 was 68.6 lbs of phosphorus and the maximum 3 month loading was 30.79 lbs of phosphorus. These amounts are 39.2% of the annual loading limit and 56.0% of the 3 month loading, respectively, and do not exceed either of the maximum allowable phosphorus loads. The average water use at the Hatchery was 6.8 million gallons per day (mgd) which is 67% less than the Consent Agreement limit of 20 mgd.

The average volume-weighted total phosphorus concentration of Big Platte Lake was 7.7 mg/m^3 in 2013. The water quality goal of 8.0 mg/m^3 of phosphorus was achieved 62% of the time. This level of attainment is similar to the result for the past several years and is not consistent with the goal of 95% attainment as stipulated in the Consent Agreement.

A total of 17,859 adult coho and 158 adult Chinook salmon passed the Lower Weir in 2013. These numbers are lower than that seen in recent years and are in compliance with the Consent Agreement limits of 20,000 adult coho and 1,000 adult Chinook salmon.

Major Accomplishments for 2013 and 2014

1 All requirements of the Settlement Agreement have been met by the parties for 2013.

2 PRSFH laboratory procedures for measurement of total phosphorus have proven reliable

and consistent. Iron interference issues have been resolved.

3 Phosphorus mass balance calculations for the hatchery have become more accurate with the inclusion of the Hot Pond and with the automatic sampling equipment programmed to obtain 72 hour composite samples. This approach is far superior to grab or 24 hour composite sampling. It is concluded that near-continuous sampling of the phosphorus concentration at various inlet and output locations is required to get an accurate representation of phosphorus mass balance calculations for the Hatchery. This mass balance closure ensures that the reported Hatchery loadings are accurate and not inappropriately influenced by random variations in flow or concentration.

4 Three bioenergetics papers have been peer reviewed and published in the journal of Aquaculture. One paper has been submitted and accepted is waiting for publication, and a draft of another has been completed and will be submitted shortly for peer review.

5 The Platte River Watershed Plan has been accepted by the Michigan DEQ. The USEPA review process is underway.

6 The database has been improved and simplified. Work is underway to import data for daily flow and other operational parameters from a portable tablet device.

7 Twenty-two conference calls were conducted in 2013. These discussions of hatchery operations and the water quality of Big Platte Lake have proven useful to attaining the goals of the Consent Agreement (see Appendix A).

Recommendations for 2014 and 2015

1. The Implementation Coordinator should continue efforts to calibrate and validate the fish bioenergetic and Hatchery process models and publish the results in peer reviewed journals.

2. Efforts should continue to improve the accuracy of the phosphorus mass balance calculations for the Hatchery. The project to improve existing estimates of the fish tissue phosphorus content should be completed and a paper on the results submitted to a peer-reviewed journal for possible publication.

3. It recommended that the validated bioenergetic model be used to assist in determining feeding rates at the PRSFH to demonstrate its application and utility. If successful, the software and user manual should be made available to others engaged in aquaculture operations.

4. It is recommended to host a workshop on aquaculture. The topics would include policy and regulations; use of bioenergetics for efficient fish production; application of advanced phosphorus removal technology; and the impacts of aquaculture waste discharges on the water quality of lakes and streams.

5. Efforts should be made to define the minimum number of samples needed to characterize changes in the annual average phosphorus concentration of Big Platte Lake and to determine compliance with the Consent Agreement water quality standard.

6. It is recommended that work continue on the watershed plan and that it be expanded into the Upper Platte River Watershed.

7. It is recommended that a new series of storm event sampling be conducted for comparison with results from several years ago. Event sampling should occur at 3 locations: the Platte River upstream of the Hatchery at the Stone Bridge site; Brundage Creek at the Old Residence site; and the Platte River at the USGS site.

8. It is recommended that the current BASINS model be re-calibrated for the Lower Platte River Watershed using data collected during recent years. Following re-calibration, it is recommended that the BASINS model be expanded to the upper watershed. This will require additional data in the Upper Platte River Watershed to support the development of the BASINS model and models for total phosphorus for Long Lake and Lake Ann.

9. It is recommended that a shoreline *E. coli* and *Cladophora* survey be conducted around Big Platte Lake every 10 years or following significant visual changes in shoreline periphyton distribution or density. The survey should consist of two sampling periods. The first sampling should be conducted in the early summer and should measure phosphorus and fecal coliform bacteria and map the growth of *Cladophora* as an indicator of sources of phosphorus. The second survey should be conducted in late summer to determine if summer residents increase local concentrations of phosphorus or

the number of indicator bacteria.

10. It is recommended that the septic tank demonstration project be continued through 2014.

11. Efforts should be made to quantify the effect of the Honor Wastewater Treatment Plant the water quality of Big Platte Lake. This effort should include sampling of test well waters near the site and the resumption of sampling of Collision Creek, the Platte River at Pioneer Road and the Henry Street Bridge, and at an upstream location on the North Branch of the Platte River.

12. All SOP documents and equipment maintenance schedules should be reviewed and updated annually. Authorship and date of publication should be included on the documents. Certification letters regarding the accuracy of the net phosphorus loading, fish production, and weir numbers in the database should be sent to the Implementation Coordinator for inclusion in the Annual Report (Appendix B, C, and D).

13. It is recommended that sampling of Little Platte Lake be resumed when funding is available. The cycling of various forms of nitrogen is of particular interest because available data indicate that nitrogen limits algal growth during the summer in Little Platte Lake. An annual mass balance budget for various forms of nitrogen should be constructed.

14. The functionality and reliability of the database requires significant maintenance, it is recommended that these efforts continue. It is recommended that a refined smaller version of the database developed and documented.

15. It is recommended that conference calls continue between the parties during 2015 but a reduced quarterly frequency.

Acknowledgements

The Implementation Coordinator would like to take this opportunity to again thank Gary Whelan (MDNR Fisheries Division) and Wil Swiecki (PLIA) for their continuing contributions to this project. Gary has extraordinary leadership and management skills and has kept this project focused and moving forward. Wil has been tireless in his efforts to ensure the reliability of the data and has displayed incredible perseverance working toward the PLIA goal of preserving the water quality of

the Lake. As a result, excellent coordination and communication has been maintained within our group as well as with many outside organizations and individuals. The minutes of our coordination meetings in 2013 are contained in the Appendix A.

In addition we wish to commend the following individuals from the MDNR Fisheries Division: Edward Eisch for his support of the Consent Agreement requirements and the overall management of the facility; Aaron Switzer for work on fish production and his broad water quality sampling expertise that helps to guide other staff; Paul Stowe for his efforts on sample collection of Hatchery, Lake, and tributaries; and Nikki Sherretz for her work on laboratory measurement of total phosphorus.

We also acknowledge and appreciate the support and assistance of several individuals from the Platte Lake Improvement Association (PLIA): Jim Berridge for his work on the database; Mike Pattison for his regular participation in the coordination meetings and his work on the web site; Steve Peterson for his marketing and public relations efforts; and Maris Ziemelis for taking over the PLIA task of independent measurement of the Secchi depth in Big Platte Lake.

Hatchery Operations

Net Total Phosphorus Load

The water used to culture fish becomes enriched with phosphorus as it passes through the Hatchery from fish excretion, egestion, and from unconsumed feed. A summary of Hatchery and fish production activities is contained in Appendix E. The net phosphorus daily loading from the Hatchery is defined as the difference between the daily phosphorus loading that leaves the system (usually from the Upper Discharge or other discharge point) and the daily phosphorus entering the system from three major surface water sources (Brundage Spring, Brundage Creek, and the Platte River) and two minor mostly groundwater sources (Filter Backwash and Hot Pond waste pump). Negative net loads on any day are set equal to zero for purposes of calculating compliance with the requirements specified in the Consent Agreement and the Hatchery NPDES permit. Linear interpolation is used to determine the net load on days when no measurements are taken. This may require the use of the last measurement of the proceeding year and the first measurement of the following year to complete the calculation. The summation of daily net loads for the year gives the annual net phosphorus loading. Figure 2 shows the history of total annual net phosphorus loads from the Hatchery from 2005 through 2013. The net phosphorus load from the hatchery to the Platte River was 68.6 lbs. for 2013.

The concentrations of total phosphorus and turbidity of the Hatchery inlet and outlet flows were measured using 72-hour composite samples during 2013. Figure 3 shows the concentration of total phosphorus in the Upper Discharge during 2013. Note that there are three distinct periods. High concentrations were typical during the first 100 days of 2013, followed by low values during the summer, then a general rise for the remainder of the year. Figure 4 shows the corresponding 3-month net phosphorus loads for 2013. These values generally follow the fish biomass in the system with the loads for the first 4 months corresponding to a period when water temperatures at the Hatchery are increasing and the Chinook salmon from the current year and the coho salmon from the proceeding year class are reaching maximum size just before being planted. The lower loading during the summer occurs during a period where the size of the current year class coho salmon is still relatively small. Normally, rapid growth and increased feeding of the current year class coho salmon results in a higher loading during late summer and fall. These increases are offset by the addition of ferric chloride in excess of the stoichiometric requirement during 2013 as shown in Figure 5 (also see Appendix E).

Phosphorus Mass Balance

Phosphorus mass balance models are essential tools that can be used to help understand and manage the net phosphorus load from the Hatchery as a function of production activities and facilities operation. The mass balance equation requires that the accumulation of phosphorus in the Hatchery is equal to the difference between the amount of phosphorus that enters the system (Inputs) and the amount leaving the system (Outputs).

Accumulation or Storage of P = Sum of Inputs – Sum of Outputs (1)

The input terms refer to any phosphorus that enters the Hatchery, these terms include:

1. Food P. This term is the amount of phosphorus associated with the food that is fed to the fish in the Hatchery starter building and raceways. This term is calculated by multiplying the weight of the food fed times the percent phosphorus content of the feed.

2. Source Water P. This is the amount of phosphorus contained in all of the Hatchery source water. The sources are Brundage Spring and Creek, the Platte River (not used during 2013), and the Service and Hot Pond waters (primarily groundwater with a minor amount of surface runoff). The phosphorus input load is determined by multiplying the flow rate times the phosphorus concentration.

3. Fry Tissue P. This term refers to the phosphorus introduced to the system when fry are added into the fish inventory. It is calculated by multiplying the wet weight biomass of the fry times the percent phosphorus in the fry tissue. Note that this approach avoids the need to count or weigh the egg harvest and egg mortalities.

The output terms refer to phosphorus that leaves the Hatchery, these terms include:

1. Shipped, Planted, and Mortality Fish Tissue P. This term refers to all the phosphorus that leaves the Hatchery in the form of fish tissue. It is not relevant to the mass balance equation if the fish are shipped to another watershed, planted in the Platte River, or disposed as mortalities. The phosphorus value of this term is calculated by multiplying the whole wet weight biomass of the fish times the percent phosphorus in the fish tissue.

2. Discharge P. This term refers to the gross loading of phosphorus that leaves the system as effluents from the Hatchery. Currently, the Upper Discharge is only outlet flow. Note that the phosphorus value of this term is calculated by multiplying the discharge flow rate times the phosphorus concentration. The Net Discharge based on mass balance is the difference between the phosphorus measured Gross Discharge and the sum of the measured phosphorus inputs and can be a negative value. Possible negative values are arbitrarily set equal to zero for purposes of Settlement Agreement and NPDES compliance. Therefore, the Net Discharge based on mass balance is usually somewhat higher the reported Net Discharge for compliance.

3. Trucked P. This term refers to the amount phosphorus that is trucked away from the Hatchery, predominately the result of emptying and cleaning the solids storage tank. The value of this term is calculated by multiplying the measured number of gallons of liquid trucked away times the average measured phosphorus concentration of the liquid.

The accumulation or storage terms are calculated by subtracting the outlets from the inputs. Accumulation can be positive or negative. The three major accumulation terms are:

1. Fish Tissue P. This term refers to the phosphorus present in fish in the Hatchery Building and raceways. The value of this term is calculated by multiplying the whole wet weight biomass of the fish times the percent phosphorus in the fish tissue. If the value is greater at the end of the year than the start of the year, the accumulation term is positive. If the fish tissue phosphorus is less at the end of the year than the start of the year, this term is

negative. Additions, transfers, or removals of fish from the system are not considered in the calculation because such factors are accommodated by other terms in the mass balance equation.

2. Tank P. This term refers to the amount of phosphorus in the solids storage tank. The value of this term is the average phosphorus concentration of the solids in the tank multiplied by the sludge volume. This term can also have a positive or negative value depending on the amount of phosphorus in the tank at the start and end of the year. Phosphorus removed by truck is included in separate terms in the mass balance equation.

3. Pond P. This term refers to the amount phosphorus that settles and is stored in the bottom of the pond. Phosphorus that settles to the bottom is prevented from leaving the pond by a clay liner and remains in the bottom sediments until the system is drained and dredged. The phosphorus value of this term cannot be easily measured directly, but can be calculated by subtracting all the inputs of phosphorus to the pond from the outlets. Normally, the inputs are greater than the outlets. Other terms in the mass balance are needed to accommodate the case where the pond is drained and bottom materials removed.

Hatchery Mass Balance for 2013

Figure 6 shows Hatchery mass balance terms for 2013. The phosphorus associated with the source water and discharge was measured using the Sigma 72 hour sampling method. The fish production terms were calculated using a fish tissue phosphorus content of 0.48% of the gross wet weight. This value is based on data for rainbow trout published by Shearer (1997); however it is recommended that efforts be completed to measure the tissue phosphorus content of the PRSFH coho and Chinook salmon. There was a net decrease of 2 lbs. of phosphorus associated with fish resident in the system at the end of the year when compared to values at the start of the year. The calculations suggest that the filters removed about 49% of the phosphorus from the water that leaves the Hatchery Building and Raceways. Approximately 98% of the phosphorus removed by the filters is retained in the sludge storage tank with about 6.96 lbs of phosphorus flowing to the pond as clarifier overflow. The sludge storage tank was emptied and cleaned in early October 2013. The measured removal was 277.6 lbs of phosphorus. Linear extrapolation is used to estimate that an additional accumulation of approximately 62.2 lbs of phosphorus would be in the tank at the end of the year. This amount is offset by 84.6 lbs that were present in the tank at the beginning of 2013. Approximately 74.0 lbs (19%) were removed by the pond

resulting in a net gross discharge of 53.0 lbs based on mass balance that gives credit for negative discharge days. The net Hatchery loading increases to approximately 68.6 lbs. when no credit is given for negative days.

It is imperative that significant efforts be continued to accurately measure all the inputs and outputs of phosphorus from the system so that mass balance calculations can be verified each year. Understanding of the operation of the Hatchery and the ability to track movement of various phosphorus pathways comes under significant question without such mass balance closure.

Lake Water Quality of Big Platte Lake

Total Phosphorus: The annual variation of the volume-weighted total phosphorus concentration in Big Platte Lake for 2013 is shown in Figure 7. The average value for the year was 7.70 mg/m^3. There were 139 days when the total phosphorus concentration exceeded the 8.0 mg/m^3 goal. The Consent Agreement mandates that the volume-weighted total phosphorus concentration of Big Platte Lake be maintained below 8.0 mg/m^3 95% of the time. The actual attainment was 62%, significantly lower than the 95% requirement.

Secchi Depth: Secchi disk depth is a visual method used to measure water clarity and is an important indicator of water quality. Measurements of Secchi depth have made in Big Platte Lake since 1982. The 2013 seasonal variation of Secchi depth in Big Platte Lake is shown in Figure 8. The minimum measured Secchi depth was about 9 feet. Secchi depth dynamics are a complex function of calcite precipitation and the concentrations of plankton and phosphorus in the Lake. Readers should note that as phosphorus concentrations in the Lake decrease, corresponding increases in water clarity may be less than expected due to the precipitation of calcite (marl).

Dissolved Oxygen: Figure 9 shows the annual variation of dissolved oxygen concentrations in Big Platte Lake during 2013. Dissolved oxygen depletion in the hypolimnion of Big Platte Lake is closely related to temperature gradients and the onset of spring stratification (Figure 10). The concentration of dissolved oxygen dropped below 2 mg/L in waters deeper than 90 feet for 97 days in 2013. This is a critical period for phosphorus dynamics in the Lake because dissolved phosphorus will be released from the sediments during this anoxic and chemically reducing period. Shallower water depths at 75, 60, and 45 feet experience shorter periods of low dissolved oxygen conditions as shown at the top of Figure 9. Another key period of phosphorus release from sediments is during the winter ice cover when there is significant potential for oxygen depletion. These data are used to calculate the estimated phosphorus release from the sediments. The internal loading and cycling of phosphorus can be compared to both non-point

and point sources and can be used to estimate an annual phosphorus budget for the lake as shown in Figure 17. Ultimately, the magnitude of the internal cycling of phosphorus determines how quickly the lake will respond to changes in input phosphorus loadings.

Watershed Flow and Phosphorus Balances

Watershed Flow and Phosphorus Balance

Figure 11 shows the long-term trend of mean annual flow of the Platte River as measured by the U.S. Geological Survey (USGS) (Station ID 04126740). The mean annual Platte River flow was 141.1 cubic feet per second (cfs) in 2013. This flow is significantly higher than the long-term average flow of 123.4 cfs since 1990. Thus, 2013 can be characterized as wet year compared to an average year.

Figure 12 shows the daily hydrograph of the Platte River as well as the days sampled for water quality. Note that only one or two samples were taken around the peak of a high flow event, while the remaining samples characterize baseline flow conditions. An analysis of the hydrograph as indicated by the green triangles suggests that there were about 32 storm events when higher than baseline flow and total phosphorus concentrations are expected. Figures 13 and 14 show measurements of total phosphorus and turbidity at the USGS site on the Platte River and at the North Branch of the Platte River at Deadstream Road. Overall, most of measurements reflect baseline conditions.

Figures 15 and 16 show the annual average flow and total phosphorus concentrations at various sites in the Lower Platte River Watershed. Figure 17 shows the phosphorus load balances for the lower watershed starting at Fewins Road and extending to the outlet of Big Platte Lake. The flow balance includes the tributary flows into the Platte River and discharge by the Hatchery. Tributary and non-point flows and flows at intermediate locations on the Platte River are based on linear relationships with the USGS measured flows at US-31 (USGS Gage 04126740 – Platte River at Honor, MI). These linear relationships were developed over a three-year period using flow measurements at intermediate locations in the watershed. The flow at the USGS location is about 2.2 times the flow at Fewins Road, and the Lake outlet is about 2.7 times that of the flow at Fewins Road. Figures 12 and 15 show about 32 storm events in 2013 where flows rapidly increased and then receded over a one or two day period. The storm flows during peak events accounted for about 11% of the total flow during 2013. Baseflows are generally associated

groundwater inputs and accounted for 89% of the hydrologic inputs.

The development of an accurate annual phosphorus balance for the watershed is not a simple task because the Platte River and tributary loadings are significantly affected by high flows that occur during several storm events throughout the year. The measured total phosphorus concentrations during 2013 reflect baseline conditions. Thus, estimates of the total phosphorus loading into Big Platte Lake based on these flow measurements are not expected to accurately estimate the loading because of the inaccurate and under representation of storm events. Unfortunately, it is impractical to measure flow and phosphorus concentration during every storm event at all key locations in the watershed every year.

Extensive storm event measurements were taken from 2004 to 2006 at the Old Residence location on Brundage Creek and at the Stone Bridge and USGS Gauging Station at Honor, MI sites on the Platte River using continuous water sampling equipment. The average event total phosphorus concentrations at these locations were 71.7, 50.8, and 42.6 mg/m^3, respectively. The storm event concentrations at the Fewins site and North Branch sites were assumed to be identical to those measured at the Stone Bridge site. The measured storm event total phosphorus concentrations measured at the Old Residence site on Brundage Creek were used to characterize storm events for the Stanley, Carter, and Collision Creek sites. The total phosphorus concentrations during baseflow conditions were averaged for all years for Stanley, Carter, and Collision Creeks because limited measurements are available for these sites and they are no longer included in the regular monitoring program. These data, along with the regular monitoring data for 2013, were used to determine the total phosphorus loads into Big Platte Lake as shown in Figure 17.

The annual phosphorus load at the USGS Gauging Station site was 5,607 pounds in 2013. This value is about 75% higher than the average loading for the past several years. Thus the 2013 phosphorus loads were exceptionally high in 2013 compared to other years. Storm events contributed 14.3% of total phosphorus load compared to 10.7% of the flows. The total phosphorus concentration at the USGS Gauging Station at Honor, MI site was measured 19 times during 2013. The average total phosphorus concentration was 18.3 mg/m^3 and the annual average flow was 141.1 cfs. This is equivalent to an annual phosphorus load of 5,085 lbs., an amount that is about 9% lower than the annual load that accounts for increases during storm events. The difference is the result of storm event flows with their higher total phosphorus concentrations being disproportionately greater than corresponding phosphorus loads from dry weather or baseflow conditions.

The left hand side of Figure 17 shows numerical values of direct and internal phosphorus loads. The direct drainage phosphorus load was 494.4 lbs. This value is based on the direct drainage area between the USGS site and the lake outlet. This area is multiplied by a unit area phosphorus load determined from the calibrated USEPA BASINS model and varies as a linear function of the annual average flow at the USGS site. Sediment release of 153.4 lbs. was determined by multiplying the number of days the dissolved oxygen was below 2 mg/L in four zones (see Figure 9) by the area of each zone and the sediment release rate. The atmospheric load was 137.1 lbs. in 2013. This value was calculated by multiplying the total annual rainfall (30.1 inches), the lake surface area, and an atmospheric total phosphorus concentration of 7.95 mg/m^3. The lost fish loading was 215.7 lbs. in 2013. This value is calculated by multiplying the difference between the fish biomass that passes the lower weir and the fish biomass collected at the upper weir by the fish tissue phosphorus concentration. This value is a very conservative upper bound and does not account for possible removal by anglers or ovarian predators. The outlet loading of 2803 lbs. for 2013 is calculated by multiplying the outlet flow times the lake median total phosphorus concentration. The difference between the sum of all the external and internal loads and the outlet load is retained in the lake bottom sediments. The retention was 62.2 % of the inlet load in 2013. The apparent settling velocity was 25.11 m/yr. This value is about double values seen in the past several years. It is noteworthy that the impact on the Lake of the high tributary loads in 2013 was entirely offset by this high apparent settling velocity. The annual average volume-weighted phosphorus concentration in 2013 was about the same as concentrations measured during the past several years.

The above calculations are considered adequate representations of the hydrologic and phosphorus watershed balances despite the approximations used in the analyses. Practical alternatives to this approach are problematic. The monitoring program needed to compile a more accurate phosphorus balance for the total watershed is monumental and outside of the program scope. Given these difficulties and limitations, the above approach is considered a good alternative and a reliable screening tool that can be used for planning applications. However, it is recommended that the full dry and wet weather monitoring program be resumed and the BASINS model be re-calibrated if watershed planning issues arise in the future that involve large expenditures or significantly influence watershed land use.

Monitoring Program Recommendations

Hatchery

The net Hatchery total phosphorus load is evaluated by subtracting the inlet load from the total outlet load. It is recommended that measurements of flow, total phosphorus concentration, and

turbidity be taken at the current six locations using automatic samplers. The equipment should collect 72 hour composite total phosphorus samples twice each week. The flow rates should be recorded daily based on the capacity and the running times of the pumps. The flow rates of the backwash and Hot Pond waste pumps should continue to be added to the flows from Brundage Creek and Brundage Spring to calculate the total flow of the Upper Discharge. In addition, all flow rates should be calibrated annually. It is recommended that monitoring program support phosphorus mass balance calculations for the Hatchery. This can be accomplished by continuing the recording of food use and composition, fish produced, and fish removed through mortality or transport from the system each month. It is important to continue efforts to carefully measure the volume and total phosphorus concentration of sludge removed from the storage tank.

Streams

The tributary sampling program should allow for the reasonable estimates of the phosphorus loading into Big Platte Lake. Measurements of phosphorus should be taken on a regular basis independent of flow conditions. It is desirable to measure turbidity and flow during unusually high flow conditions. These data can be used to strengthen existing correlations between the flow at the USGS site and the flow of various tributaries and the correlations for turbidity as a function of flow. Turbidity can be measured in the laboratory using existing equipment. These data allow evaluation of water quality for various hydrologic conditions; provide sub-watershed loading estimates; and assist in defining high priority remediation areas. The recommended minimum monitoring program for 2015 should include several sites on the Platte River: one just upstream of the Hatchery; one at Vets Park; another at Pioneer Road; and one at the USGS Station on US31. One sample should be taken in the North Branch of the Platte River at Deadstream Road and at Collision and Carter Creek sites before entering the Platte River.

Big Platte Lake

It is recommended that Big Platte Lake be sampled for total phosphorus and turbidity at a single location every two weeks during 2015, whenever it is safe to do so. A calibrated Yellow Springs Instruments (YSI) or HydroLab meter should to be used to measure dissolved oxygen, temperature, pH, conductivity, and oxidation-reduction potential. The volume weighted concentration should be based on three layers; surface, middle, and bottom. The surface sample should be a single sample collected from just under the water surface. The middle layer should be an equal volume composite of the water from collected 7.5, 15, 30, 45, and 60 feet. The bottom layer should be a composite of equal volume samples from 75 and 90 feet. Phytoplankton and zooplankton should be sampled during the spring, summer, and fall and

preserved for possible analysis in the future in the event major shifts are observed in the plankton community distribution. Secchi depths should be measured with a standard Secchi disk and collected during each lake sampling. These Secchi disk depth data should be supplemented by additional measurements during periods when lake phosphorus samples are not being collected. Turbidity measurements of lake water can be discontinued in 2015.

References

Shearer, K. D. (1995). The use of factorial modeling to determine the dietary requirements for essential elements in fishes. Aquaculture. 133, 57-72.

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

RICK SNYDER
GOVERNOR

KEITH CREAGH
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June 17, 2014

Dr. Raymond P. Canale
710 SW Manitou Trail
Lake Leelanau, MI 49653

Dear Dr. Canale,

The purpose of this letter is to certify that Nikki Sherretz and I have reviewed and updated all Standard Operating Procedures related to water quality sample collection and processing for the year 2013.

Sincerely,

Paul Stowe, Fisheries Technician
Platte River State Fish Hatchery
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STANDARD OPERATING PROCEDURES FOR WATER QUALITY SAMPLE COLLECTION AND PROCESSING AT PLATTE RIVER STATE FISH HATCHERY

Edited and Revised
Paul Stowe
12/05/2014

SCOPE

The Platte River State Fish Hatchery collects water quality data from Big Platte Lake and its tributaries in an effort to quantify phosphorus concentrations in the watershed. This data will also be used to detect changes in water quality over time. The ultimate goal of this effort is to restore and preserve water quality in the Platte River watershed.

PURPOSE

The purpose of this document is to provide a detailed outline of the procedures used in sample collection and processing. Adherence to consistent sampling and processing protocol is vital to ensure data is of a known quality and integrity.

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STANDARD OPERATING PROCEDURES
COLLECTING SAMPLES FOR CHLOROPHYLL *a* ANALYSIS

1. SCOPE/ PURPOSE

1.1 This Standard Operating Procedure (SOP) describes the procedure for collecting and processing samples for Chlorophyll *a* analysis. This sample allows composite water samples to be collected from the entire column of the photic zone. It is assumed that the photic zone of the lake being studied is two times the Secchi depth.

2. REFERENCES

2.1 Handbook of Common Methods in Limnology, Lind, Owen T., 1995.

3. DEFINITIONS

3.1 Chlorophyll *a* is a photosynthetic pigment found in plants, including phytoplankton. It constitutes about 1 to 2% of the dry weight of planktonic algae; therefore the total phytoplankton biomass may be estimated based on the chlorophyll *a* concentration.

3.2 Photic zone is the column of water reaching from the surface to the photic depth. The Photic depth is the depth that receives 1% of surface illumination.

4. MATERIALS

4.1 Tube sampler.

4.2 Kemmerer.

4.3 Brown bottles.

5. SAMPLE COLLECTION

5.1 The tube sampler is lowered 30 feet into the water column and then emptied into a 5 liter (L) Nalgene brown bottle labeled “TUBE”. This procedure is repeated three times to provide enough water for complete sample collection.

5.2 The Kemmerer is used to collect a composite of water samples from depths 45, 60, 75, and 90 feet. This is done by using the Kemmerer to collect a sample from each of those depths and emptying all of them into a single 5 L Nalgene brown bottle labeled “45+”.

5.3 Once the sample water is collected and transported back to the lab, the 5 L Nalgene brown bottles are shaken vigorously before pouring. This procedure is repeated following each chlorophyll *a* sample filter apparatus filling.

5.4 Carefully grab the edge of a 45 µ filter with tweezers and rinse filter with distilled water.

5.5 Place a 45µ filter (grid down) on the filtering apparatus on the vacuum pump.

5.6 Pour 200mL of the appropriate 5 L Nalgene brown bottle sample into the filtering apparatus and turn on vacuum pump.

5.7 Once all water has passed through the filter, turn off the vacuum pump.

5.8 Place the filter into a mini Petri dish and label with the date, bottle number, and the amount filtered.

5.9 Wrap Petri dish in aluminum foil, label the same as the Petri dish, and place in freezer until measurement date.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
CLEANING SAMPLE AND LABORATORY CONTAINERS

1. SCOPE

1.1 These Standard Operating Procedures (SOPs) describe the methods to be used for cleaning sample and laboratory containers.

2. PURPOSE

2.1 It is critical that these procedures are followed to ensure that all sample and laboratory containers are contaminant free and that they are prepared in a way that is suitable for the activities for which they are designed.

3. PROCEDURES

3.1 5 and 10 L Nalgene plastic bottles and caps

3.1.1 After samples are collected the bottles and tops should be rinsed with tap water and scrubbed with a brush to remove any dirt. The bottles are turned upside down in the sink and allowed to drain. The bottles should never be washed with detergents.

3.1.2 Rinse with a 3% mixture of hydrochloric acid after each use. (980 mL Type III de-ionized water and 30 mL Hydrochloric acid)

3.1.3 If cleaning more than one bottle, pour HCl solution into next bottle to be rinsed.

3.1.3.1 If rinsing more than one bottle, order should be as follows. Lake bottles, Wastewater Pumps Reservoir, Site 11, Site 12, Site 14, Site 15, Site 28, and Site 39.

3.1.4 Once HCl solution has been transferred, rinse bottle with Type III de-ionized water and allow to drain and dry.

3.1.5 Steps 3.1.2-3.1.4 should be done monthly or as needed to prevent buildup of possible TP on the walls of the vessels.

3.2 Erlenmeyer flask

3.2.1 Rinse with tap water and scrub with a brush to remove any dirt.

3.2.2 Rinse with a 3% mixture of hydrochloric acid.

3.2.3 Rinse with Type III de-ionized water and allow it to drain and dry.

3.3 250 mL Sample bottles and caps

3.3.3 Same procedure as Erlenmeyer flask.

3.3 Laboratory Glassware and caps

3.3.1 Same procedure as Erlenmeyer flask.

4 QUALITY CONTROL

4.1 It is critical that these procedures are followed to ensure that all equipment is contaminant free.

4.2 If any container or equipment is thought to be compromised, it must be cleaned in order to keep the utmost control on sampling results.

Author:
Aaron Switzer 2003
Revised:
Paul Stowe 2013

STANDARD OPERATING PROCEDURES
ISCO SAMPLERS

1. SCOPE/PURPOSE

1.1. This standard operating procedure (SOP) describes the procedure for using the ISCO portable samplers. There are two of these samplers located on the hatchery grounds. The design of the sampler allows it to sample a calibrated volume of water at programmed time intervals over a 72 hour period.

2. REFERENCES

2.1. 3700 Portable Samplers – Installation and Operation Guide, Teledyne Isco, Inc., 2011

3. DEFINITIONS

3.1. Platte River State Fish Hatchery uses ISCO automated water samplers to monitor the amount total phosphorus entering and exiting the hatchery.

4. PROCEDURE

4.1 The ISCO sampler is opened by removing the cover that contains the keypad.

4.2 The properly labeled, acid washed, 10 L wide mouth poly carboy is placed inside the unit.

4.4 Replace cover and make sure that the sampler outlet hose is fed into the mouth of the carboy.

4.5 Press the START SAMPLING button of the keypad.

4.6 The display will read “SAMPLING 1 OF 144” or it will ask “START SAMPLING?”

4.7 If the display reads “START SAMPLING” and the sampler has not started sampling, then press the “ENTER/PROGRAM” button on the lower right of the keypad.

4.8 The sampler will start to take a sample and read “SAMPLING 1 OF 144.” Return in approximately 72 hours.

4.9 Press the red “STOP” button on the keypad. The display will read “PROGRAM HALTED”. Collect the sample and replace cover.

5. SAMPLER MANTENANCE

5.1 The sampler tubing should be replaced at least once every six months or as needed.

5.2 The sampler should be calibrated at the time of tube replacement or as needed. Refer to the manual at S:\FIS\PLIA Stuff\ISCO3700Manual.pdf.pdf.

5.3 Any maintenance and/or modifications to the program is recorded and entered into the ISCO Log on the PM file.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES FOR RUNNING THE JENWAY MODEL 6320D VISIBLE RANGE SPECTROPHOTOMETER

1. SCOPE/PURPOSE

1.1 This Standard Operating Procedure (SOP) describes the procedures for obtaining an absorbency reading for Phosphorous analysis.

2. REFERENCES

2.1 Jenway Model 6300 & 6320D Visible Range Spectrophotometers Operating Manual

3. DEFINITIONS

3.1 A Spectrophotometer is an instrument used for to determine the intensity of various wavelengths in a spectrum of light.

4. MATERIALS

4.1 Jenway Spectrophotometer

4.2 100 mm Glass Cuvette

4.3 Processed sample

4.4 Jenway 63-0 software installed on computer

5. PROCEDURES

5.1 Take cover off of Jenway and turn machine on, the switch is located in the back center, and let it warm for 30 minutes.

5.2 Open 63-Zero Software on computer desktop.

5.3 Once the software has opened click on the Photometrics tab.

5.4 Make sure in the menu options it is on ABS if running absorbencies and the wavelength factor is set at 880 nm.

5.5 Once the samples have had their proper amount of reaction time, pour the processed sample into the cuvette, insert into slot in the spectrophotometer, and close the lid.

5.6 Once reading has stabilized, click on the read button in the 63-zero program, make sure the read out is displayed in the logging area.

5.7 Once a reading has been obtained rinse the cuvette with the next sample to be read.

5.8 Repeat steps 5.5-5.7 until all your samples are run.

5.9 When all the samples have been run, save results to Jenway Files folder using the format of yymmdd for tracking purposes.

5.10 Shut off Jenway, close software, and cover.

Author:
Paul Stowe 2013
Revised:

STANDARD OPERATING PROCEDURES
USING A KEMMERER TYPE SAMPLER

1. SCOPE/PURPOSE

1.1 This standard operating procedure (SOP) describes the procedure for using the Kemmerer type sampler at discrete depths. The design of the sampler allows transfer of water into storage bottles without agitation. Water samples are collected for a variety of analysis; including total dissolved solids, phytoplankton, zooplankton, phosphorous, calcium, and alkalinity.

2. REFERENCES

2.1 Handbook of Common Limnology Methods, Lind, Owen T., 1985

3. DEFINITIONS

3.1 The messenger is a lead device that is dropped down the line to which the sampler is attached. When it reaches the sampler it trips the device causing the plungers to close.

4. PROCEDURE

4.1 The Kemmerer is opened and lowered to the depth of interest. This is determined by measured markings on the rope to which the sampler is attached.

4.2 When the desired depth is reached the messenger is dropped to close the sampler and it is raised to the surface and lifted into the boat.

4.3 The sample is then deposited into the appropriate bottle(s) for each analysis required.

5. SAMPLER STORAGE

5.1 The sampler is stored in the open position to keep moisture from being trapped inside and to avoid plunger wear.

Author:
Aaron Switzer 2003
Revised:
Paul Stowe 2014

STANDARD OPERATING PROCEDURES
USING LI-COR RADIATION SENSORS

1. SCOPE/PURPOSE

1.1 This standard operating procedure (SOP) describes the procedure for using the Li-Cor Radiation Sensor in the atmosphere and at three foot depth intervals in Platte Lake.

2. REFERENCES

2.1 Li-Cor Radiation Sensors Instruction Manual, Li-Cor Inc., 1990

3. DEFINITIONS

3.1 The spherical quantum sensor is the light bulb like device on a lowering frame to which coaxial cable is attached. The Li-Cor model LI-250 Light Meter is attached at the other end of the coaxial cable.

3.2 The Li-Cor model LI-250 Light Meter measures photosynthetic active radiation.

4. PROCEDURE

4.1 The spherical quantum sensor and the lower frame are held in the atmosphere on the sunny side of the boat.

4.2 Attach the other end of the coaxial cable to the light meter.

4.3 Turn on the light meter by holding the ON/CAL button for at least two seconds. Pressing the ON/CAL button once more places the meter in calibration constant mode. The calibration constant for the atmosphere is -133.7. The constant can be changed by pressing the HOLD/MULTISELECT button.

4.4 Once the proper calibration constant is selected press the ON/CAL button again to put the meter in the read mode. The proper units for the read mode are umol.

4.5 A reading is taken by pressing the AVG button, which takes a 15 second average of the current readings. Take the reading for the atmosphere at this point and recorded on the data sheet. Pressing the HOLD/MULTISELECT button puts the meter back into read mode.

4.6 The meter must now be calibrated for reading in the water. Refer to 4.2 and 4.3 for this procedure. The calibration constant for the water is -216.6.

4.7 Refer to 4.4 for the procedure of taking readings. The first reading in the water is taken with the spherical quantum sensor just under the surface of the water on the sunny side of the boat.

4.8 Readings are then taken at three foot intervals until a reading of 1% of the surface reading is achieved.

4.9 The meter is then turned off by pressing and holding the OFF button. Unplug the coaxial cable from the light meter and prepare for storage. See Section 5.

5. SAMPLER STORAGE

5.1 The light meter is stored in a plastic zip lock type bag which is placed in the tool box.

5.2 The coaxial cord is reeled up on the cord reel and a sock is placed over the spherical quantum sensor. The entire apparatus is then placed in one of the Rubbermaid totes.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
MILLIPORE DIRECT-Q 3 UV ULTRAPURE WATER SYSTEM

1. SCOPE/PURPOSE

1.1 This Standard Operating Procedure (SOP) describes the procedure for using the Millipore Direct-Q 3 UV Ultrapure Water System to produce water for laboratory and rinsing uses at Platte River State Fish Hatchery.

2. REFERENCE

2.1 DIRECT-Q 3 UV SYSTEM, User Manual, Millipore Corporation, 2006.

3. DEFINITIONS

3.1 Ultrapure water comes in two forms from the DIRECT-Q 3 UV water system. Type I water is used for mixing solution used in spectrophotometry and Type III water is used for general rinsing of lab ware.

4. PROCEDURE

4.1 Type I Water

4.1.1 Connect tubing to barbed outlet at the top of the unit.

4.1.2 Put vessel to be filled under the unit and put tubing from upper outlet into bottle opening.

4.1.3 Press the blue-green button just above outlet one time and wait.

4.1.4 Water will begin to be dispensed from the unit. The system will also display the temperature and resistivity of the water that is being dispensed.

4.1.5 The unit will turn itself off when the internal reservoir is emptied or when the blue-green button is pressed once again.

4.2 Type III Water

4.2.1 Place vessel to be filled under the unit and blue ball valve.

4.2.2 Open blue ball valve.

4.2.3 Unit will drain internal reservoir through valve and continue to make Type III water at the rate of approximately 2.4 L/Hour.

4.2.4 Once bottle is filled to desired level, close valve and remove vessel and put cap on.

5. MAINTENANCE

5.1 Smartpak must be replaced and new one installed and flushed when the pack alarm display is blinking.

5.2 Vent filter must be replaced when the Smartpak is replaced.

5.3 Millipack must be replaced and new one installed and flushed when the Smartpak is replaced.

5.4 UV lamp must be replaced when the UV lamp alarm display is blinking.

5.5 The system and the tank should be sanitized yearly.

5.6 The screen filter on the inlet tubing female fitting should be checked and cleaned twice yearly.

5.7 All of the maintenance procedures can be seen in full detail by looking at the manual.

Author:
Paul Stowe 2013
Revised:

STANDARD OPERATING PROCEDURES
FOR COLLECTING SAMPLES FOR PHYTOPLANKTON ANALYSIS

1. SCOPE/ PURPOSE

1.1 This Standard Operating Procedure (SOP) describes the procedure for using the tube sampler to collect samples for phytoplankton analysis. This sample allows a composite water sample to be collected from the entire column of the photic zone. It is assumed that the photic zone of the lake being studied is two times the Secchi depth.

2. REFERENCES

2.1 Handbook of Common Methods in Limnology, Lind, Owen T., 1995.

2.2 Fish Hatchery Management, Piper, et al., 1982.

3. DEFINITIONS

3.1 Phytoplanktons are minute plants suspended in water with little or no capability for controlling their position.

3.2 Photic zone is the column of water reaching from the surface to the photic depth. The Photic depth is the depth that receives 1% of surface illumination.

4. MATERIALS

4.1 Tube sampler.

4.2 5 L brown Nalgene bottle.

4.3 10 L Nalgene bottle.

4.4 Four 250 mL bottles.

5. SAMPLE COLLECTION

5.1 Phytoplankton is collected seasonally (spring, summer, fall)

5.2 The tube sampler is lowered 30 feet into the water column and then emptied into a 5L brown Nalgene bottle labeled “Tube”.

5.3 The bottle is then shaken vigorously and one 250 mL bottle is filled.

5.4 Add 10 drops of Lugol iodine to the 250 mL sample bottle and mix.

5.5 Pour the remaining sample into the 10L nalgene bottle. The contents will be processed at the hatchery lab.

5.6 This procedure is repeated three times to provide enough water for complete sample collection.

5.7 The Kemmerer is used to collect a composite of water samples from depths 45, 60, 75, and 90 feet. This is done by using the Kemmerer to collect a sample from each of those depths and emptying all of them into a single 5 L Nalgene brown bottle labeled “45+”.

5.8 From the “45+” 5 L brown Nalgene composite bottle, shake vigorously and fill one 250 mL bottle.

5.9 Add 10 drops of Lugol iodine to the 250 mL sample bottle and mix.

5.10 Put all 250 mL sample bottles in cooler for transport back to the hatchery laboratory.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
FOR PROCESSING TOTAL PHOSPHOROUS (TP) ANALYSIS

1. SCOPE/ PURPOSE

1.1 This Standard Operating Procedure (SOP) describes the procedure of processing samples for Total Phosphorous (TP) analysis. These results can be used for performance evaluation of hatchery methods and processes, as well as watershed trends.

2. REFERENCES

2.1 Standard Methods. American Public Health Association. 2005.

3. DEFINITIONS

3.1 Total phosphorous (TP) is a combination of the different forms of Phosphorus including dissolved and non-dissolved orthophosphate.

3.2 Photic zone is the column of water reaching from the surface to the photic depth. The Photic depth is the depth that receives 1% of surface illumination.

4. MATERIALS

4.1 Water Samples.

4.2 Di-ionized (DI) water from Millipore Direct-Q3 UV (Type I).

4.3 Test Tubes.

4.4 Conc. Sulfuric Acid.

4.5 Sodium Hydroxide, 10N

4.6 Ammonium Molybdate Tetrahydrate.

4.7 Abscorbic Acid.

4.8 Antimony Potassium Tartrate Trihydrate.

4.9 Potassium Persulfate.

4.10 Assorted laboratory glassware.

4.11 Tin foil.

4.12 Cut-off calibrated graduated cylinder (50 mL).

4.13 Calibrated glass scoop.

4.14 Purchased Phosphorus standards.

4.15 Parafilm.

4.16 Repeating Pipetter and dispensing tips.

4.17 Digester.

4.18 Stir plate and stir bar.

4.19 Jenway Spectrophotometer.

4.20 100 mm glass cuvette.

4.21 Kimberly Clark Kimwipes

5. SAMPLE PROCESSING

5.1 Gather samples to be processed and the corresponding bottle report. Import the bottle report in to the PRSFH Lab Data Template and create a new file using the format of "PRSFH Lab Data yymmdd". Once imported, the TP Results page will automatically list the samples to be processed in the order they should be read.

5.2 Put the appropriate number of test tubes in rack for the samples to be processed and four additional for the standards to be read and the calibration blank.

5.3 For the calibration blank, rinse test tube, calibrated graduated cylinder, and sample funnel with Type I DI water. Add 50 mL of Type I DI water using the calibrated graduated cylinder, and the sample funnel to the test tube.

5.4 Starting with the standards, agitate well, pour a small amount in to the test tube using the appropriately labeled funnel; and cap, shake, and drain. Also pour a small amount of the standard in to the cut-off graduated cylinder, and pour off while rotating to thoroughly rinse the vessel. These steps are done to rinse the lab ware with the standards prior to gathering the amount to be processed.

5.5 After the lab ware has been rinsed properly, agitate standard once again and fill calibrated graduated cylinder with 50 mL of standard and pour in to test tube using the standards funnel.

5.6 Repeat steps 5.4 and 5.5 using water samples to be processed instead of standards and the sample funnel.

5.7 Turn on digester and let it go through its start up cycle. Once it has done so, turn off and then back on to set soak time at 150 minutes @ 121° C.

5.8 Add 1.0 mL of 11N Sulfuric acid to each test tube, including the calibration blank, standards, and water samples.

5.8.1 To make 11N Sulfuric acid, mix 300 mL of conc. Sulfuric acid with 700 mL of Type I DI water and store in glass stoppered flask.

5.9 Add 0.5 grams of Potassium Persulfate to each test tube, including the calibration blank, standards, and water samples using the calibrated glass scoop. Once added, screw cap tight, and invert tube twice.

5.10 Place each test tube, including the calibration blank, standards, and water samples in to digester block. Soak tubes for 150 minutes @ 121° C.

5.11 Once the tubes have been fully digested, remove and allow to cool to room temperature.

5.12 Add 1 mL of 10N Sodium Hydroxide to each test tube, including the calibration blank, standards, and water samples. Agitate each tube for approximately 20 seconds.

5.13 Make Ascorbic acid solution by mixing Ascorbic acid in to Type I DI water in the following proportion. 1.76 g to 100 mL of Type I DI water. Put the solution on the stir plate with the stir bar, and mix. This is a one-time use solution only, discard any extra.

5.14 Make combined reagent using the following proportions, in this order, and stir after each addition. 50 mL of 5N Sulfuric acid, 5 mL of Antimony Potassium Tartrate solution, 15 mL of Ammonium Molybdate solution.

- 5.14.1 To make 5N Sulfuric acid, mix 140 mL of conc. Sulfuric acid in to 860 mL Type I DI water. Store in a glass stoppered flask.
- 5.14.2 To make Antimony Potassium Tartrate solution, dissolve 3.42 g of Antimony Potassium Tartrate powder in to 1 L of Type I DI water. Store in a glass stoppered flask.
- 5.14.3 To make Ammonium Molybdate solution, dissolve 40 g of Ammonium Molybdate powder in to 1 L of Type I DI water. Store in a glass stoppered flask.

5.15 Mix the combined reagent (5.14) with the Ascorbic acid solution (5.13) in the following proportion. Mix 70 mL of combined reagent with 30 mL of Ascorbic acid solution on the stir plate using the stir bar. Yellow color should form upon the mixing of the two solutions. If no color occurs, then repeat steps 5.13 and 5.14 before combining.

5.16 Take mixed solution and put tin foil over the top and place in small red cooler to keep out of the light.

5.17 Once the calibration blank, standards, and water samples have reached room temperature, the mixed solution can be added to each test tube. Using repeating pipetter, add 8 mL of mixed solution to each tube, cap, and invert twice.

5.18 Upon adding the mixed solution to the final tube, start a timer for 20 minutes.

5.19 After 20 minutes is up, the samples are ready to be read.

5.20 Calibrate the spectrophotometer at 880 nm by pouring the contents of the calibration blank tube in to the cuvette. Once the absorbency has stabilized press the CAL button on the spectrophotometer. It should now read 0.00 with the cuvette still in the unit.

5.21 The first tubes to be read are the standards. These values must be put in to the lab data file for updating the standard curve. If the curves remain within tolerance the rest of the samples may be run.

5.22 Following the Jenway SOP read the rest of the samples and import the Jenway file in to the lab sheet. This will automatically calculate the TP for each sample.

Authors:
Paul Stowe and Nicole Sherretz 2013
Revised:
Paul Stowe and Nicole Sherretz 2014

STANDARD OPERATING PROCEDURES PROCESSING TOTAL SUSPENDED SOLIDS

1. SCOPE/PURPOSE

1.1 This standard operating procedure (SOP) describes the procedure for processing samples for total suspended solids (TSS) in the Platte River State Fish Hatchery water quality lab. TSS in water is measured by the mass of non-filterable material collected and dried in a known volume of water.

2. REFERENCES

4.22 Standard Methods. American Public Health Association. 2005.

3. PROCEDURE

3.1 Prepare glass fiber filter disk (Millipore type AP40, 2.0µm pore size or less).

3.2 Put filter disk on filtering apparatus, turn on vacuum pump, and rinse with 3 successive washes of at least 20 mL of reagent grade water.

3.3 Continue suction to remove all traces of water and then turn off the vacuum pump.

3.4 Remove the disk from filtering apparatus and transfer to an aluminum drying dish using filter tweezers.

3.5 Place drying dish in drying oven at 103-105ºC for 1 hour.

3.6 Place drying dish in desiccator and allow it to come to room temperature.

3.7 Remove the filter from desiccator and weigh using an analytical balance that is properly calibrated for accuracy and precision.

3.8 Record weight of rinsed and dried filter on data sheet.

3.9 Place filter on filtering apparatus and turn on vacuum pump.

3.10 Agitate sample to be processed by vigorously shaking sample repeatedly as it is poured in to a 1 L graduated cylinder.

3.11 Measure out 1 L of water or the total amount of sample, whatever is greater. Record the amount to be filtered on the data sheet.

3.12 Pour the sample in to the filtering apparatus.

3.13 Rinse the graduated cylinder and the filtering apparatus with type III water multiple times to capture any residual material that may have adhered to the walls of the lab ware.

3.14 Continue vacuum to remove all traces of water and then turn off vacuum pump.

3.15 Remove the disk from filtering apparatus and transfer to the aluminum drying dish using filter tweezers.

3.16 Place drying dish in drying oven at 103-105ºC for 1 hour.

3.17 Place drying dish in desiccator and allow it to come to room temperature.

3.18 Remove the filter from desiccator and weigh using an analytical balance that is properly calibrated for accuracy and precision.

3.19 Record weight of filtered and dried sample and record value on the data sheet.

3.20 Calculate the TSS by using the following equation…

$$\text{mg TSS/L} = ((A - B) \times 1000) / \text{sample volume, mL}$$

where:

A= weight of filter + dried residue, mg, and
B = weight of filter, mg.

Author:
Paul Stowe 2013
Revised:

STANDARD OPERATING PROCEDURES PROCESSING TURBIDITIES USING HACH TURBIDIMETER

4. SCOPE/PURPOSE

4.1 This standard operating procedure (SOP) describes the procedure for using the Hach Turbidimeter (Model Number 2100N) in the Platte River State Fish Hatchery water quality lab. Turbidity in water is the presence of suspended solids, which reduce the transmission of light either through scattering or absorption.

5. REFERENCES

5.1 Laboratory Turbidimeter Instruction Manual, Hach Company, 1999

6. DEFINITIONS

6.1 The turbidimeter is used to measure the presence of suspended solids.

7. PROCEDURE

7.1 Warm samples to room temperature to avoid condensation on the sides of the sample tube.

7.2 Turn ON turbidimeter and allow warm up time of 30 minutes.

7.3 Fill sample tube to the white line at the top. Apply a thin bead of silicone oil to the surface of the sample cell. Spread the oil uniformly across the surface using the black oiling cloth. The surface should appear dry, not wet.

7.4 The sample cell is then placed into the turbidimeter. Open the cover and line up the white down arrow on the sample cell with the arrow on the turbidimeter. Close cover and press ENTER.

7.5 The first number to appear on the display is used for the first reading, readings are NTU. Readings are done in triplicate, repeat procedure with two more samples.

7.6 The meter's calibration must be checked every lake and/or tributary sampling day.

- 7.6.1 Agitate formazin standards and measure each of them and record values in S:\FIS\PLIA Stuff\DO, pH, and Turbidity Calibration.xls.
- 7.6.2 Calibrate the unit following the "Quick Reference Guide" procedures and the formazin standards.
- 7.6.3 After calibrating the unit, measure the samples from the lake and/or tributary sampling.
- 7.6.4 Once all samples have been completed, re-agitate the formazin standards and measure each of them and record values in S:\FIS\PLIA Stuff\DO, pH, and Turbidity Calibration.xls.

7.7 When finished using the turbidimeter turn OFF and replace transparent dust cover.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
SAMPLING PREPARATION

1 SCOPE

1.1 The Platte River Fish Hatchery collects water quality data from Platte Lake and its tributaries as part of an ongoing water quality program. This data is used to detect changes in water quality over time.

2 PURPOSE

2.1 The purpose of this document is to provide a detailed outline of the procedures used in sample collection. Adherence to a consistent sampling protocol is vital to ensure data is of a known quality and integrity.

3 RESPONSIBLITIES

3.1 The Technician performing the preparation work shall be trained in standard procedures described within.

4 PROCEDURE

4.1 Day before event –

4.1.1 Conduct an inspection of YSI, sonde, all electronic equipment, and change batteries if needed.

4.1.2 Inspect boat and trailer and make sure there is plenty of gas in can.

4.1.3 Gather together equipment.

4.1.4 Gather together bottles and coolers.

4.1.5 Clean any equipment or bottles that have not been cleaned.

4.2 Day of event -

4.2.1 Calibrate YSI following SOP before departure.

4.2.2 Fill coolers with ice or ice packs if weather dictates.

4.2.3 Conduct sampling in accordance with SOPs.

4.2.4 After sampling is completed. Return all equipment to designated storage location and conduct post calibration check on YSI.

4.2.5 Refrigerate samples.

4.2.6 Run calibration, samples, and drift check on turbidimeter following SOP.

4.2.7 Clean bottles and related equipment.

4.2.8 Enter data collected into Access database “Sample FP”.

4.2.9 Create Export files, check for QA/QC, print, and put copies into binder in lab.

4.3 Day after event -

4.3.1 If not done already, conduct any items not complete from the day before.

4.3.2 Conduct maintenance as needed on any equipment.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
PLATTE HATCHERY, BIG PLATTE LAKE, AND TRIBUTARY SAMPLING

1. SCOPE

1.1 The Platte River Fish Hatchery collects water quality data from Platte Lake and its tributaries as part of an ongoing water quality program. This data is used to detect changes in water quality over time.

2. PURPOSE

2.1 The purpose of this document is to provide a detailed outline of the procedures used in sample collection. Adherence to a consistent sampling protocol is vital to ensure data is of a known quality and integrity.

3. RESPONSIBILITIES

3.1 The individual technician responsible for sampling shall be trained in the standard operating procedures described within.

4. PROCEDURES

4.1 Platte Hatchery sampling - per location (NOTE: Sample only the water sources being used at the present time.)

4.1.1 Wastewater Pumps Reservoir (10)

Equipment and bottles
- (3) 250ml acid washed plastic bottles
- (1) Hatchery Data Sheet
- (1) Labeled Turbidity bottle

Step 1: Remove 10 liter Nalgene bottle from ISCO sampler.
Step 2: Shake sample container vigorously.
Step 3: Pour a small amount of water into 250ml plastic bottle. Recap shake and empty.
Step 4: Shake Nalgene bottle one more time.
Step 5: Refill to neck of bottle.
Step 6: Repeat for two remaining bottles. Swirl Nalgene bottle to keep sample well mixed before filling each bottle.
Step 7: Place sample bottles in refrigerator.
Step 8: Shake Nalgene bottle and collect sample for turbidity.

4.1.2 Brundage Spring (11)

Equipment and bottles (1100 series – pink labels)
- (3) 250ml acid washed plastic bottles
- (1) Hatchery Data Sheet
- (1) Labeled Turbidity bottle

Step 1: Remove 10 liter Nalgene bottle from Sigma sampler.
Step 2: Take temperature of sample water from mixing drum, turn off pump and drain drum.
Step 3: Perform maintenance/cleaning on pump, assembly and drum.
Step 4: Shake sample container vigorously.

Step 5: Pour a small amount of water into 250ml plastic bottle. Recap shake and empty.
Step 6: Shake Nalgene bottle one more time.
Step 7: Refill to neck of bottle.
Step 8: Repeat for two remaining bottles. Swirl Nalgene bottle to keep sample well mixed before filling each bottle.
Step 9: Place sample bottles in refrigerator.
Step 10: Shake Nalgene bottle and collect sample for turbidity.

4.1.3 Brundage Creek (12)

Equipment and bottles (1200 series – yellow labels)
(3) 250ml acid washed plastic bottles
(1) Hatchery Data Sheet
(1) Labeled Turbidity bottle

Step 1: Remove 10 liter Nalgene bottle from Sigma sampler.
Step 2: Take temperature of sample water from mixing drum, turn off pump and drain drum.
Step 3: Perform maintenance/cleaning on pump, assembly and drum.
Step 4: Shake sample container vigorously.
Step 5: Pour a small amount of water into 250ml plastic bottle. Recap shake and empty.
Step 6: Shake Nalgene bottle one more time.
Step 7: Refill to neck of bottle.
Step 8: Repeat for two remaining bottles. Swirl Nalgene bottle to keep sample well mixed before filling each bottle.
Step 9: Place sample bottles in refrigerator.
Step 10: Shake Nalgene bottle and collect sample for turbidity.

4.1.4 Effluent Pond Intake (14)

Equipment and bottles (1400 series – green labels)
(3) 250ml acid washed plastic bottles
(1) Hatchery Data Sheet
(1) Labeled Turbidity bottle

Step 1: Remove 10 liter Nalgene bottle from Sigma sampler.
Step 2: Take temperature of sample water from mixing drum, turn off pump and drain drum.
Step 3: Perform maintenance/cleaning on pump, assembly and drum.
Step 4: Shake sample container vigorously.
Step 5: Pour a small amount of water into 250ml plastic bottle. Recap shake and empty.
Step 6: Shake Nalgene bottle one more time.
Step 7: Refill to neck of bottle.
Step 8: Repeat for two remaining bottles. Swirl Nalgene bottle to keep sample well mixed before filling each bottle.
Step 9: Place sample bottles in refrigerator.
Step 10: Shake Nalgene bottle and collect sample for turbidity.

4.1.5 Upper Discharge (15)

Equipment and bottles (1500 series – red labels)
- (3) 250ml acid washed plastic bottles
- (1) Hatchery Data Sheet
- (1) Labeled Turbidity bottle

Step 1: Remove 10 liter Nalgene bottle from Sigma sampler.
Step 2: Take temperature of sample water from mixing drum, turn off pump and drain drum.
Step 3: Perform maintenance/cleaning on pump, assembly and drum.
Step 4: Shake sample container vigorously.
Step 5: Pour a small amount of water into 250ml plastic bottle. Recap shake and empty.
Step 6: Shake Nalgene bottle one more time.
Step 7: Refill to neck of bottle.
Step 8: Repeat for two remaining bottles. Swirl Nalgene bottle to keep sample well mixed before filling each bottle.
Step 9: Place sample bottles in refrigerator.
Step 10: Shake Nalgene bottle and collect sample for turbidity.

4.1.6 Clarifier Overflow (28)

Equipment and bottles (2800 series – orange labels)
- (3) 250ml acid washed plastic bottles
- (1) Hatchery Data Sheet
- (1) Labeled Turbidity bottle

Step 1: Remove 10 liter Nalgene bottle from ISCO sampler.
Step 2: Shake sample container vigorously.
Step 3: Pour a small amount of water into 250ml plastic bottle. Recap shake and empty.
Step 4: Shake Nalgene bottle one more time.
Step 5: Refill to neck of bottle.
Step 6: Repeat for two remaining bottles. Swirl Nalgene bottle to keep sample well mixed before filling each bottle.
Step 7: Place sample bottles in refrigerator.
Step 8: Shake Nalgene bottle and collect sample for turbidity.

4.1.7 Backwash Line (39)

Equipment and bottles (3900 series – white labels)
- (3) 250ml acid washed plastic bottles
- (1) Hatchery Data Sheet
- (1) Labeled Turbidity bottle

Step 1: Remove 10 liter Nalgene bottle from ISCO sampler.
Step 2: Shake sample container vigorously.
Step 3: Pour a small amount of water into 250ml plastic bottle. Recap shake and empty.
Step 4: Shake Nalgene bottle one more time.
Step 5: Refill to neck of bottle.
Step 6: Repeat for two remaining bottles. Swirl Nalgene bottle to keep sample well mixed before filling each bottle.
Step 7: Place sample bottles in refrigerator.
Step 8: Shake Nalgene bottle and collect sample for turbidity.

4.2 Big Platte Lake

Equipment Requirements

Boat and motor
Life jackets
YSI 600R/Sonde/cord
Kemmerer/messenger
Secchi disk/line
Tube sampler
GPS
Extra batteries C/AA/ 9V
Pencil x2
Lake Data Sheet

Bottles

(2) 10 L acid washed plastic bottle
(1) 15 L acid washed plastic bottle

4.2.1 90+ ft Location

Step 1: Record the lake gauge height (by outhouse) on data sheet.
Step 2: Locate sampling waypoint (Buoy) on GPS unit and anchor boat at that position.
Step 3: Lower secchi disk until it is no longer visible on the shaded side of the boat. Record the number of feet that it was lowered in to the water on the datasheet. (see Secchi Disk SOP)
Step 4: Calibrate YSI 650 MDS and 600R sonde for depth (see YSI calibration SOP).
Step 5: Lower sonde on cable to each required depth. Allow values to stabilize approximately two minutes and record values for temperature, conductivity, D.O, pH and ORP on data sheet.
Step 7: Use Kemmerer to collect water at the surface and place water in a 10L plastic bottle. Lower and collect samples at 7.5, 15, 30, 45, and 60 feet and place the water in the 15L plastic bottle. Lower the Kemmerer and collect samples at 75, and 90 foot depths, and place in the other 10L bottle. (See Kemmerer SOP)

4.3 Tributaries – per location

4.3.1 North Branch Platte River at Dead Stream Rd.

Equipment and bottles

(1) Dip Sampler
(3) 250ml acid washed plastic bottles
(1) 200ml rinsed bottle
(1) Tributary Data Sheet
(1) PVC Staff Gage
(1) YSI and Sonde

Step 1: Lower Dip Sampler off center of catwalk.
Step 2: Fill bottle, agitate and empty.
Step 3: Refill to neck of bottle.
Step 4: Repeat for two remaining bottles.

Step 5: Record bottle numbers on data sheet.
Step 6: Fill 200ml bottle for turbidity readings.
Step 7: Read staff gauge height at the upper section of the fish ladder and record value on data sheet.
Step 8: Lower PVC staff gage along the north keyway on the dam read staff gage at the top of the keyway and record value on data sheet.
Step 9: Take photo of water that includes substrate.
Step 10: Using YSI and sonde allow unit to stabilize after approximately two minutes and record values on data sheet.

4.3.2 Platte River at US Hwy31 Bridge below Honor

Equipment and bottles

(3) 250ml acid washed plastic bottles
(1) 200ml rinsed bottle
(1) Tributary Data Sheet
(1) YSI and sonde

Step 1: On the down stream side of the bridge, face up stream and take out bottle and hold up stream.
Step 2: Fill bottle, agitate and empty.
Step 3: Refill to neck of bottle.
Step 4: Repeat for two remaining bottles.
Step 5: Record bottle numbers on data sheet.
Step 6: Fill 200ml bottle for turbidity readings.
Step 7: Read gauge height and record value on data sheet.
Step 8: Take photo of water that includes substrate.
Step 9: Using YSI and sonde allow unit to stabilize after approximately two minutes and record values on data sheet.

4.3.4 Platte River at Stone Bridge

Equipment and bottles

(3) 250ml acid washed plastic bottles
(1) 200ml rinsed bottle
(1) Tributary Data Sheet

Step 1: On the down stream side of the bridge, face up stream and take out bottle and hold up stream.
Step 2: Fill bottle, agitate and empty.
Step 3: Refill to neck of bottle.
Step 4: Repeat for two remaining bottles.
Step 5: Record bottle numbers on data sheet.
Step 6: Fill 200ml bottle for turbidity readings.
Step 7: Read gauge height and record value on data sheet.
Step 8: Take photo of water that includes substrate.

Author:
Aaron Switzer 2003
Revised:
Paul Stowe 2012
Paul Stowe 2013
Paul Stowe 2014

STANDARD OPERATING PROCEDURES
SLUDGE HAULING

1 SCOPE

1.1 The Platte River Fish Hatchery collects water quality data from Platte Lake and its tributaries as part of an ongoing water quality program. This data is used to detect changes in water quality over time. Part of this program includes modeling of a phosphorus budget for the Platte River State Fish Hatchery. The phosphorus contained in the sludge that leaves the hatchery is a major component of the whole-hatchery phosphorus budget.

2 PURPOSE

2.1 The purpose of this document is to provide a detailed outline of the procedures used in sample collection while the sludge tank is being emptied. Adherence to a consistent sampling protocol is vital to ensure data is of a known quality and integrity.

3 RESPONSIBLITIES

3.1 The Technician performing the preparation work shall be trained in standard procedures described within.

4 PROCEDURE

4.1 Day before event –

4.1.1 Notify PLIA contacts via email.

4.1.2 Gather together 250 ml sample bottles labeled in red lettering - sludge.

4.1.3 Print waste collection data sheets.

4.1.4 Gather together digital camera and GPS.

4.2 Day of event -

4.2.1 Meet with truck drivers to discuss sampling protocol.

4.2.2 Collect three samples from each load leaving the hatchery grounds. Collect samples at the beginning, middle and end of each load.

4.2.3 Record date, time, gallons loaded and sample bottle numbers.

4.2.4 It is essential that the Technician ride along or follow truck drivers to the injection site. Digital photographs should be taken at the site and GPS coordinates recorded. Photos should include the injection unit during the actual injection process. Send this information, including photos, to the PLIA contacts.

4.2.5 Combine all samples from triplicate sampling during emptying in to a composite carboy for later analysis.

4.2.6 Enter data collected into Access database “Sample FP”.

4.2.7 Create Export files, check for QA/QC, print, and put copies into binder in lab.

4.3 Day after event -

4.3.1 Send Export files to PLIA Contacts.

4.3.2 Monitor level of sludge tank

4.4 Weeks after event –

4.4.1 Monitor level of sludge tank during refill, and average sludge depth once a month and enter in to preventative maintenance data sheet.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
SLUDGE TANK AND CLARIFIER OVERFLOW SAMPLING

1. SCOPE

1.1 The Platte River Fish Hatchery collects water quality data from Platte Lake and its tributaries as part of an ongoing water quality program. This data is used to detect changes in water quality over time. Part of this program includes modeling of a phosphorus budget for the Platte River State Fish Hatchery. This data is used to detect changes in water quality over time.

2. PURPOSE

2.1 The purpose of this document is to provide a detailed outline of the procedures used in sample collection. Adherence to a consistent sampling protocol is vital to ensure data is of a known quality and integrity.

3. RESPONSIBLITIES

3.1 The Technician performing the preparation work shall be trained in standard procedures described within.

4. PROCEDURE

4.1 Clarifier Overflow Sampling - Site 28

Equipment and bottles

(3) 250ml acid washed plastic bottles - 2800 series, “28xx”
(1) 200ml rinsed bottle – labeled “28”
(1) Production Waste Data Sheet

Step 1: Check clarifier to assure it is full and overflowing.
Step 2: Collect samples at the pipe that enters the effluent pond on the east side bank.
Step 3: Fill bottle, agitate and empty.
Step 4: Refill to neck of bottle.
Step 5: Repeat for two remaining bottles.
Step 6: Record bottle numbers on data sheet.
Step 7: Fill 200ml bottle for turbidity readings.
Step 8: Place 250ml bottles in Ziploc bag and store in refrigerator.
Step 9: Run turbidities and record on data sheet.

4.2 Sludge Tank Overflow Sampling - Site 27 (Only Sample if bypass is Open)

Equipment and bottles

(3) 250ml acid washed plastic bottles - RED labels
(1) 200ml rinsed bottle – RED labels
(1) Production Waste Data Sheet

Step 1: Check sludge tank to assure it is full and overflowing.
Step 2: Collect samples at the pipe that enters the effluent pond on the east side bank.
Step 3: Fill bottle, agitate and empty.
Step 4: Refill to neck of bottle.

Step 5: Repeat for two remaining bottles.
Step 6: Record bottle numbers on data sheet.
Step 7: Fill 200ml bottle for turbidity readings.
Step 8: Place 250ml bottles in Ziploc bag and store in refrigerator.
Step 9: Run turbidities and record on data sheet.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
SECCHI DEPTH TRANSPARENCY

1. SCOPE/ PURPOSE

1.1 Secchi disk transparency is used to estimate photic depth.

2. REFERENCES

2.1 Handbook of Common Methods in Limnology, Lind, Owen T., 1985.

3. DEFINITIONS

3.1 The Secchi dick is a 20-cm disk on which opposite quarters are gloss black and gloss white.

3.2 Photic zone is the column of water reaching from the surface to the photic depth.

3.3 The photic depth is the depth that receives 1% of surface illumination.

4. MATERIALS

4.1 Secchi disk.

4.2 Calibrated line.

5. PROCEDURES

5.1 Lower the Secchi disk on the calibrated line until it disappears from view. Record this depth.

5.2 Raise disk until it reappears and record depth.

5.3 The average of these depths is “Secchi Disk Transparency.”

5.4 Make the determination of Secchi disk transparency in the shade of the boat.

5.5 Do not wear sunglasses when making the determination.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES FOR WATER SAMPLE SHIPPING

1. SCOPE

1.1 The Platte River Fish Hatchery collects water quality data from Platte Lake and its tributaries as part of an ongoing water quality program. This data is used to detect changes in water quality over time. Part of this program includes modeling of a phosphorus budget for the Platte River State Fish Hatchery. This data is used to detect changes in water quality over time.

2. PURPOSE

2.1 The purpose of this document is to provide a detailed outline of the procedures used in sample preparation collection. Adherence to a consistent sampling protocol is vital to ensure data is of a known quality and integrity.

3. RESPONSIBLITIES

3.1 The employee performing the preparation work shall be trained in standard procedures described within.

4. PROCEDURE

4.1 Gather cooler and bottles.

4.2 Be sure to check each bottle cap and bottle to ensure that they are securely fastened and not damaged or leaking.

4.3 Add the data sheet and any additional packing material.

4.4 Place an ice pack in the cooler and close the lid tight.

4.5 Use the clear packing tape in the lab to secure the cooler lid.

4.6 Using UPS smart pick up and send to receiving address.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
SIGMA MODEL 900 PORTABLE SAMPLER

1. SCOPE/PURPOSE

1.1 This standard operating procedure (SOP) describes the procedure for using the Sigma 900 portable samplers. There are five of these samplers located on the hatchery grounds. The design of the sampler allows it to sample a calibrated volume of water at programmed time intervals over a 72 hour period.

2. REFERENCES

2.1 Model 900 Standard Portable Sampler – Instrument Manual, American Sigma, 2002

3. DEFINITIONS

3.1 Platte River State Fish Hatchery uses this type of automated sampler to monitor the amount total phosphorus entering and exiting the hatchery.

4. PROCEDURE

4.1 The Sigma sampler is opened by removing the cover that contains the keypad.

4.2 The properly labeled acid washed 10L wide mouth poly carboy is placed inside the unit.

4.4 Replace cover.

4.5 Press the START button located in the center of the keypad at the top.

4.6 The display will read “START OR RESUME PROGRAM?” - press the START button.

4.7 Within 30 seconds the display will read “PROGRAM RUNNING”.

4.8 Return in approximately 72 hours.

4.9 Press the CHANGE/HALT key, #2 on the keypad. The display will read “PROGRAM HALTED”. Collect the sample and replace cover.

5. SAMPLER MANTENANCE

5.1 The sampler tubing should be replaced at least once every six months or as needed.

5.2 The sampler should be calibrated at the time of tube replacement or as needed. Refer to the Sigma binder in the lab for these methods.

5.3 Any maintenance and/or modifications to the program is recorded and entered into the Sigma Log - Access database and the Sigma binder.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
STREAM FLOW METER

1. SCOPE/PURPOSE

1.1 This standard operating procedure (SOP) describes the procedure for ensuring accurate meter performance (Pygmy and Price AA) in the field.

2. REFERENCES

2.1 USGS, Office of Surface Water Technical Memorandum No. 89.07

3. DEFINITIONS

3.1 The current meters are used to determine flow and velocity of the flowing waters in the Platte Lake Watershed.

4. PROCEDURE

4.1 The meters are visually inspected before field measurements are made. Bent cups and other signs of wear will give inaccurate flow results.

4.2 Before taking field measurements, a full timed spin test should be performed. A spin test simply means spinning the cups and recording the time it takes for the cups to stop moving.

Minimum acceptable spin test times are:
Pygmy meter: 0:45 seconds
Price AA meter: 2:00 minutes

4.3 A record of spin tests is kept in the current meter log.

4.4 Between measurements in the field, the cups are spun (not timed) to check for smooth operation.

5. SAMPLER STORAGE

5.1 The meters are dried and stored in their protective cases provided by the manufacturer.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
HOBO WATER LEVEL LOGGER

1. SCOPE/ PURPOSE

1.1 The HOBO water level logger is used to as an aid in calibrating flow rates entering and exiting the hatchery.

2. DEFINITIONS

2.1 The water level logger is a 6" x 1" solid stainless steel cylinder.

2.2 The Optic USB Base Station is device used for communication between the water level logger and the computer. It is located in the laboratory at the hatchery.

2.3 The stilling well is a 4" PVC pipe that is used to stabilize the water surrounding the level sensor.

3. MATERIALS

3.1 HOBO water level logger.

3.2 Optic USB Base Station.

4. PROCEDURES

4.1 Launching Logger

4.1.1 Insert water level logger into optic USB base station and open HOBOware program on computer desktop.

4.1.2 Follow onscreen prompts to launch logger.

4.1.3 Once logger is successfully launched remove from base station and transfer to clarifier stilling well.

4.1.4 Insert water level logger into screw cap and lower into the stilling well.

4.2 Retrieving Logger

4.2.1 Remove water level logger from the stilling well.

4.2.2 Insert water level logger into optic USB base station and open HOBOware program on computer desktop.

4.2.3 Follow onscreen prompts to retrieve data from logger.

4.2.4 Transfer data into an Excel spreadsheet and email to implementation coordinator.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES FOR CALIBRATION OF YSI 650 MDS AND 600R SONDE

1 SCOPE

1.1 The Platte River Fish Hatchery collects water quality data from Platte Lake and its tributaries as part of an ongoing water quality program. This data is used to detect changes in water quality over time.

2. PURPOSE

2.1 This (SOP) describes the proper procedure for calibration of YSI 650 MDS and 600R sonde units. These instruments are used for the collection of water quality data on Big Platte Lake and its tributaries. Adherence to a consistent calibration protocol is necessary to ensure effective and consistent water quality data collection.

3. REFERENCES

3.1 YSI Environmental Operation Manual

4. CALIBRATION

4.1 The YSI 650 MDS and 600R sonde are calibrated in the lab at Platte River State Fish Hatchery. All calibration solutions are stored in the lab. The YSI 650 MDS and 600R are always calibrated prior to use on the day that it is used in the field.

4.2 Conductivity Calibration

4.2.1 Rinse the calibration cup twice with distilled water, then once with 0.02N KCL solution. Fill the calibration cup with the 0.02N KCL solution such that the conductivity block is fully submerged. Tap the sonde unit to dislodge any possible air bubbles.

4.2.2 Select “Sonde Menu”, then “calibrate”, “conductivity”. Then “spcond”.

4.2.3 Enter the value 2.76 ms/cm for calibration of (0.02N KCL). The display will then return to the data display screen, with the option “calibrate” highlighted. Record the displayed spcond value as the initial reading. Then select enter; the calibration will stabilize and be completed. Record the displayed value in the YSI calibration logbook as the calibrated value. Select the highlighted option “continue” by pressing enter. The display will then continue with options. Advance to “sonde run”.

4.2.4 Rinse the calibration cup twice with distilled water then once with 0.01N KCL solution. Fill the calibration cup with the 0.01N KCL solution such that the entire conductivity block is fully submerged. Tap the unit to dislodge any air bubbles.

4.2.5 Record the displayed conductivity value in the logbook as the “initial reading”.

4.2.6 After use in the field, conduct the post-calibration procedure by repeating 4.2.1 and 4.2.3. The displayed value for each solution should be recorded as the “after use” value. The difference between the “after use” value and the “calibrated value” (for 0.02N KCL) and “initial value” (for 0.01N KCL) should be recorded as drift.

4.3 Oxidation Reduction Potential (ORP)

4.3.1 To determine if the sensor is functioning correctly place the probe in 3682 Zobell solution and monitor the millivolt reading. The probe should read in the range of 221-241 at normal ambient temperature (17-32 degrees Celsius). If the reading is out side this range, the probe can be calibrated to the correct value outlined in section 2.6.1 of the operations manual.

4.4 Temperature

4.4.1 The temperature sensor is factory calibrated.

4.5 Depth Calibration

4.5.1 Calibration of depth should occur in the field immediately prior to use.

4.5.2 Suspend sonde unit so that the probe is just above water surface. Select "sonde menu", then "calibrate", then "pressure –ABS" on display unit. Enter calibration value (0.0 feet). The display will then return to the data display screen, with the option "calibrate" highlighted. Select enter, and the calibration will stabilize and be complete.

4.6 pH Calibration

4.6.1 Remove the weighted probe guard from sonde. Rinse calibration cup and probes with distilled water. Thoroughly mix container of pH 7 buffer, making sure the solution is dated and fresh. Rinse the probes in the calibration cup with pH 7 buffer, and then fill the cup with buffer until all probes are submerged. Allow readings to stabilize for approximately 90 seconds.

4.6.2 Select "Sonde Menu", then "Calibrate", then "pH" then "3 point cal" on the display unit. Enter the first pH buffer for calibration (pH 7). The display will then return to the data display screen, with the option "calibrate" highlighted. Record the displayed pH value as the initial reading in the YSI calibration logbook. Then select enter, the calibration will stabilize and be completed. Record the new displayed value in the YSI calibration logbook as the calibrated value. Select the highlighted option "continue" by pressing enter.

4.6.3 Repeat for both pH 10 and pH 4.

4.6.4 After use in the field conduct the post-calibration procedure by repeating 4.6.1 for all three-pH solution. The displayed values should be recorded as the after use value in the YSI calibration logbook. The difference between the "after use" value and the "calibrated" value is the drift.

4.7 Dissolved Oxygen (DO) calibration

4.7.1 Start the vacuum pump attached to air stones. The air stones are in two 10L glass bottles, one refrigerated and one at room temperature. Let the vacuum pump run at least one half hour to completely saturate the water.

4.7.2 Place sonde (with attached weighted probe guard) into five-gallon DI water bucket in lab. Allow the unit to stabilize in bucket for 10 minutes.

4.7.3 Obtain the current barometric pressure from weather station, read in inches (in.) of Hg. Convert this value to millimeters (mm) of Hg through a multiplication factor of (25.4). Record the mm of Hg value in YSI calibration logbook.

4.7.4 Select "Sonde Menu", then "Calibrate", then "DO%" on the display unit. Enter the calculated barometric pressure "mm/Hg". The display will return to the data display screen, with the option "calibrate" highlighted. Press enter and the calibration will stabilize and be completed.

4.7.5 Place the sonde into the refrigerated 10L glass bottles from 4.7.1 which are now saturated with oxygen. Let the 650 stabilize approximately 90 seconds. Record the value for DO% and DO mg/L. Repeat this procedure for the 10L glass bottle at room temperature. Compare these readings to the Oxygen Saturation at Temperature spreadsheet posted on the side of the refrigerator. The 650 DO mg/L readings should be within the hundredth. If not consult the YSI Operations Manual for proper recalibration procedures.

4.7.6 After use in the field, conduct the post-calibration procedure repeating 4.7.1 through 4.7.5 as listed above. The difference between the displayed DO value recorded in the logbook and the post-calibration reading is the drift, which should be recorded in the logbook.

5. MAINTENANCE

5.1 After use the YSI 650 MDS and 600R sonde should be cleaned and stored in the lab.

5.2 The cable is cleaned and recoiled. Clean and lubricate the rubber connectors. Store the sonde unit with ~ ½ inch of tap water in storage cup.

5.3 Replace Dissolved Oxygen (DO) membrane every 30 days. Avoid over stretching the membrane, invert sonde unit several times; check for trapped air bubbles under the membrane.

5.4 Rinse pH bulb with tap water to remove any film or debris. If good readings are not established, soak the probe in a dishwashing liquid 10-15 minutes. A cotton swab can be used gently to clean the bulb if needed.

5.5 Clean the conductivity block and electrodes with dishwashing liquid solution every four months.

5.6 The temperature sensor is factory set and requires no maintenance.

5.7 The function of the Redox (ORP) sensor should be checked quarterly against a standard Zobell's solution.

Author:
Aaron Switzer 2003
Revised:

STANDARD OPERATING PROCEDURES
COLLECTION AND PRESERVATION OF ZOOPLANKTON SAMPLES

1. SCOPE/ PURPOSE

1.1 A zooplankton tow net is used to collect zooplankton in Platte Lake. The samples are preserved and sent to the lab for analysis.

2. DEFINITIONS

2.1 The zooplankton net is conical in shape and has a metal frame at the large opening and a male plastic connection at the small opening.

2.2 The plankton bucket attaches to the male plastic connection at the smaller opening on the zooplankton net.

3. MATERIALS

3.1 Zooplankton net and plankton bucket.

3.2 Calibrated line.

4. PROCEDURES

4.1 Connect the calibrated line to the frame at the large end of the zooplankton net.

4.2 Lower the zooplankton net slowly into the water. Make sure there are no air bubbles trapped in the net. Continue to lower the net until the 85' mark is reached. The 85' mark is bright red edged with black.

4.3 Once the 85' mark is reached allow the line to become taut and begin retrieving the net. The average rate of retrieval is 60 seconds.

4.4 When the net reaches the surface hold vertically above the water surface and splash surface water onto the sides of the net to wash down any zooplankton stuck to the inside of the net.

4.5 Remove the plankton bucket form the net and pour its contents into a 250ml sample bottle, be sure to record the bottle number on the Laboratory Data Form.

4.6 Spray down the inside of the plankton bucket with a squeeze bottle filled with tap water from the hatchery. Repeat.

4.7 Add formalin to the sample bottle to preserve the zooplankton. The amount of formalin is approximately 20% of the total sample volume.

5. STORAGE

5.1 Following sampling the net is rinsed and hung in the lab to dry. The plankton bucket is removed, rinsed and inverted for drying.

5.2 Once dry the plankton bucket is placed back on the net. A sock is used to cover the bucket to prevent damage to the net. The net is carefully folded up in a towel and put into storage.

Author:
Aaron Switzer 2003
Revised:

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

RICK SNYDER
GOVERNOR

KEITH CREAGH
DIRECTOR

June 17, 2014

Dr. Raymond P. Canale
710 SW Manitou Trail
Lake Leelanau, MI 49653

Dear Dr. Canale,

The purpose of this letter is to certify that I have reviewed and updated the Water Sampling and Processing Preventive Maintenance, and Calibration Schedule for the year 2013.

All equipment calibration and preventive maintenance has been completed. All equipment is in good working order. Please review and contact me with any questions.

Sincerely,

Paul Stowe, Fisheries Technician
Platte River State Fish Hatchery
15210 US Hwy 31
Beulah, MI 49617

Platte River State Fish Hatchery
Summary of 2013 Production and Operational Activities

Antibiotic Use

The antibiotic use at the Platte River State Fish Hatchery (Hatchery) in 2013 only focused on disease treatment. In the past, Chinook salmon were fed oxytetracycline coated feed to produce a readable mark on the vertebra of hatchery produced fish. In 2013, all Chinook salmon were coded wire tag marked in trailers by mass marking equipment.

In June 2013, the Atlantic salmon fry contracted bacterial gill disease. The recommend treatment was 15 mg/L Chloramine-T bath for one hour per day for three consecutive days. These fish, located in Starter Tanks 1 through 4 were treated June 11 through June 13, 2013. There was a total of 0.9 kg of Chloramine-T used for treating fish. The hatchery discharge during the treatment period averaged 7.46 million gallons per day (MGD).

In September 2013, the same group of Atlantic salmon contracted bacterial gill disease again. The recommended treatment was 15 mg/L Chloramine-T bath for one hour per day for three consecutive days. These fish, now located in indoor Rearing Tanks 2 and 3, were treated September 4 through September 6, 2013. There was a total of 3.2 kg of Chloramine-T used for treating fish. The hatchery discharge during the treatment period averaged 5.67 MGD.

In November 2013, the same group of Atlantic salmon contracted external Flavobacteriosis. The recommended treatment was 15 mg/L Chloramine-T bath for one hour per day for three consecutive days. These fish, located in indoor Rearing Tanks 1, 2 and 4, were treated November 28 through November 30, 2013. There was a total of 4.7 kg of Chloramine-T used for treating fish. The hatchery discharge during the treatment period averaged 5.53 MGD.

Disinfectant Use

Parasite-S and Formacide-B were used in 2013 to control bacterial biofilm and fungus on fish eggs. Parasite-S is Western Chemical's and Formacide-B is B.L. Mitchell's trade name for formalin that consists of 37% formaldehyde by weight in water and is FDA approved for use in aquaculture. The standard treatment used is a 15-minute flow-through with formalin at a concentration of 1,667 ppm. Formalin was used from January 1, 2013 through January 23, 2013 and again from October 8, 2013 through December 26, 2013 to treat fungus on salmon eggs. There was a total of 387.1 gallons of formalin used. The maximum treatment was 6.75 gallons

per day, during a 30 minute period. Hatchery flows averaged 5.51 MGD during the 2013 salmon incubation season.

Weir Operations

The Consent Agreement with the Platte Lake Improvement Association (PLIA) allows 20,000 adult coho salmon to be passed upstream of the Lower Platte River Weir during the fall salmon run. This number ensures that sufficient eggs and milt can be obtained in order to maintain the coho salmon production program. The Consent Agreement also allows for passage of up to 1,000 adult Chinook salmon to maintain the feral run in this stream and to provide sportfishing opportunities.

The Lower Weir grates were installed on August 15, 2013 and removed for the season on November 12, 2013, after consultation with the Consent Agreement parties. As fish collected below the weir in sufficient numbers, coho salmon were passed upstream for egg take purposes, and surplus Chinook and coho salmon were harvested and removed from the watershed by the American-Canadian Fisheries Inc. of Traverse City, Michigan under contract to the DNR. Fish were passed upstream of the weir by raising the boat gate slightly and manually counting the number of fish by species that swam upstream under the gate. For harvest operations, the pumps were turned on and fish were allowed into the holding pond, where they were later removed. Members of the PLIA were contacted prior to passing fish upstream and were invited to observe the passage and harvest operation.

In 2013, a total of 158 adult and 24 jack Chinook salmon, and 17,859 adult and 1,544 jack coho salmon, 116 steelhead trout, and one brown trout were passed upstream of the Lower Weir during the period from August 15 to November 12, 2013. A total of 809 adult and 93 jack Chinook salmon, and 13,558 adult and 952 jack coho salmon were harvested at the Lower Weir and removed from the watershed by American-Canadian Fisheries Inc. Biological sampling of the spawning fish was conducted at the Traverse City processing plant by DNR Fisheries Division staff.

All of the dam boards for the Upper Weir were installed by August 27, 2013, after consultation with the Consent Agreement parties. Any migrating salmon were directed to the maturation ponds after this time. Coho salmon egg take occurred between October 15 and October 22, 2013. After eggs and milt were collected, all fish were harvested and shipped to the American-Canadian Fisheries Inc. processing plant in Traverse City. In 2013, a total of 13 adult and three jack Chinook salmon, and 13,558 adult and 952 jack coho salmon were harvested from the Upper

Weir and shipped to the same processing plant. On October 24, 2013, the ponds were harvested for the final time, and Upper Weir operation was suspended for the season.

The total number of fish that were unaccounted for between the Lower and Upper Platte River Weirs included 145 adult and 21 jack Chinook salmon, and 5,629 adult and (21) jack coho salmon. This year class was slightly below the state average size. Therefore, adults may have been counted as jacks or vice versa while passing at the Lower Weir. It is assumed that these fish were either caught by anglers, or spawned and died in the river prior to reaching the Upper Weir. Normally, approximately 75% of the adult coho passed above the Lower Weir are harvested at the Upper weir. In 2013, 71% of the salmon passed at the Lower Weir were harvested at the Upper Weir.

Egg Take and Egg Incubation

The coho salmon egg take operation occurred at the Hatchery between October 15 and October 22, 2013. A total of 4,860,038 coho salmon eggs were collected and fertilized. This included 2,859,077 green eggs for the Hatchery, 1,927,341 green eggs for other state fisheries agencies or research studies (Bodine State Fish Hatchery in Indiana and Jake Wolf State Hatchery in Illinois, and 73,620 for the continuing Thiamine Deficiency Study at Wolf Lake State Fish Hatchery). The number of green eggs taken for the Hatchery was similar to the number taken in the fall of 2012 because the rearing assignment for coho salmon was scheduled to remain at full production of approximately 1.57 million yearlings for the spring of 2015.

Chinook salmon eggs were taken at the Little Manistee River Weir and transferred as green eggs to the Hatchery in October 2013. A total of 1,766,536 eggs were incubated at the Hatchery, a number decreased slightly from 2012 due to reduced stocking requirements for Lake Michigan. Incubation took place during the months of October, November and December, and the earliest hatching Chinook salmon were put in tanks at the beginning of January 2014.

Fish Production

There were 3,104,183 (1,027.6 kg) Chinook and coho salmon fry put down in to rearing units at the end of December 2013 and the beginning of January for the 2014 production cycle.

The Chinook and coho salmon were reared for production purposes, and during calendar year 2013, the Hatchery raised and stocked 788,541 (27,413.79 kg) spring yearling coho salmon in the Platte River below the Upper Weir. In addition, 2,243,131 (33,255.83 kg) fish were raised and

shipped to other locations outside the Platte River watershed. This includes 1,340,561 (7052.22 kg) spring fingerling Chinook salmon, 579,897 (19,584.41 kg) spring yearling coho salmon, 221,808 (3967.82 kg) fall fingerling coho salmon, 100,865 (2,651.38 kg) spring yearling Atlantic salmon and 36,453 (318.00 kg) fall fingerling Atlantic salmon. The Atlantic salmon are part of the continuing experimental rearing program at the Hatchery.

During the course of the year a total of 59,027 kg of feed was fed to the production lots of coho and Chinook salmon and the experimental lot of Atlantic salmon. This feed was predominantly BioOregon BioDry 1000 LP diet (96.9% of the annual food fed) and has phosphorus percentages below 0.9%. A small amount of BioOregon BioVita Starter (3.1% of the annual food fed) was fed to fry. This starter diet contained approximately 1.4% phosphorous.

At the end of the calendar year there were 1,729,052 (46,230.12 kg) yearling coho and Atlantic salmon on hand. There were also 2,503,462 (842.84 kg) coho and Chinook salmon fry that had just been put down in to the hatchery building rearing and starting tanks. Please note that the Chinook salmon fry were put down on January 2, 2014 and are included in these numbers.

Waste Handling

Throughout the production cycle, all egg and fish mortalities were removed from the incubators and rearing units on a daily basis. Mortalities were weighed or counted and disposed of at a certified landfill, or in the case of egg mortalities, to the salmon harvest contractor.

Fish waste was removed daily from the rearing units either by manual cleaning or automatic filtering of the wastewater by the disk filters. The filters were hot water (steam) power washed quarterly, while remaining in place during the year. Any filters (1) that received damage during the quarterly cleanings were replaced immediately. There were approximately 11 occasions where broken filters were discovered during daily preventative maintenance walk a rounds, these filters were replaced the same day.

Filtered waste was first treated with ferric chloride at the clarifier for phosphorus precipitation. This material was then stored in a sludge tank until disposal. The top six feet of sludge tank (ten feet total depth) was decanted and directed back to the clarifier, after consultation with all Consent Agreement parties. This process (decanting the top water) was achieved by slowly lowering the stand pipe during the week prior to emptying. The sludge tank was pumped out by BioTech Agronomics, Inc. on October 3 and 4, 2013 and a total of 112,000 gallons of sludge was removed. All sludge was land applied per the Michigan Department of Environmental Quality's

(DEQ) Manure, Paunch and Pen Waste Exemption guidelines at a site (N 44 39'47" W 86 05'34") outside of the Platte River watershed.

Ferric Chloride

A full scale ferric chloride injection system is located at the sludge tank and clarifier pump building. The system injects 37% ferric chloride solution into the center of the clarifier to precipitate additional phosphorus. During 2013, the Hatchery injected 1,638 gallons of ferric chloride to the effluent management system and the monthly use of ferric chloride in the clarifier in 2013 is shown in Table 1.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gallons	160	136	151	133	111	63	150	143	159	157	126	149

Table 1. Monthly use of ferric chloride in clarifier for 2013.