National Park Service
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Natural Resource Program Center

Shallow Lake Limnology Monitoring Protocol

Central Alaska Network (CAKN) and Arctic Network (ARCN)
Version 2.0

Natural Resource Report NPS/AKRO/NRR—2011/347



ON THE COVER
Shallow Lakes in Denali National Park and Preserve
NPS Photograph

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Natural Resource Technical Report NPS/AKRO/NRR—2011/347

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Background and Objectives

Introduction

The Central Alaska Network (CAKN) and the Arctic Network (ARCN) are part of the National Park Service (NPS) Inventory and Monitoring (I&M) Program. CAKN is composed of three national park units: Wrangell-St. Elias National Park and Preserve, Denali National Park and Preserve, and Yukon-Charley Rivers National Preserve. ARCN is composed of Gates of the Arctic National Park and Preserve, Noatak National Preserve, Kobuk Valley National Park, Cape Krusenstern National Monument and Bering Land Bridge National Preserve.

The Inventory and Monitoring Program is the result of the National Parks Omnibus Management Act, which was passed by Congress in 1998. This Act directs the National Park Service to "establish baseline [resource] information and to provide information on the long-term trends in the condition of National Park System resources." To accomplish this formidable task, the NPS has grouped parks into 32 networks based upon ecological similarities. Four of these networks are in Alaska.

The lands encompassed by CAKN and ARCN are vast: the eight park units within these two networks contain over 16.5 million hectares (40.8 million acres) and span an area that is 1200 km from east to west and 1000 km from north to south. Based on area, the two networks represent 50% of all the land in the National Park Service system. Yet despite this immense coverage, these eight park units contain natural resources — both physical and biological — that are similar in many respects. Perhaps the most significant shared feature is the integrity of their ecological systems. These Parks and Preserves provide the space and the time to see and understand natural processes that are occurring at great spatial and temporal scales.

The primary goal of the I&M program is to build a holistic database that will allow detection of change across the ecosystems of the networks — specifically, to detect change in the ecological components of the Network parks, and in the relationships among those components. The Networks have developed and prioritized a suite of "vital signs" for long-term monitoring. Park vital signs are selected physical, chemical, and biological elements and processes of park ecosystems that represent the overall health or condition of the park.

Rationale for Monitoring Shallow Lakes

When people think of Alaskan Parks they visualize spectacular mountain ranges and massive glaciers, big clear lakes and large glacial rivers, pristine wilderness where vast ecosystems remain intact and unmodified by human hands. Rarely do they think of the large flat expanses of land that predominate in much of the state. But it is here in the flat lands where large wetland systems perform critical ecological functions that support large populations of mammals, waterfowl and furbearers, upon which area residents still rely for survival. Yet it is in these

seemingly pristine systems where scientists are seeing the first signs of climate change that appear to be related to global warming, and where they predict the greatest changes might occur.

In acknowledgement of the importance of wetland ecosystems, the Central Alaska and Arctic Networks have chosen to monitor the physical, chemical and biological properties of standing water. Shallow lakes and ponds (lakes <5 m deep) were selected as the platform for monitoring standing water for three primary reasons: 1) they are abundant, 2) they provide diverse ecological functions, and 3) they are sensitive to climate warming.

Abundance

Nearly 47% of the state of Alaska is classified as wetland (Hall, Grayer, & Wilen, 1994) and shallow ponds and lakes are a major wetland feature. Geospatial analysis shows that the two networks combined contain well over 50,000 shallow lakes and ponds. Lake density ranges greatly across the two networks from low density areas in the mountains of Wrangell-St. Elias National Park and Preserve to high densities in Bering Land Bridge National Preserve. This wide distribution across a variety of landscapes allows ample opportunity to access and sample lakes throughout the network parks, and provides an excellent platform for field experiments.

Ecological Diversity

Shallow lakes serve a diverse array of ecological functions. The interactions of physical, biological and chemical components of a shallow lake, such as soils, water, plants and animals, enable the ecosystem to perform vital services including water storage; storm protection and flood mitigation; shoreline stabilization and erosion control; groundwater recharge; groundwater discharge; water purification through retention of nutrients, sediments, and pollutants; and stabilization of local climate conditions, particularly rainfall and temperature (Mitsch & Gosselink, 2000).

Wetlands, of which shallow lakes are one type, are among the world's most productive environments and provide a wide variety of ecological benefits (Mitsch & Gosselink, 2000). They are cradles of biological diversity, providing the water and primary productivity upon which countless species of plants and animals depend for survival. Due to high nutrient concentrations they often support high rates of primary production by phytoplankton as well as littoral vegetation. Their shallow nature and high rates of primary production allow development of large beds of macrophytic vegetation that provide critical habitat to macroinvertebrates and rearing areas for waterfowl, shorebirds and fishes.

Because they are so productive and support diverse groups of plants and animals, shallow lakes are important to the people who hunt and trap within the boundaries of the Parks. These people rely on shallow lakes for harvesting subsistence resources such as moose, waterfowl, and furbearers. Because of their remoteness, modern protected status, and the resulting relative lack of human influence on them, the shallow lake ecosystems of the parks also have enormous value

as references of background conditions for monitoring efforts on other more developed lands in the region (MacCluskie & Oakley, 2003; L. Eldred, AK DEC, personal communication).

Very little is known about the physical, chemical or biologic structure of shallow lake ecosystems in CAKN and ARCN, despite their ecological importance. This lack of knowledge regarding these systems is somewhat surprising since they are critical to subsistence users in Alaska and because several lines of evidence suggest these systems are declining. As of 2004, 11 bird species that depend on boreal forest wetlands have been listed as species of concern by the North American Bird Conservation Initiative (NABCI) because their populations have been slowly declining. All of these bird species are found in wetlands throughout the CAKN (Table 1) and ARCN and the majority nest and rear their young here. Wetlands in the CAKN are part of the northwestern interior forest conservation unit (BCR4) outlined in the NABCI, which covers most of central Alaska and the Yukon Territory. This conservation effort is dedicated to promoting and advancing integrated bird conservation in North America. Ducks Unlimited has ranked BCR4 as number three of the 25 most important and threatened waterfowl habitats on the continent.

Table 1. Distribution of bird species of concern found in wetlands in CAKN parks

Bird Species	Denali National Park and Preserve	Wrangell-St. Elias National Park and Preserve	Yukon-Charley Rivers National Preserve
Greater Scaup	X	X	X
Lesser Scaup	X	X	X
White-winged Scoter	X	X	X
Black Scoter	X	X	
Surf Scoter	X	X	X
Short-eared Owl	X	X	X
Rusty Blackbird	X	X	X
Olive-sided Flycatcher	X	X	X
Blackpoll Warbler	X	X	X
Lincoln's Sparrow	X	X	X
Horned Grebe	X	X	X

Shallow lakes behave as microcosms, or small theatres where the ecological interactions of organisms and their environment can be more easily tracked. Because they have distinct boundaries, they are easier to sample than other wetland ecosystems. Working in an ecosystem where changes are relatively easy to track will enhance our ability to document trends and to provide early warnings of impending threats.

Climate Change Implications

It appears that not only are waterfowl populations declining, but shallow lake ecosystems appear to be disappearing as well. Over the past 20 years much concern has been expressed regarding the apparent decline in water level in shallow lake ecosystems in Alaska. Many

scientists, native elders and local people have noticed a drying trend in shallow lake ecosystems throughout the networks. Empirical evidence in Alaska corroborates this trend and shows a dramatic decrease in lake surface area, likely due in large part to global climate change (Yoshikowa & Hinzman, 2003; Riordan, Verbyla, & McGuire, 2006). In subarctic interior Alaska, increases in warmth and dryness from the 1970s to present have occurred with decreased tree growth (Lloyd & Fastie, 2002) and temperature-induced drought stress (Barber, Juday, & Finney, 2000). Reduction of surface water area has also occurred in some areas of both networks during this period (Figure 1 and Figure 2). Shallow lakes are particularly sensitive to global climate change because the hydrologic cycle here is closely tied to seasonal snow cover and permafrost, which interact with topography and geology to create and maintain vast wetlands characterized by the presence of shallow lake and pond systems.

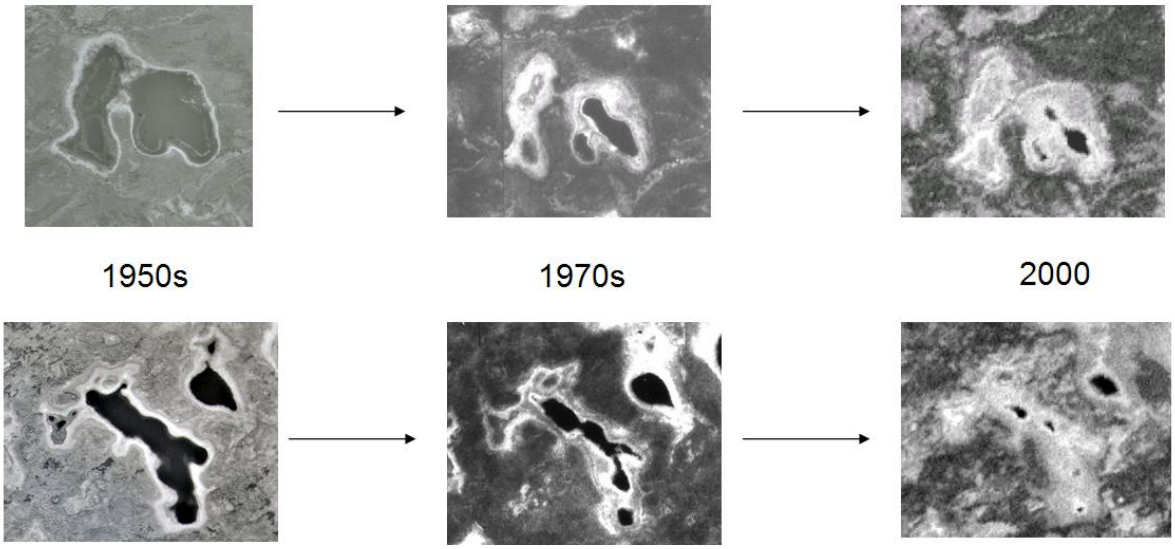


Figure 1. Examples of reduced lake surface water area in the Yukon Flats National Wildlife Refuge, an area approximately 50 km northwest of Yukon-Charley Rivers National Preserve

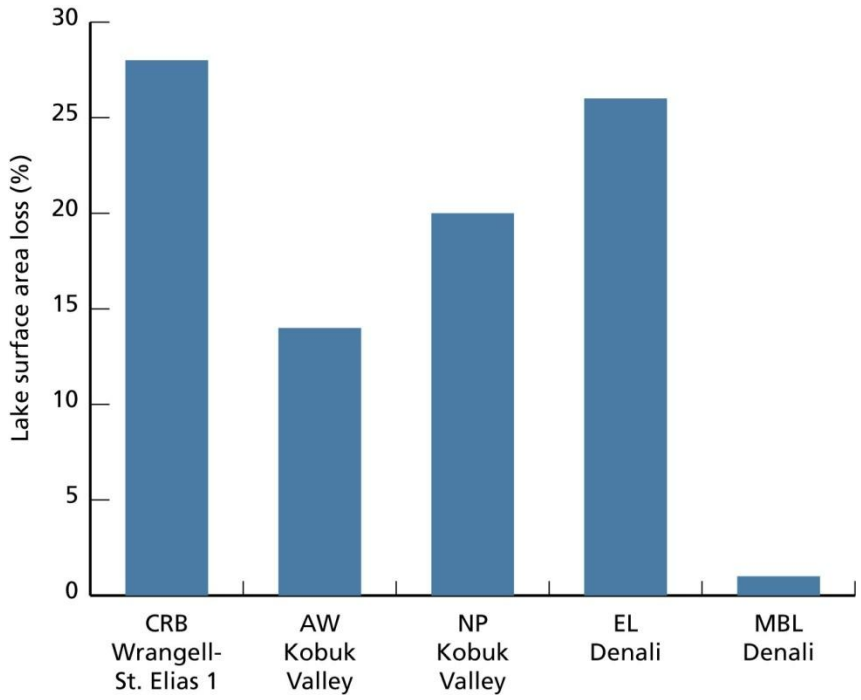


Figure 2. Change in lake surface area over the past 30–50 years in national parks located in the two networks. CRB = Copper River Basin, AW= Ahnewetut Wetlands, NP= Nigeruk Plain, EL= Eolian Lowlands, MBL= Minchumina Basin Lowlands. Sources: Necsoiu et al. 2009; Riordan et al. 2006; Larsen 2008.

Several studies in Alaska have linked lake drying with permafrost degradation (Yoshikowa & Hinzman, 2003; Jorgenson, et al., 2001). In subarctic Alaska, freshwater wetlands undergo seasonal inundation during spring snowmelt (Ford & Bedford, 1987). Ice-rich permafrost prevents percolation of surface water to groundwater and maintains these ponds despite relatively low rates of precipitation. Much of the Central Alaska Network lies within the zone of discontinuous permafrost and many areas within this zone have been dramatically affected by permafrost degradation related to global climate change. Extensive permafrost degradation has been documented in western Canada (Bielman, Vitt, & Halsey, 2001), Russia (Pavlov, 1994), China (Ding, 1998), Mongolia (Sharkhuu, 1998) and interior Alaska (Osterkamp, et al., 2000). The discontinuous permafrost zone is particularly susceptible to degradation because the ice is very near the melting temperature and so is easily thawed by slight increases in temperature (Luthin & Guymon, 1974).

When permafrost degrades, one of two things often happens. Where thawed ground sinks below water level, new wetlands are formed. In upland areas, however, drainage is often enhanced, converting wetlands to a drier ecosystem. Under either condition, permafrost degradation changes the hydrologic cycle. Hydrology is considered to be the single most important factor in the establishment and maintenance of shallow lake ecosystems (Mitsch &

Gosselink, 2000), and changes in climatic conditions that influence the availability of water in these systems will dramatically affect the structure and function of wetland communities, especially the plants and animals dependent upon them.

The objective of the vital signs monitoring program is characterizing and determining trends in the condition of park natural resources. Trend information is essential to assess the effectiveness of management and restoration activities, and to provide early warning of impending threats. Scientists are currently detecting and monitoring trends in climate data in Alaska.

A report from the Alaska Regional Assessment Group for the U.S. Global Change Research Program (1999) documents the climate of the past century and projections for the next. This research showed that Alaska has already experienced a series of dramatic changes in the past 60 years, and that interior Alaska has experienced the greatest change. Since the 1950s, it has warmed about 4 ºF on average annually, and 7 ºF in the interior in winter (Chapman & Walsh, 1993; Weller, et al., 1998), with much of this warming occurring in a sudden regime shift in about 1977 (Weller & Anderson, 1998). The majority of the state has also become wetter, with a 30% average increase in precipitation between 1968 and 1990 (Groisman & Easterling, 1994). The growing season in Alaska also has lengthened by 14 days (Keyser, et al., 2000). These climate changes have already been linked to changes on the landscape such as increased melting of glaciers, warming and thawing of permafrost, and retreat and thinning of sea ice (Lachenbruch & Marshall, 1986; Wadhams, 1990; Echelmeyer, et al., 1996; Osterkamp & Romanovsky, 1996; Cavalieri, et al., 1997; Sapiano, Harrison, & Echelmeyer, 1998; Krabill, et al., 1999; Dowdeswell, et al., 1997; Serreze, et al., 2000; Ostercamp, 1994).

Climate models presented by the Scenarios Network for Alaska Planning predict continued strong warming in Alaska, with increases reaching 1.5-5.0 ºF by 2030, and 5-18 ºF by 2100. Temperature increases are expected to be most pronounced in the interior and northern regions, and average winter temperatures are expected to have greater increases than the averages for the other seasons. Continued precipitation changes are also projected, with increases of 20-25% projected in the north and northwest, and decreases expected along the south coast of Alaska. These authors also suggest that increased evaporation from warming is projected to more than offset the increased precipitation, making soil drier in most of the state. Changes in temperature and precipitation will undoubtedly affect seasonal stream-flow and the ability of the environment to store and release water from snowpack, glaciers, and lakes. All of the above variables will be affected by a continuing trend towards a warmer climate, and this in turn will likely alter disturbance regimes; the most import being fire (Chapin, et al., 2003).

Anthropogenic global climate change and the subsequent effects on fire frequency and intensity as well as potential changes in the distribution of permafrost and hydrologic regime may lead to more rapid changes in the size, abundance or distribution of aquatic resources on the

landscape. For these reasons there is mounting concern regarding the stability of shallow lake ecosystems in the Central Alaska and Arctic Networks. It is with these concerns in mind that we propose to monitor shallow lakes and their associated vital signs. We expect the shallow lake monitoring program will provide the broad-based, scientific information necessary to help make sound management decisions and support research, education, and public awareness regarding the parks that is required of the Inventory and Monitoring program.

Rationale for Shallow Lakes Vital Signs

Vital signs to be monitored in shallow lake ecosystems include: 1) water quantity, 2) water chemistry, 3) structure and composition of littoral vegetation, and 4) macroinvertebrate communities. These vital signs were chosen because they represent important physical, chemical and biological elements of these poorly understood ecosystems and because they are essential to the maintenance of healthy wetland ecosystems.

One purpose of the vital signs monitoring program is to provide park managers across the country with information to help them better manage park ecosystems. These managers are confronted with complex and challenging issues that require a broad-based understanding of park resources as a basis for making decisions, working with other agencies, and communicating with the public to protect park natural systems and native species. Subsistence issues and global climate change are two of the most complex and difficult issues park managers in Alaska must deal with. It is the responsibility of park managers to know and understand what changes are occurring in their parks and it is the job of the monitoring program to provide information regarding trends in natural resources. We believe that the data obtained from monitoring these four vital signs will provide invaluable information for managers who are making these difficult decisions.

Water Quantity

A critical component to the mission of the inventory and monitoring program is having knowledge of the current condition of natural resources in each park. Knowing what natural resources occur in each park and understanding how and why they are changing is extremely important to this program. One of the measurable objectives of the shallow lake monitoring program is to track changes in water quantity on the landscape scale. The primary means by which we will track trends in water quantity is to monitor shallow lakes using remote sensing. Current and future conditions can be monitored using satellite imagery or aerial photography. Tracking long term trends in the number and surface area of shallow lakes will improve our understanding of the affects of a reduced water balance at the landscape level. By examining the trends inside and outside of wildfire burns, the impact of wildfire on aquatic systems can also be assessed at the landscape scale.

A variety of ancillary data will help us understand and track inter-annual variation in water quantity. The two primary data sets that will allow us to track this variability are annual estimates of total precipitation and water level. Concern regarding climate change prompted the networks to develop the climate vital sign. The networks have installed several weather stations throughout the parks. These weather stations will provide critical information regarding the hydrologic cycle including estimates of total precipitation and temperature. Snow monitoring efforts, which include measurements of snow depth along snow courses, snow markers and establishing at minimum one Nipher station to get high quality data regarding winter precipitation, are particularly important to shallow lake monitoring because these data provide critical information regarding the primary source of water recharge to these systems. The network is also developing a permafrost monitoring protocol that will help explain shallow lake dynamics related to permafrost change. Together these data will help explain why shallow lakes are changing.

Monitoring water level is an essential tool to help determine water quantity changes on the landscape scale. Shallow lake ecosystem dynamics are largely driven by changes in water level (Mitsch & Gosselink, 2000). As the water volume of lakes is reduced, the physical, biological and chemical characteristics of the system could change substantially. With reduced volume, shallow lakes may freeze to the bottom during cold winters, eliminating fish species. Other substantial changes may include length of the growing season, wind-induced mixing, gas transfer, underwater light availability, water chemistry, and zooplankton and phytoplankton dynamics (Vincent, Laurion, & Pienitz, 1998; Adrian, et al., 1999). Water level can also have profound effects on many wetland components including, decomposition and biogeochemical cycling, contaminant concentration and bioavailability, plant species composition and primary production, and the distribution and abundance of other organisms living within the wetland.

Water Chemistry

Chemical properties of water can be extremely informative. Many water quality characteristics are relatively uniform within an ecoregion and result from regional, watershed, geologic, basin and hydrologic characteristics. These measures can help us understand the types of water bodies found in our parks. Water quality variables such as alkalinity, conductivity, turbidity, color and dissolved organic carbon can tell us a great deal about the chemical signature of the water in a lake basin and can be useful as a monitoring tool to indicate changing conditions. Monitoring many of these chemical constituents is made easy and relatively cost effective because of the accurate multi-meter probes available today.

Factors such as light, water chemistry, oxygen (O_2) availability, temperature, and pH can control biotic communities. These factors can also indicate anthropogenic effects on the system. Variables selected for monitoring and the reasons for their selection are given in Table 2.

Table 2. Water quality parameters to be monitored

Water Quality Variable	Rationale for Sampling
Epilimnetic temperature*	Changes over time can indicate warming/climate change, reduction in size of hypolimnion
Dissolved oxygen (DO)*	Important for understanding biogeochemical cycling, lake productivity, and distribution of biota
pH*	Measure of hydrogen ion activity
Specific conductivity*	Proxy for productivity
Total nitrogen (TN)	Trophic state
Total nitrate (NO_3) plus nitrite (NO_2)	Trophic state
Ammonia	Trophic state
Total phosphorus	Trophic state
Orthophosphate	Measure of biologically available phosphorus
Chlorophyll-*a* / phaephyton	Measure of algal biomass – trophic state
Apparent color	Related to light availability – lake metabolism
Secchi depth	Measure of light availability – lake metabolism
Alkalinity	Buffering capacity of water – changes have been related to permafrost degradation
Hardness	Measure of calcium and magnesium
Base cations/anions	Measure of weathering rates and indication of retrogressive thaw slumps
Dissolved organic carbon (DOC)	Measure of carbon contributions to lake and indication of permafrost degradation

*represent core water quality parameters required of Water Resources Division (WRD)

Structure and Composition of Littoral Vegetation

Perhaps the most conspicuous feature of a lake margin wetland is the distinct pattern of aquatic vegetation that rings the open water zone in response to seasonal patterns of immersion and emersion. Because wetland plants are so sensitive to slight changes in immersion time and soil moisture, or more explicitly oxygen conditions, they have been extensively used to identify and classify wetland ecosystems (Cowardin, et al., 1979). Not only are aquatic plants useful for classifying wetlands but they are considered keystone species in the littoral zone where they determine the structure and function of the wetland ecosystem and form the basis of the food chain (Mitsch & Gosselink, 2000). Structurally, wetland vegetation provides critical habitat to epiphytic bacteria, and some species of algae, periphyton, macroinvertebrates, amphibians, and fish. Aquatic macrophytes have repeatedly been shown to support higher invertebrate diversity and abundance when compared to adjacent non-vegetated zones (Dvorak & Best, 1982; Iversen, et al., 1985). In the littoral zone, vegetation not only provides a substrate and cover to organisms but is also the primary contributor to the detrital pathway by way of leaf litter inputs (Mitsch & Gosselink, 2000).

Aquatic plants also have profound impacts on the chemical signature of water in wetlands; they remove nutrients by uptake and accumulation, and they can act as a nutrient pump by moving compounds from the sediment and into the water column (Mitsch & Gosselink, 2000).

They frequently improve water quality by removing nutrients, metals and other contaminants from the water and sediment.

Plants are excellent indicators of wetland condition for many reasons, including their relatively high levels of species richness, rapid growth rates, and direct response to environmental gradients and change (U.S. EPA, 2002). Plants are found in all wetlands and sampling techniques are well developed for both emergent and to a lesser extent submergent species. Plants also respond to human-related alteration of the environment in such a way that the change in the plant community can easily be quantified. There is a high diversity of wetland plants, and each species has a different tolerance to human disturbance. The ecological tolerances are well known for many species. Aquatic plants are virtually all immobile so they are effective indicators of both acute and chronic stress occurring at a location. Finally plant taxonomy is well known and with adequate training most observers can accurately conduct field surveys.

Of particular importance to the networks is our ability to detect changes in plant species composition in relation to changes in hydrology. A great deal of research has been conducted on the relationship between hydrology and plant community dynamics. Wetland plants have been shown to respond to water depth (Spence, 1982; Grace & Wetzel, 1982; Grace & Wetzel, 1998), water chemistry (Ewel, 1984; Pip, 1984; Rey Benyas, et al., 1990; Rey Benyas & Schneider, 1993) and flow rates (Westlake, 1967; Lugo, Brown, & Brinson, 1988; Nilsson, 1987; Carr, Duthie, & Taylor, 1997). Aquatic plants are also known to respond to changes in nutrient regime (Pip, 1984; Kadlec & Bevis, 1990), light, sediment loading and turbidity (van der Valk, 1981; van der Valk, 1986; Sager, Whillans, & Fox, 1998; Wardrop & Brooks, 1998), toxic contaminants and metals, and salinity. Typically, macrophytes respond more slowly to environmental changes than do phytoplankton or zooplankton; as a result of the longer response time, plants are likely to be better integrators of overall environmental condition. For these reasons we believe monitoring vegetation will be an excellent means by which to track changing conditions in shallow lake ecosystems.

Macroinvertebrate Communities

Macroinvertebrates are the most frequently used group in bioassessments of aquatic ecosystems (Hawkes, 1979; Hellawell, 1986; Abel, 1989; Oswood, Miller, & Irons, 1991; Rosenberg & Resh, 1993; Karr, et al., 1986) because they have several advantages over other biota. Some of the most significant benefits of monitoring macroinvertebrates (Table 3) are that they are ubiquitous, they have relatively low mobility (Rosenberg & Resh, 1993) compared to organisms like fish and aquatic birds, and they are moderately long-lived. As a result they are continuously exposed to the habitat conditions of their local environment and can reflect cumulative impacts to an aquatic system over a relatively long period of time. They generally occur in sufficient variety and abundance that they are easy to collect. They are present year-round and are often abundant.

Table 3. Summary of the advantages for monitoring macroinvertebrate populations (Adapted from Oswood, et al., 2001)

Advantages of Macroinvertebrate Sampling
They are ubiquitous and generally have low mobility
They are the primary food resource for fish, black bear in spring, moose, and some aquatic birds
Assemblages are diverse, with organisms that have differential sensitivities
Sampling protocols are well developed, tested, and cost effective
A variety of assessment methods for data analysis can be employed
Specific responses have been established for many taxa
They are well-suited to experiment studies
They have close association with sediments which are repositories of nutrients and toxins

Many macroinvertebrate species respond in a predictable way to environmental changes. The biochemical and behavioral responses of these organisms have been studied and are well-documented at the individual, population and community levels (Johnson, Wiederholm, & Rosenberg, 1993), making invertebrates excellent indicators of habitat change or degradation. It is important to understand, however, that they do not respond to all types of impacts (Hawkes, 1979).

Macroinvertebrates are themselves important not only as a food resource but as major contributors to global biodiversity. Benthic invertebrates are in constant contact with lake sediments and can therefore reflect influences of pollutants or disturbance. Ecologically they provide a link in the food chain between primary producers (algae) or organic detritus, and fish or birds and are fundamental members of the detrital pathway. Because they are the primary food resource for most fish and some aquatic birds the diversity and abundance of macroinvertebrate populations is of direct management concern (Oswood, et al., 2001).

Macroinvertebrates can be found in most habitats of shallow lakes: the substrate (benthic invertebrates), the submerged vegetation, the water column, the water surface, and in vegetation growth at the waters edge. The littoral zone of lakes and ponds supports more diverse assemblage of macroinvertebrates than the sublittoral or profundal zones (Moore, 1981; Wiederholm, 1984). Thus, monitoring will be done in the littoral zone of each lake and will sample only macroinvertebrates (as opposed to small invertebrates). Monitoring this community is made easier because well-developed and standardized methods have been developed, although many of these methods are designed for use in lotic (flowing water), rather than lentic (still water) systems.

By inventorying the species and groups of invertebrates that inhabit shallow lakes, we can evaluate and monitor the ecological health and productivity of the system. Measures of macroinvertebrate population numbers or community composition, along with water chemistry and other monitoring parameters, can give detailed information on the health of the ecosystem being monitored. This information, collected over time, will be highly valuable in measuring

amount and rates of change within an ecosystem, whether due to natural or human influences. For these reasons we believe monitoring macroinvertebrate populations will provide us with valuable information regarding ecological changes taking place in shallow lake ecosystems. These data will be an effective tool for monitoring trends and detecting changing conditions.

Measurable Objectives

The Shallow Lake and Pond Limnology Monitoring Protocol has four objectives:

1. Detect decadal-scale trends in the area, distribution, and number of shallow lakes and ponds in Central Alaska and Arctic Network park units.

2. Detect decadal-scale trends in the water chemistry of shallow lakes and ponds in Central Alaska and Arctic Network park units.

3. Detect decadal-scale trends in the structure and composition of vegetation in shallow lakes and ponds in Central Alaska and Arctic Network park units.

4. Detect decadal-scale trends in macroinvertebrate taxa richness in shallow lakes and ponds in Central Alaska and Arctic Network park units

Sampling Design

Rationale for Sampling Design Selection

Many different sampling strategies have been employed to monitor lake ecosystems throughout the world. Most often, lake monitoring programs are geared toward understanding the dynamics of a specific lake, and typically these studies are designed to evaluate the effects of human perturbation. Monitored lakes are often selected because of their proximity and importance to humans. Many lakes throughout the United States are monitored in this way by state, regional and federal agencies. In Alaska, scientists have been monitoring Toolik Lake since 1975 and more than 200 publications and theses have been written on this lake. This intense level of research has contributed greatly to our understanding of deep lake dynamics in the Arctic, but these studies have a limited scope of inference to shallow lakes. Several studies have also been done on large lakes in the Matanuska and Susitna Borough in Alaska, generally with the purpose of identifying effects of specific human actions on particular portions of the lakes. There again, the methods used are of limited utility either on small shallow lakes or on a broad-scale program in remote areas.

The spatial extent over which lakes vary among years is poorly understood (Magnuson, Benson, & Kratz, 1990). Magnuson et al. (1990) showed that several variables including ice cover, water level, and water temperature are linked to climate change and that lakes within a limited geographic range experienced temporal synchronicity. However, our pilot research indicates a high degree of heterogeneity, even among lakes of close proximity. This is likely due to the complex pattern of permafrost, geologic and edaphic factors, and associated drainage patterns and flow regimes throughout the pilot region. To overcome these issues, we believe it is essential that our sampling strategy allows us to understand the variability among lake ecosystems within the networks. A limited number of monitoring programs have focused on comparing large numbers of lakes sampled over short periods of time to help understand ecosystem processes. The limitation of these studies is that they are snapshots of time and do not account for intra- or inter-annual variation within a given study area.

The objectives of this project require that our sampling design examine both the temporal and spatial aspects of lake dynamics. This has led to the selection of a sampling design that will allow for large numbers of lakes to be sampled across the landscape, but will also include a small number of lakes that will be sampled more intensively throughout the season of open water.

During the sampling season, a large number of lakes will be sampled in a given park unit (Objective 1). Most of these lakes will only be sampled for water chemistry (Objective 2), but 40-50% of the lakes will also undergo biological assessments for vegetation and/or macroinvertebrates (Objectives 3 and 4). This allows us to maximize the number of lakes

sampled across the landscape, while having a subset of lakes where a full suite of data has been collected.

In order to better understand diurnal and seasonal fluctuations in water quality, we will also deploy a small set of multi-variable probes to continuously monitor the four core water quality measures (temperature, dissolved oxygen, pH, and specific conductivity) throughout the open water season, as described in SOP 8: Continuous Lake Monitoring. These probes will be deployed in no more than three easily accessed lakes within each of the park units where monitoring will occur. These data will provide us with essential baseline information on fluctuations in water quality throughout the season. This will provide us with estimates of inter and intra-annual variation and allow us to make inferences to shallow lakes in the entire network. In addition, a small group of easily accessed lakes will be sampled repeatedly each season for water chemistry to determine the variation in nutrient concentrations throughout the growing season.

The sampling design described is consistent - to the degree feasible - with the limited information available on other lake water quality sampling and monitoring projects around Alaska. Most of the monitoring projects that have been conducted are on large lakes. The shallow depth and small size anticipated under this monitoring protocol require some modifications in, for instance, the sampling depth. Also, the extensive nature of this program and the remoteness of the sampling sites preclude the use of some of the more time and equipment-intensive procedures used in existing programs. Furthermore, we have designed the in-situ monitoring methods to balance ease of use with precision and the ability to detect change.

Methods that are simple and easy to use allow quicker data collection and the ability to sample more sites than methods that may be more precise, but effort-intensive. Ease of use is necessary in order to meet Objective 1, which requires collecting information on a large number of lakes over a broad area. Precision is necessary to detect and isolate ecological changes through time, but an optimization of precision and ease-of-use is necessary to detect temporal variation. Detection power that may be compromised by using less precise methods is often more than made up for in ecological system characterization by the increased sample sizes that are possible with faster, less expensive methods.

Lake Population to be Sampled

Physical, chemical and biological monitoring will be limited to a subset of shallow (<5m deep) lakes and ponds, which must be larger than 1 hectare and smaller than 50 hectares, within each park unit to be monitored. Monitoring objectives related to remote sensing will be limited to closed-basin water bodies with an area of less than 50 hectares. A water body of 1 hectare can be resolved on satellite imagery, and therefore we define that as the minimum size of our shallow lake population. The physical, chemical and biologic sampling will be limited to the open water

season and will include lakes or groups of lakes that are randomly selected from the sampling frame.

Lake Frame Construction

Remotely sensed imagery will be obtained for high density lake regions in both CAKN and ARCN. We will use freely available remote sensed imagery. We will locate and prepare any historical images of the lake regions to measure water quantity and track changes in the past. We will also work with park staff and cooperators to acquire imagery that can be used for measurements of water quantity. Data sources include the Alaska high altitude aerial photography, Landsat TM, Radarsat2, IKONOS, Quickbird and any images that might be suitable. Refer to SOP 2: Delineation of Study Region, SOP 3: Acquisition of Recent Imagery, and SOP 4: Image Rectification for detailed procedures regarding the acquisition and use of imagery for this project.

Prior to the first field season in each park, applicable remotely sensed images will be compiled into a complete coverage of all parks, and processed to identify individual water bodies, their sizes, and their location, as detailed in SOP 5: Delineation of Shallow Lakes. We hope to automate this process in the future. The lake population identified will be used to select lakes for sampling. Following identification of water bodies in the satellite imagery, primary investigators will identify all navigable waters in the list. Navigable waters will include rivers and streams navigable by motorized boats and rafts, as well as ponds and lakes that are large enough to permit float plane landings and take offs. Once the navigable waters are identified, all water bodies will be attributed by distance to nearest navigable body.

Lake Selection

The overall sample design for the pond and lake monitoring study will select an un-equal probability sample of ponds and lakes based on distance from navigable water. The probability of including a pond or lake in the overall sample will be inversely proportional to its distance from the nearest navigable water. This design was chosen because of the high costs of traveling to a particular water body on foot after arrival at the closest navigable water body. Because of the time and effort required to haul personnel and equipment into sample units by foot, overall expenses will be reduced if more lakes and ponds are sampled near navigable waters than farther away. Properly weighted estimates based on data from the un-equal probability sample will apply to all water bodies in the sample frame.

The un-equal probability sample will be drawn in a way that assures a high degree of spatial balance. Spatial balance means that sampled ponds and lakes will be spread out approximately uniformly throughout each park. Spatial balance will be achieved by drawing an un-equal probability general randomized tessellation stratified (GRTS) sample (Stevens & Olsen, 2004). GRTS samples assure spatial balance by recursively subdividing the parks, drawing the sample,

and then reversing the ordering. The final result is a list of ponds and lakes such that any contiguous set is evenly distributed, as described in SOP 7: Sampling Frame and Lake Selection.

Prior to selection of the GRTS scheme, principal investigators will select no more than three lakes in each park unit to be monitored for annual sampling. These lakes will be located close to easily navigable waters and will serve as index sites for the broader GRTS sample. These lakes will be placed in panel 1 of the pond and lake sampling study, and will not be available for selection in the GRTS sample.

Once the index sites are determined and the un-equal probability GRTS sample is drawn, the pond and lakes membership design will allocate units to panels in groups from the ordered GRTS sample. If n_2 units are required in the 3r^d panel, the first n_2 units in the ordered GRTS sample will be assigned to panel 3. If n_3 units are required in panel 4, units from the $(n_2 + 1)^{th}$ to the $(n_2 + n_3)^{th}$ in the ordered GRTS sample will be allocated to panel 3. If n_4 units are required in panel 4, units from the $(n_2 + n_3 + 1)^{th}$ to the $(n_2 + n_3 + n_4)^{th}$ will be allocated to panel 4, and so on. This membership design will assure a high degree of spatial balance in each panel.

The rotation design will require lakes in panel 1 to be sampled every year using continuous data recorders, those in panel 2 to be sampled 6 times annually, and those in panels 3-5, 6-8, and 9-11 to be sampled for 1 year and then not revisited for 2 years. Panel 1 will include ≤3 lakes in each park. Each lake will be monitored using continuous data recorders maintained annually. Panel 2 will consist of 3-10 lakes in each park that will be resampled 6 times each year. Panels 3-5 will consist of 100 lakes from 1 park within each network (100 in ARCN and 100 in CAKN each year), each sampled once. Panels 6-8 and 9-11 will be similar to panels 3-5, except a different group of 100 lakes/network would be selected. This would result in approximately 300 lakes being sampled within each park over each 9 year period, 100 lakes within each park every third year, resampled every 10 years.

Sample Location Selection

To facilitate the assessment of shallow lake condition, a permanent benchmark will be installed at each lake as a reference, as described in SOP 13: Establishing and Marking Benchmarks. Sampling transects and locations will be flexible through time as lake conditions change, but will use the benchmark as a reference point. This approach focuses sampling effort on an index area that extends from the deepest part of the lake to the reach of vegetation most typical of the shoreline of the lake in question.

Water samples will be collected from the deepest areas of each lake. Transects for bioassessments refer to the permanent benchmark, but may be in different locations from one sampling visit to the next.

Sampling Frequency and Replication

Water Quantity

Water quantity will be monitored for two consecutive years approximately five years apart. Any available remote sensed images will be acquired during those years and used to measure lake surface area for all lake regions being monitored, as described in SOP 6: Calculating Lake Area Change. Lake regions to be monitored include Denali National Park and Preserve, Yukon-Charley Rivers National Preserve, Wrangell-St. Elias National Park and Preserve, Bering Land Bridge National Preserve, Kobuk Valley National Park and Noatak National Preserve. Acquiring remote sensed images in back to back years will provide us with information regarding the inter-annual variation of water quantity.

Bathymetry measurements will be collected at each lake sampled from panels 3-11, which will provide on-site data for calculating lake volume. Lake level will be measured each time a lake is sampled where there is a permanent benchmark installed.

Water Chemistry

Field sampling frequency and replication depends on the sampling frame a pond or lake is assigned. Lakes in panel 1 will be sampled every year and be monitored continuously throughout the entire open water season for the four core parameters (temperature, dissolved oxygen, pH and specific conductivity). Lakes in panel 2 will be sampled 6 times throughout the open water season. Data collected from the sites in these two panels will be used to help understand inter and intra-annual variation in water quality.

Lakes in panels 3-11 will each be sampled once during the sampling season for the panel, and revisited every 10 years. The lakes in panels 3-11 will be sampled using the synoptic sampling techniques detailed in the methods section. The number of lakes sampled each year will be most dependent on the cost of sampling and the time constraints of the sampling season. We will attempt to sample 200 lakes per year initially and modify this number as pricing schedules change.

Structure and Composition of Littoral Vegetation

Vegetation assessments will be performed at 40-50% of the lakes in panels 3-11. The same lakes will have vegetation assessments performed through time, so that there are lake-specific time series. Vegetation assessments will be performed at the lakes in panels 1 and 2 every five years. Vegetation is assessed along three transects at each lake sampled; these transects are parallel to each other and perpendicular to the shoreline, with the first transect originating at the permanent benchmark and extending towards the deepest part of the lake.

Macroinvertebrate Communities

Macroinvertebrate sampling will be performed as time and resources allow. Ideally, samples would be collected on the same schedule as vegetation assessments, but current levels of funding and staffing do not allow for this vital sign to be monitored. Three samples are collected along a transect through the littoral vegetation zone at each lake where sampling occurs.

Field Methods

It is more relevant to the objectives of this monitoring program to have high power of detecting change in the system overall than the ability to detect change in any particular lake. Most lake monitoring programs are targeted toward monitoring of particular species invasion or some other specific issue. Moreover, they focus on a relatively small number of lakes. Under those circumstances, methods with high precision and low detection limits are important and feasible. However, the enormity of this lake monitoring project, combined with the general nature of the monitoring objectives, precludes the use of high-intensity methods that provide low detection limits. Therefore, methods were selected that allow fast, inexpensive sampling of a large number of lakes. We prioritize obtaining information on a large number of lakes at the expense of resolution and statistical power to detect small changes in any one lake. The increased sample size that can be obtained with lower-resolution methods is expected to result in higher power detection capabilities of system-wide changes.

Field Season Preparation, Field Schedule, and Equipment Setup

Prior to the field season, in April or May, all observers should review the entire protocol, including all of the SOPs. Special attention should be paid to SOP 1: Field Season Preparation, and SOP 9: Training Personnel. Calibrating all the equipment and reviewing the sampling procedures is critical to maintaining an accurate dataset so it is imperative that each observer successfully complete the training program. The training program will help reduce inter-observer errors to maintain data consistency.

All of the equipment and supplies listed in SOP 10: Field Trip Mobilization should be organized and made ready for the field season, and copies of the field data forms should be made on all-weather paper. To obtain as complete a data set as possible, it is essential that adequate field equipment and supplies are available for the duration of each field trip. Therefore, extra supplies of all consumables will be packed for each trip.

Before each field season, lakes should be selected, and the time, date and logistics for sampling should be arranged including all park compliance. Seven to eight lakes should be scheduled for sampling each field day depending upon their proximity to one another. The number of lakes that can be sampled in one day will be dependent on their proximity to access points (roads, landing lakes, rivers) and to one another. Weather and the potential transportation modes and availability are substantial limitations in these remote parks. Personnel workloads, weather and forest fires require a somewhat flexible schedule.

Field Trip Preparation (Mobilization)

Field trip mobilization procedures are given in SOP 10: Field Trip Mobilization. Field preparation entails assembling gear and making sure field gear is in good working order;

assembling sample supplies; creating sample labels; preparing sample materials; preparing field data forms; preparing data recorder for data entry; setting up database for upcoming data; preparing field transportation and camping support for field crews; and other tasks required for successful sampling trips. Lists of lakes to sample must be generated and a sampling plan must be established, along with contingency plans for poor weather or other confounding factors that arise.

Data/Sample Collection

Each night, the group will discuss the next day's plans and establish the route for visiting sampling lakes. Each field day, the procedures of SOP 11: Daily Field Startup, will be followed prior to sampling the first lake. The lake sampling crew then travels to the first lake for the day and follows the sequence of lakes established the night before.

Benchmarks

Upon arrival at the lake to be sampled, the crew will determine whether a sampling location has already been located for that lake. The sampling location for each lake will be identified during the initial survey (see SOP 13: Establishing and Marking Benchmarks). The location will be recorded using a GPS receiver (see SOP 12: Using the GPS) and the sampling location will generally be marked with a permanent reference benchmark. If the lake has already been sampled, the procedures detailed in SOP 14: Relocating Lake and Sampling Locations should be followed to locate the sampling site.

If no sampling location has been previously established, the procedures of SOP 13: Establishing and Marking Benchmarks will be followed. The benchmark will be installed in a location that is likely to remain undisturbed and that will be easy to find during subsequent visits (note that these visits may be several years apart, so the benchmarking method must be robust and findable). Bedrock or a very large rock is a substrate preferable to soil, due to its stability, and will be used if available. One person will canvas the lake using the inflatable boat and a hand-held fathometer to locate the deepest part. This information will then inform the placement of any bioassessment transects to be laid out (see SOP 18: Vegetation Sampling and SOP 19: Aquatic Invertebrate Field Sampling for details).

Photographs

Photographs should be taken to document the lake, following the procedures described in SOP 15: Documenting a Lake Using Digital Photography. The benchmark location is a good location to use for taking pictures, but additional photo points can be marked in the GPS to geotag specific photographs. It is helpful to have a compass bearing for the camera direction if a photograph is to be geotagged accurately. Photos should include the lake and its margin, but it is also desirable to include distant terrain features that will aid in replicating the photo during future visits.

Water Level

In this study, a tripod mounted survey level will be used to take readings from a survey rod to measure water elevation. This method is detailed in SOP 16: Water Level Determination, and requires two people. One person will use the one using the Abney level and taking notes, while the second person will be moving the survey rod and holding at the benchmark, the lake shore, and any needed turning points in between. The relative lake level is calculated by subtracting the survey rod reading on the benchmark (which should always be higher than the lake shore) from the survey rod reading at the water's edge.

Water Chemistry

Water chemistry sampling will occur as described in SOP 17: Water Chemistry Field Data, Bathymetry and Sample Collection. Samples should be collected from the deepest location(s) in the lake. The deepest location can be found in these shallow ponds by traversing the lake in a small boat and taking readings with an electronic depth-finder, or by probing depths with a survey rod or depth line. The location need not be extremely precise, but should be the last area to become exposed should the lake go dry. A GPS point should be taken at the sampling location. This location will not be the same from one sampling visit to the next, but should always be sampled in what is currently the deepest water in the lake.

Most shallow lakes will be bedded in fine sediments that are easily entrained in the water column. Once entrained, they can take a very long time to settle, greatly increasing the sampling time at each lake. In very small and shallow ponds, it may even be desirable for someone on shore to pull the water quality sampling person into position in order to avoid disturbing sediments by polling or paddling. (*For safety reasons, these ropes must NEVER be affixed to a person!*)

Samples will be collected from 0.5 m below the water surface. If the lake is less than one meter deep at the sampling location, the sample will be collected from mid-depth. In both cases, the total depth and the sampled depth (measured from the water surface) will be recorded.

The following variables will be sampled:

- **Conventional water quality parameters** (epilimnetic temperature, pH, specific conductance, and dissolved oxygen)
- **Water clarity** (Secchi depth)
- **Nutrients** (total Nitrogen, total Phosphorus nitrate, ammonia, orthophosphate)
- **Alkalinity** (HCO_3^- and acid neutralizing capacity)
- **Total hardness** (calculated)
- **Base Cations and Base Anions** (Na, Ca, Mg, K, Cl, SO_4)
- **Dissolved Organic Carbon**

- **Silica**
- **Chlorophyll-*a***

Additional samples may be collected for the USGS or other agencies, as time allows.

Vegetation

The protocol for sampling vegetation is detailed in SOP 18: Vegetation Sampling, and includes aerial reconnaissance, transects for species composition and frequency, and documentation of rare plant species.

While in the air or just after arriving at the lake, one of the crew members maps the distribution of open water, wetland vegetation and any important information such as areas of the lake in drawdown, and the location of open mudflats, thermokarst or any notable physical features. Mapping includes sketching areas of emergent vegetation onto a prepared map of each lake. Sketching should be quick and general. The object of this method is to detect large changes in vegetation patterns; it is not intended to have enough resolution to detect small changes. If aerial mapping is not possible, mapping may also be done by walking the perimeter of the lake, standing at a vantage point where the entire lake can be seen, or paddling the boat around the lake perimeter.

The vegetation transect survey begins at the benchmark and transects the littoral vegetation. Species composition and frequency are measured along a series of three transects located near the lake benchmark. Percent cover, frequency, and species composition are obtained from these samples. Any additional species that are observed but not collected in the samples will be added to the observed species list and – except in the case of rare plants – collected, as described in SOP 20: Preserving Vegetation Samples. Rare plants will be identified, noted, and their locations recorded using GPS.

Aquatic Macroinvertebrates

Lakes often show a progression or gradient of attached plant types from shore to deeper water which provides a diversity of habitats for macroinvertebrates. An idealized transect for both vegetation and macroinvertebrate sampling would show emergent macrophytes near shore, followed by floating macrophytes, followed in turn by submerged macrophytes. This entire near-shore area of plant life is termed the littoral zone. Transects will be set up perpendicular to the shoreline if possible, in order to sample the maximum amount of habitats in the littoral zone of each lake. In the case of narrow littoral zones, the macroinvertebrate sampling line will be turned obliquely to shore such that the entire width of the littoral zone is still sampled, but that samples will be evenly spaced across it, providing a consistent sampling scheme. Transect location and orientation will be detailed extensively with field notes and photographs.

SOP 19: Aquatic Invertebrate Field Sampling details the procedure for establishing a transect and collecting samples. Macroinvertebrates will be sampled from three locations along the transect. A standard D-net was specified for semi-quantitative sampling which allows comparison of data between sites, and at the same site over time. In order to do this however, sampling must be standardized and conducted in the same manner over time.

The D-net will be used to sweep from the water surface, down through the water column and any aquatic vegetation, to the substrate and back to the surface again. Samples will be rinsed into a collection tray, rinsed in a 500 μ sieve, and collected into sample bottles that will be adequately labeled. Detailed information will be collected for each sample regarding depth, distance from shore, dominant vegetation, and dominant habitat on the field data form. Data on adult insects observed during the sampling will also be recorded.

Decontamination

Before leaving the field site, ensure there are no contaminating pieces of vegetation on the boat, personnel, or any sampling equipment or aircraft. Humans are the most effective spreaders of vegetation and aquatic biota, due to our mobility. We must be especially conscientious about not spreading noxious and invasive, non-native species among lakes of the parks. Therefore, a decontamination procedure will be followed prior to moving from one lake to the next, and before returning to base camp.

Sample Processing

Some of the water samples require processing at the end of the field day. Refer to SOP 21: Processing of Water Chemistry Samples for detailed procedures regarding the proper methods for filtering, preserving, and storing water samples until they are shipped to the laboratory for analysis. Many of the samples need to be frozen or refrigerated, so arrangements should be made accordingly when field excursions are planned.

Vegetation samples should be pressed or dried as described in SOP 20: Preserving Vegetation Samples. Macroinvertebrate samples do not require any particular storage treatment, as long as the concentrations of ethanol in the sample bottles are adequate (see SOP 19: Aquatic Invertebrate Field Sampling), and the sample bottles are tightly capped.

Field Trip Demobilization

Upon returning from the field, the crew must complete the tasks outlined in SOP 22: Field Trip Demobilization. Successful completion of these procedures will ensure that equipment and materials are in order and ready for the next field excursion, samples are treated appropriately, and that all data is stored securely.

Laboratory Analysis

Water, chlorophyll, vegetation, and macroinvertebrate samples to be processed by labs are logged into the database, as described in SOP 17: Water Chemistry Field Data, Bathymetry and Sample Collection, SOP 18: Vegetation Sampling, and SOP 19: Aquatic Invertebrate Field Sampling. This allows for tracking of samples, creation of inventory lists, and a cross-check for QA/QC when lab results are received. Once data are received from laboratory sources, it is imported into the database following the procedures detailed in SOP 24: Data Management.

Water Chemistry

Water samples are submitted to a professional laboratory for chemical analysis. Ideally, the same laboratory would be used from year to year in order to minimize variability in data caused by different laboratory conditions or methods. Water samples are currently analyzed by CCAL (Cooperative Chemical Analytical Laboratory), and the methods used for these analyses are listed in Table 4. Chlorophyll is currently analyzed by the Kielland Lab of the Institute of Arctic Biology at the University of Alaska Fairbanks using EPA Method 445.0 Modified for Biotek Synergy HT plate reader.

Table 4. List of methods for chemical analysis of water samples

Water Quality Variable	Method
Alkalinity	APHA 2320 with modification (CCAL)
Ammonia	APHA 4500-nh3 G; EPA 350.1
Calcium	APHA 3111 with moficiations (CCAL)
DOC	APHA 5310 B
Chloride	APHA 4110; EPA 9056A
Specific conductivity	APHA 2510
Magnesium	APHA 3111 B
Nitrate	APHA 4500-NO3
pH	APHA 4500 H
Orthophosphate	APHA 4500-P E; EPA 365.2
Total phosphorus	APHA 4500-PB; APHA 4500-P E; EPA 365.2
Potassium	APHA 3111 B
Silica	APHA 4500-SiO2
Sodium	APHA 3111 B
Sulfate	APHA 4110 B

Vegetation

Plant species vouchers will be verified or determined by staff at the University of Alaska Fairbanks Herbarium.

Aquatic Macroinvertebrates

Macroinvertebrate samples will be submitted to a professional laboratory for taxonomic analysis. Samples are currently analyzed by ABR Inc. – Environmental Research & Services. Methods are described in SOP 23: Macroinvertebrate Processing and Identification. Samples from the field will be logged in and stored until they can be sorted and identified.

Method Compatibility

Methods used for other monitoring programs in the state of Alaska and nationally were sought and every attempt was made to use compatible methods. However, no monitoring program was identified that had the same subject, objectives, and scale as this one. However, a graduate research project in Yukon Flats national Wildlife Refuge conducted by Patricia Heglund in the mid 1980s guided the development of this work and the methods here are very similar to the methods she utilized. Since the development of this monitoring plan, the State of Alaska Department of Environmental Conservation has begun implementing the EPA lake monitoring program. Our sampling scheme is very similar and will likely provide comparative data.

Our Water Chemistry methods are similar to those used for studies from the Matanuska-Susitna Borough area by the State of Alaska Departments of Environmental Conservation and Fish and Game. We could not exactly replicate the methods used by the State, due to transportation constraints, the large number of lakes to monitor, the small size of lakes in the study, and the focus of the monitoring objectives, but the data should still be largely compatible with what was collected by those agencies. The methods adopted here are compatible with pilot study data collected to date by CAKN personnel.

No general broad scale vegetation monitoring projects were identified in Alaska with methods that were appropriate to the large number of remote lakes in this project, although similar methods were used for a study performed in interior Alaska by Heglund (1992). Most monitoring is oriented toward location and tracking of specific invasive species and incorporates underwater survey methods, which were deemed undesirable for this program. Selected methods were adapted from monitoring programs overseen by the Washington State Department of Ecology; the U.S. Geological Survey and Army Corps of Engineers monitoring of lakes in Wisconsin; the U.S. Environmental Protection Agency national monitoring recommendations; and the U.S. Forest Service PACFISH/INFISH program.

The aquatic macroinvertebrate methods selected are also used by the U.S. Fish and Wildlife Service in the state of Alaska and will therefore be compatible with the extensive data from that source.

The method compatibility of this project is also discussed in SOP 28: Quality Assurance and Quality Control, along with additional QA/QC issues. Most of the specific QA/QC protocols are addressed in individual SOPs, or are referenced throughout this narrative, as summarized in SOP 28.

Data Management

The project manager will be responsible for the safekeeping and organization of the data sheets and ensuring that data are entered into the database. Data management protocols are all detailed in SOP 24: Data Management.

Database Design

Most of the data associated with this project is housed in a single database. This database has a two-tier architecture, in which the application's presentation (forms, queries and reports) is in Microsoft Access, while the underlying data model and business logic is contained in a Microsoft SQL Server database. The Access file is commonly referred to as the "front end", while the SQL server database is commonly referred to as the "back end". The SQL Server is located at the Fairbanks Administrative Center office building, and the Access front-end is kept on the CAKN network drive:

J:\Monitoring\Water_Quality_Macroinvert\Database\ShallowLakes

The database keeps information about each lake sampled in the table tblPonds. This contains information about the lakes that doesn't generally change through time. The location, basic characteristics, and ecoregion designation of each lake is entered here, and generally does not need to be changed much over time. Standard data collected at each lake during a sampling visit is then recorded in the table tblEvents, which is related to tblPonds based on the Lake Name assigned to each entry in tblPonds. Each entry in tblEvents must have a Lake Name field entry that matches one of the Lake Names listed in tblPonds. The table tblEvents contains the observational data collected regarding the physical characteristics of the lake at the time of the visit, and allows for entry of comments about the current condition of the lake.

When data is entered into the database, the main entry form that is used is frmMain, which displays the fields from tblEvents. In addition, the form contains tabbed forms for entering specific data into separate tables. The tabs include forms for Water Samples, Invertebrates, Nested Frequency Plots, Vegetation Transects, Vegetation Mat Profiles, Water Profiles and Bathymetry. There is also a tab for entering data about loon sightings, which contributes to the data set of another I&M Vital Sign. When collecting a particular data type, one can navigate to the appropriate form.

All of the data entered into forms using the frmMain is automatically tagged with the same Lake Name and Sample Date as the data being entered into tblEvents. This results in all of the ancillary data collected at a given site on a given date being linked together through the table tblEvents. Any data entered into any one of the ancillary data tables must have a matching entry in tblEvents. The combination of Lake Name and Sample Date provides a simple and robust primary key, allowing any suite of variables to be linked together in a view or query.

Data Entry and Storage

While in the field, data will be entered using a variety of techniques:

1. Direct entry into the database using a Tablet PC
2. Assigning attributes to spatial locations using Trimble GPS units
3. Logging sample information using YSI MDS 650 field computers
4. Filling in paper data sheets (printed on all-weather paper)

At the end of each day, data will be backed up to a second source, as outlined in SOP 24: Data Management. All electronic data should be copied to a second source, such as a field laptop or thumb drive. Paper forms should be filed in a safe location. Data from field forms may also be entered into the database using the Tablet PC at the end of the field day, if time allows; these sheets should be clearly marked as having been entered into the database.

At the end of a field excursion, all data should be transferred to the CAKN network drive, and filed in the folder structure according to the conventions outlined in SOP 24: Data Management. Once data has been safely stored on the network drive, any duplicate copies on the field laptop or thumb drives should be deleted, in order to reduce potential for confusion about which file is the most recent. If time allows, data from datasheets may be entered into the database using the Tablet PC.

At the end of the season, the Data Manager for the project must ensure that all field data collected throughout the summer has been entered, checked, and imported into the database. All instances of the database on Tablet PC computers must be concatenated to the main database on the FAC SQL Server. These procedures are outlined in SOP 24: Data Management, and there is a Data Processing Checklist that should be used to track all the actions taken for all data. Because there are so many different instruments and tools used to collect data, often each requiring specific protocols for downloading, processing, and importing or archiving data, it is essential to keep track of all data processing and management steps as they are completed. A Data Processing Checklist should be completed for each park where data is collected in any given year.

Laboratory data received following sample analysis must be imported into the appropriate tables in the database. Protocols and sample scripts required for accomplishing this import are described in SOP 24: Data Management. The original documents containing the lab results should be filed in the appropriate folder in the Laboratory_data folder for this project.

The folder structure for this project is illustrated in Figure 3. A new folder should be added for each year in the Field_Data folder, the TrimbleData folder, and for each analysis group within the Laboratory_data folder. This folder structure is housed on the CAKN network drive:

J:\Monitoring\Water_Quality_Macroinvert

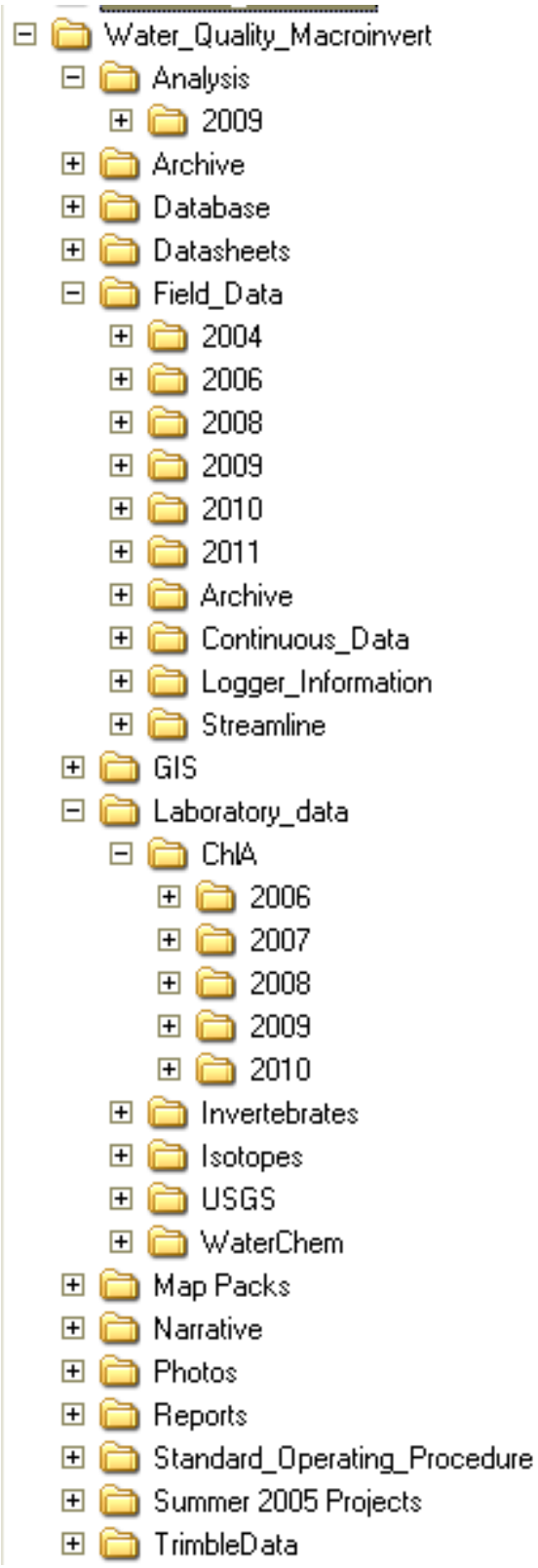


Figure 3. Folder structure for the Shallow Lakes project

Data Verification

Data verification is an essential part of data collection. It is critical that the data are carefully reviewed prior to leaving the lake. Once all data have been collected, the observer who has been recoding data asks a second observer to review the data sheets for completeness. It is this person's responsibility to inspect the data sheets and fill in any missing data. This is the most important point of data verification as it is the last opportunity to acquire any missing data. Data collection will be verified again at the end of the day after all data have been collected. After the data have been entered into the Access database by the data manager, the project manager should verify the data are accurately entered into the database by randomly comparing the data sheets to the database.

Archiving Data

Once the data have been cleaned and properly stored, a copy of the SQL Server database (including both the .mdf and .ldf files) should be archived on the CAKN network drive. This can be accomplished using the same SQL Back-Up Tool program used for creating field backups of the database on the Tablet PC. This is an additional security measure to the back-ups regularly performed on the SQL Server database by IT personnel at the FAC. These regular backups are invaluable, for if damage to the database should occur, IT personnel are able to retrieve a copy of the database from any given date.

When changes are made to the Access front-end for the database, the previous version of the front-end should be moved into a folder designated with the year within the Database folder. Only the current version of the front-end should be kept in the root Database folder.

When data is complete, it may be exported to STORET, an operational system maintained by the United States Environmental Protection Agency where many governmental agencies and private entities actively post water quality data. Data entered into STORET must be accompanied by information on where the sample was taken (latitude, longitude, state, county, Hydrologic Unit Code and a brief site identification), when the sample was gathered, the medium sampled (e.g., water, sediment, fish tissue), and the name of the organization that sponsored the monitoring. In addition, STORET contains information on why the data was gathered; sampling and analytical methods used; the laboratory used to analyze the samples; the quality control checks used when sampling and handling the samples; quality control methods during data analysis; and the personnel responsible for the data.

The National Park Service is developing a tool to allow extraction of water quality data from Access databases such as the Shallow Lakes database, so that the data may be easily uploaded into STORET. Specific procedures for accomplishing this are in development and will be incorporated into the Data Management Plan as they are available.

Metadata

Metadata describes the attributes of an information bearing object (IBO). IBOs for this project can be in many formats, including documents, data sets, databases, fields within databases, GIS files, images, and biological collections. It is essential to use metadata to accurately account for data, because it provides critical information regarding the format of data to people who are interested in interpreting the data. A metadata record for this project includes representations of the content, context, structure, quality, provenance, condition, and other characteristics of an IBO.

Metadata for this project comes in many different forms. It is embedded within the SQL Server database, where each table and each field have a description. Database forms in Access display field descriptions at the bottom of the page when a field is activated. Access queries or views are all tagged with a description of what the query accomplishes, whether it is integral to the functioning of the database, and when it can be deleted if it is a temporary view.

Another important venue for metadata is in GIS files. Many files may be produced during a GIS analysis process, some of which are more important than others. It is very easy to accumulate large numbers of similar files, and it becomes difficult to determine which files are most appropriate for use if metadata has not been included with the file. The National Park Service has a number of metadata templates available for use, and the NPS Editor tool for metadata is also an excellent resource for quickly assigning critical metadata to any files produced for this project. All GIS files should have, at minimum, a short description of the purpose, function, and provenance of the file. GIS files to be shared with the public or with other projects will require a more rigorous standard of metadata.

When creating documents for this project, it can be helpful to add metadata either directly in the document (adding a "Notes" worksheet in an Excel file, filling in the Document Properties fields in Word documents), or by including a separate "Read-Me" file in a folder with the associated documents.

Analysis and Reporting

Refer to SOP 25: Data Analysis and Reporting for detailed information on the analyses that will be performed with the data collected for this project, along with the reporting methods that will be used to present the data.

Routine Summaries

Summary statistics (mean, min, max, total, etc.) for annual water quantity and quality measures will provide basic information related to differences between sampling locations/parks. Dramatic shifts in these measures may indicate changes to the system and direct more formal analyses, but trends are unlikely to be detected at this stage. Graphical representations of summarized data may be useful for describing apparent differences between areas sampled, and species lists and counts by lake/park may also provide short-term trend information if changes are dramatic. These can be useful, but due to the complicated revisit schedule, apparent changes over the short-term should be interpreted with caution. Rotating panel designs require careful interpretation and analysis before sound conclusions can be made.

Trend Analysis

Water Quantity and Chemistry

Generalized linear mixed models will be used to estimate long-term trends in the quantity, quality, and distribution of water on the landscape within the Networks. These will be fit in a Bayesian framework which explicitly accounts for unbalanced sampling (e.g. different coverage extents in different years) and rotating panel designs. Individual lakes will be treated as sampling units and trends at the lake and park levels will be estimated. Spatially-explicit models will help to account for variation across the landscape and will help identify trends that may otherwise be obscured. Covariates such as ecoregion, subsection, lithology, soil-type, landscape position, and lake origin will also be included to help explain variation and reveal differences in trends among lakes. The Deviance Information Criterion (DIC) will be used to select among competing models. If possible, data from all parks will be included simultaneously to increase precision and help identify change at the Network level.

Vegetation/Macroinvertebrates

Hierarchical occupancy models (Royle & Dorazio, 2008) will be used to estimate changes in species richness and abundance through time. This approach will use detection histories and counts for individual species among replicate transects to estimate species richness and abundance at the lake level. Covariates thought to influence composition or abundance can also be included to help account for differences among lakes. DIC will be used to select the most parsimonious model. Analyses will include data from all parks when possible to increase the precision of estimates and enhance the ability to detect long-term trends.

Personnel Requirements and Training

Roles and Responsibilities

The project manager will be the lead ecologist for implementing the monitoring protocol, and will be supervised by the Program Coordinators for the Central Alaska and Arctic Networks. The project manager will typically be responsible for implementing the protocol and will work with contractors to insure the completion of all tasks in a timely manner. The project manager will also be responsible for training personnel implementing the protocol to collect high quality data that comply with all QA/QC procedures for data collection and management, as described in SOP 28: Quality Assurance and Quality Control. The project manager will ensure that all procedures outlined in SOP 26: After the Field Season are followed, and will be actively involved in the collection, entry, verification, validation, and summary of data, and together with the data manager will ensure the quality and security of the data.

Qualifications and Training

The single most critical component to maintaining a good monitoring program is having well-trained and competent personnel. There are very specific methods for collecting water samples and measuring the physical, chemical and biological attributes of aquatic ecosystems. It is essential that personnel be properly trained in calibrating and operating all measuring tools. It is also essential that at least one member of each crew is well-trained in identifying the common plant flora of Alaska wetland ecosystems.

Training will consist of office and laboratory training in procedures, equipment, supplies, sample tracking, sample handling, and data management. Once all crew members have been trained in the laboratory, training sessions will be conducted at nearby lakes to ensure that all personnel are comfortable with the procedures and that all equipment is working properly. Initial field visits should be to easily-accessible lakes to facilitate troubleshooting, repairs, and revision of methods (should such be necessary) prior to being dropped in remote locations with little recourse for correction. SOP 9: Training Personnel addresses training requirements in more detail for each monitoring element.

Crew Size and Composition

Each sampling crew requires two to three people, depending on which variables will be sampled and the form of transportation. When using 2-person aircraft for transportation, it can be very efficient if the pilot is willing and able to serve as a crew member. When sampling both vegetation and macroinvertebrates along with water quality, having a crew of three allows for more rapid completion of the sampling, but transportation can be cumbersome in remote areas and the additional time required for transport can quickly outweigh the benefit of having additional personnel.

Operational Requirements

Annual Workload and Field Schedule

Shallow lake monitoring will begin mid-June and extend through mid-August. This time period coincides with peak flowering for most vegetation. Sampling efforts will require a two- or three-person field crew. Field sampling trips will generally be scheduled to be 7-10 days long. This time frame allows adequate time for sampling a large number of lakes and provides ample time for logistical access, while staying within the allowable holding times for all water samples.

Facility Requirements

Shallow lake monitoring does not require any additional facilities beyond normal office and laboratory space and equipment storage. Chemicals for calibration and preservation must be stored in the appropriate storage containers and cabinets. All chemicals and samples will be accompanied by an accurate and updated MSDS sheet.

Startup Costs and Budget

Personnel expenses for field work are based on a crew of three people: an ecologist to conduct sampling, a trained hydrologic technician and 1-2 additional biotechs/pilot-biologists. Field costs will vary greatly from year to year depending on the accessibility of lakes, the method of access (motor boat, float plane or helicopter), and the number of lakes to be sampled. Estimated cost per network is $50,000 per year.

Protocol Revision and Archiving

One of the most important aspects of any long term monitoring program is documenting any changes that occur as the program develops and matures. Every monitoring program changes as technology advances and the program learns about the ecosystem. It is important to make adaptations to the program to insure that the data are of high quality, to justify continued spending, and to maximize our understanding of the ecosystem. To help track these changes we have developed a system to track revisions and archiving of methodologies. We have also included a review history that explains the revision history so that others may see the reviewers' comments on the program as it has developed.

Protocol Structure

The Shallow Lakes Protocol includes three layers of documents:

1. Protocol Narrative
2. Standard Operating Procedures
3. Instruction Sheets

The protocol was divided into these three layers in order to streamline the documents and to acknowledge the different degrees to which protocols will require revision. The Protocol Narrative is a general overview of the protocol, which gives the history and justification for doing the work and an overview of the sampling methods, but does not provide all of the methodological details. The Protocol Narrative will only be revised if major changes are made to the protocol.

The Standard Operating Procedures are detailed instructions for performing a given task. They are expected to be revised more frequently than the protocol narrative, as new methods or technologies emerge or equipment changes are required. Often these changes will not impact the content of the Protocol Narrative. Each SOP contains a Revision History Log, which should be filled out each time a SOP is revised to explain why the change was made, and to assign a new Version Number to the revised SOP. The previous version will be archived in accordance with SOP 27: Revising the Protocol.

Instruction Sheets are very detailed, step-by-step instructions for completing specific tasks required by the SOPs. This project makes use of many different technologies, electronics, and software, many of which require either extensive experience or detailed instructions for successful use. These tools tend to change quite frequently, as updates are released, or new and more appropriate tools become available. If all of the detailed instructions are included in the SOP documents, it makes them unwieldy to read, and also requires more frequent revisions of the SOP documents. In addition, many of the different SOPs refer to the same programs or procedures, and rather than listing them repeatedly within each SOP, they can all simply refer to

the appropriate Instruction Sheet. These Instruction Sheets are produced in a stand-alone format, which allows the instructions for a specific procedure to be printed out for easy reference in the field. Again, these documents will be archived as new versions are produced, and the most recent versions of the Instruction Sheets should be available as individual documents on the NPS Natural Resource Information Portal and/or the network website(s) for this project. The published protocol will not necessarily be updated for changes at the Instruction Sheet level, but the individual Instruction Sheet documents available for download should be kept up-to-date.

Revision Procedures

Over time, revisions to both the Protocol Narrative and to specific Standard Operating Procedures (SOPs) are to be expected. Careful documentation of changes to the protocol, and a library of previous protocol versions are essential for maintaining consistency in data collection, for appropriate treatment of the data during data summary and analysis, and for tracking important changes in detection and reporting limits for water quality monitoring. The STORET database for each monitoring component contains a field that identifies which version of the protocol was being used when the data were collected.

The steps for changing any portion of the protocol are outlined in SOP 27: Revising the Protocol. The Protocol should be produced using the templates for the NPS technical reporting series Natural Resource Report. All versions of the Protocol Narrative, the Standard Operating Procedures, and Instruction Sheets should be archived appropriately.

The Protocol in its entirety must be posted in the NPS Vital Signs and Protocol Database:
http://www1.nrintra.nps.gov/im/monitor/VitalSignsDB/

Protocols are available to the public at the CAKN and ARCN websites:
http://science.nature.nps.gov/im/units/cakn/
http://science.nature.nps.gov/im/units/arcn/

The protocol is also available from the Natural Resource Publications Management website:
http://www.nature.nps.gov/publications/nrpm/

It is imperative that only the current versions of each document are used in training field personnel and in conducting the subsequent monitoring. When changes are made, forward the new copy of the protocol to all individuals known to have a previous version.

Standard Operating Procedures

SOP 1: Field Season Preparation

SOP 2: Delineation of Study Region

SOP 3: Acquisition of Recent Imagery

SOP 4: Image Rectification

SOP 5: Delineation of Shallow Lakes

SOP 6: Calculating Lake Area Change

SOP 7: Sampling Frame and Lake Selection

SOP 8: Continuous Lake Monitoring

SOP 9: Training Field Personnel

SOP 10: Field Trip Mobilization

SOP 11: Daily Field Startup

SOP 12: Using the GPS

SOP 13: Establishing and Marking Benchmarks

SOP 14: Relocating Lake and Sampling Locations

SOP 15: Documenting a Lake Using Digital Photography

SOP 16: Water Level Determination

SOP 17: Water Chemistry Field Data, Bathymetry and Sample Collection

SOP 18: Vegetation Sampling

SOP 19: Aquatic Invertebrate Field Sampling

SOP 20: Preserving Vegetation Samples

SOP 21: Processing of Water Chemistry Samples

SOP 22: Field Trip Demobilization

SOP 23: Macroinvertebrate Processing and Identification

SOP 24: Data Management

SOP 25: Data Analysis and Reporting

SOP 26: After the Field Season

SOP 27: Revising the Protocol

SOP 28: Quality Assurance and Quality Control

Shallow Lake Limnology Monitoring Protocol
Guide to Standard Operating Procedures and Supplemental Materials
Before and After the Field Season
Remote Sensing
In Lake Sampling
Laboratory Analysis
Data Management, Analysis and Reporting
SOP#1 Field Season Preparation
SOP#2 Delineation of Study Region
SOP#11 Daily Field Startup
SOP#17 Water Chemistry Field Data and Sample Collection
SOP#23 Macroinvertebrate Processing and Identification
SOP#24 Data Management
SOP#7 Sampling Frame and Lake Selection
SOP#3 Image Acquisition
SOP#12 Using the Trimble GPS
SOP#18 Vegetation Sampling
SOP#25 Data Analysis and Reporting
SOP#8 Continuous Lake Monitoring
SOP#4 Image Rectification
SOP#13 Installing Benchmark, and Establishing Sampling Transect
SOP#19 Aquatic Invertebrate Field Sampling
SOP#27 Revising the Protocol
SOP#9 Training Personnel
SOP#5 Delineation of Shallow Lakes
SOP#14 Relocating Lake and Sampling Locations
SOP#20 Preserving Plant Samples
SOP#28 Quality Assurance and Quality Control
SOP#10 Field Trip Mobilization
SOP#6 Locating Lake Area Change
SOP#15 Photo-documentation
SOP#21 Field Processing of Water Samples
SOP#14 Relocating Lake and Sampling Locations
SOP#16 Water Level Determination
SOP#22 Field Trip Demobilization
After the Field Season

Instruction Sheets

Calibrating Sondes

Calibrating Turbidity Probes

Connecting SQL Server to Access Database

Continuous Monitoring File Storage

Creating and Updating PDF Protocols

Creating Map Packs

Data Import: Chlorophyll

Data Import: Trimble Files

Data Import: Water Chemistry

Data Import: YSI Files

Database Concatenation

Deploying HOBO Dataloggers

Deploying YSI Sondes

Downloading HOBO Dataloggers

Downloading Data from YSI MDS

Downloading YSI Sondes

Field Data Backups

Generating Invertebrate Lab Data Entry Database

Generating Sample Lists

GIS: Alaska Albers Map Projection

GIS: Converting Polygons to Points

GIS: Multiple-Ring Buffers

Imagery: Landsat ETM+

Imagery: USGS Datasets

Lake Inventory Access Designation

Lake Inventory Using NHD

Loading Database onto Field Computer

Manual Lake Delineation

Preparing Sondes for Longterm Storage

Trimble Data Collection

Trimble Data Dictionaries

Trimble Data Processing

Trimble Data Transfer

Trimble Navigation

Trimble Receiver Configuration

USGS Sample Collection

Using Extensis Portfolio

Using GPS-Photo Link

Using StreamlineENV

Using Trimble Planning

Additional Resources

Datasheets

- Continuous Monitoring Log Form
- Data Processing Checklist
- Pond Data Sheet
- Sketch Map
- Sonde Calibration
- Sonde Log
- Sonde Longterm Storage
- Sonde Notes
- Vegetation Transects

Reference Documents

- Database Diagram
- Database Model
- Hach Alkalinity Protocol (8203)
- Hach Filtration Protocol (8025)
- Pack List

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Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #01: Field Season Preparation

Version 2.0 13 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	03/16/2010	H. Kristenson	Added preparations and supplies	New devices are being used in the field.	1.1
1.1	10/13/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides step-by-step instructions for preparing for the field season. These exercises should be completed before each field season. The procedures outlined here are essential for successful implementation and program maintenance. Outlined in this SOP are training requirements, scheduling requirements, and logistical organization, as well as general organization and preparedness. Each observer needs to carefully review this entire protocol including all the related SOPs, data sheets, and the instructions for use of the YSI Sondes, digital titrator, TabletPC, and GPS.

I. General Preparation and Review

1. Each observer should meet with the project lead to discuss the general project implementation plan.
2. It is imperative that each observer carefully review all background information including the project narrative and all related SOPs and supplementary materials.
3. Take YSI Sondes out of winter storage, install the probes, and calibrate sensors. Run tests to determine if they are ready for the field season, or if they will require maintenance or repairs before being used.
4. Test all temperature and water level loggers to be deployed for the season.
5. Prepare the Tablet PC for field use. Ensure that the most recent Access front end and SQL backend have been loaded, and the connection between the two components is working properly. See SOP 24: Data Management for detailed instructions for this process.
6. Prepare the Trimble GPS for field use. Make sure any updates to the TerraSync software, Windows Mobile Operating System, and firmware have been properly applied. Ensure that the

current data dictionaries are loaded and functioning properly. Perform a field test where data is collected using each data dictionary to verify that the unit is functioning properly and that no changes need to be made to the data dictionaries. Load background files if desired.

II. Scheduling Field Work

Preparing to sample lakes in remote parts of Alaska requires a great deal of planning and preparation. Carefully planning and organizing field excursions can help expedite sampling, ensure the collection of high quality data, maintain the integrity of the long term data set, and minimize health and safety concerns for all involved.

1. Conduct shallow water monitoring between late June and mid August when wetland vegetation is flowering. This will facilitate plant species identification. Earlier sampling may be conducted if the weather and thaw conditions permit, on lakes that are not expected to have aquatic vegetation, such as glacial lakes.
2. Shallow lake monitoring will require a two to three person crew for approximately three 10-day sampling bouts. Sampling efforts will vary from year to year depending on which parks/preserves will be sampled that year, as access is highly variable from park to park. Depending upon accessibility, one to three lakes should be scheduled for completion each field day per 2-person crew.
3. Prior to starting fieldwork, lakes to be sampled should be determined by referencing SOP 7: Sampling Frame and Lake Selection. This SOP contains a detailed table showing what lakes are to be sampled each year. The lakes are organized by access. This information will be extremely important in developing the field sampling schedule.
4. Using the information obtained from SOP 7, outline a coarse schedule for sampling. This schedule should include the basic information regarding general locality, mode of access, dates for sampling, observers to be involved. This should be completed by late January.
5. Submit compliance documents including tentative schedule to appropriate park personnel by February 1.
6. Ensure field staff members have received all appropriate training in water quality analysis procedures and maintenance and calibration of equipment prior to beginning fieldwork (See SOP 9: Training Personnel).
7. Each member of the field team will be certified in counter-bear measures (according to federal agency standards).
8. Compile and review aerial photos and any additional information available for lakes to be sampled that season.
9. Create map packs to be used for navigation to lake sites. The map pack should include aerial photography or satellite imagery, as well as a topographic map of the area, with all sampling lakes included in the extent of the imagery/map clearly labeled. See Instruction Sheet "Creating Map Packs" for details.

10. Compile a list of coordinates for all of the sampling sites, and forward the information to pilots, Denali dispatch and support staff if necessary.
11. If returning to a previously sampled lake, observers should carefully review SOP 14: Relocating Lake and Sampling Locations, and complete all procedures. All field staff should read the most recent previous field notebooks and trip reports. Be sure to review all notebooks, database entries, photographs, and transect descriptions from previous surveys, if available, to identify any unique events that may have been encountered. These notes may suggest additional equipment or discuss unusual environmental issues that need to be considered before revisiting the site. These resources may provide observers with useful information regarding site logistics and other information that may influence the site revisit.
12. If this is the first site visit, observers should talk with park personnel who have visited the region to obtain pertinent logistic information regarding the area.
13. Enter waypoints (latitude and longitude, in the datum being used on the GPS) for each lake into the GPS unit to be used for navigation to the site (either an eTrex for walk-in locations, or the GPS unit in the aircraft being used for transportation to the site). This location data allows lakes to be easily located. For navigation to permanent monuments, monument locations should be loaded onto the Trimble for even more accurate navigation if the monument cannot be located with the Garmin GPS units. SOP 7: Sampling Frame and Lake Selection outlines the process for generating a list of all the localities for each lake and or cluster of lakes that will be sampled, the latitude and longitude of each lake, and the order in which lakes should be re-sampled.
14. When possible, enter waypoints for access points to lakes into the GPS unit to be used for navigation to the site. This is particularly important when sampling from rivers; good access locations should be recorded for future reference.

III. Logistics

1. Arrange primary means of transportation to the field well in advance of the field season (by March) to ensure adequate transportation is available.
2. Compile an equipment list (Table 1), and organize and prepare equipment for the field season several weeks before the season begins. This will allow ample opportunity for repairs to be made or any necessary equipment to be ordered.
3. Pack equipment and make necessary logistical arrangements.
4. Finalize schedule and confirm

IV. Organizing Supplies and Equipment

1. Compile an equipment list (Table 1), and organize and prepare equipment for the field season several weeks before the season begins. This will allow ample opportunity for repairs and ordering any necessary equipment.

2. Six weeks prior to the field season, order all chemical standards (Table 2) and required reagents from HACH and Cole-Parmer (Oakton solutions) so they are received for pre-season training and instrument calibration. To insure accurate collection of in-situ water chemistry it is essential that the multiprobe be calibrated no more than 4 weeks before the start of data collection as well as regularly throughout the season.

Table 1. Field equipment list for Shallow Lake Monitoring

Number Required (per crew)	Description
In-situ water sampling (SOP 17)	
1	Copy of SOP 17, USGS sample collection instructions
1	YSI Sonde with MDS650 - with case for transportation, solutions, standards, operating manual, extra membranes, o-rings and batteries
3 sets per lake	Water bottle kit from analytical laboratory for: total phosphorus, total nitrogen, orthophosphate, NO_3/NO_2, ammonia, Si, Na, K, Ca, Mg, sulfate, Cl, alkalinity, conductivity, pH and DOC (each kit includes one each of 125, 250 and 500 mL bottles)
1	Secchi disk and line
1	Alpacka raft with kayak paddles or float tube with fins, patch kit, and pump
1	Inflatable PFD with spare CO cartridge
2 L	Rubbing Alcohol
1 set per lake	USGS Sample bottle kit, syringes, needles, filters, stopcocks (supplied by laboratory) for collecting gases, 18O, DOC
12-15	1L amber polyethylene sample bottles
1	Speedtech SM-5 Depthmate Portable Sounder, extra 9V batteries
	Coolers and ice packs or dry ice
Water Chemistry Field Processing (SOP 21)	
1	Copy of SOP 21
	Forceps for handling filters
2 or more	Filter heads, 47 mm
2 or more	Hand-operated vacuum pumps with silicone tubing
2 or more	Erlenmeyer Filter Flasks, 1L
2 or more	Rubber stopper, No. 7, 1-hole
1 or more	Graduated cylinder, 1000 mL
	Thermometer
1-2 per sample	Filter discs, 47 mm, 0.45 µm glass fiber
1-2 per sample	47 mm membrane filters
1 roll	Aluminum foil
	Small zip-top plastic freezer bags
1	Hach digital titrator
1	Erlenmeyer Flask, 250 mL
1	Graduated polypropylene cylinder, 100 mL
1	Graduated polypropylene cylinder, 25 mL
	Titrator delivery tubes (spare) with 180° bend
Macroinvertebrate sampling (SOP 19)	
1	Copy of SOP 19
1	D-net with measuring tape attached to handle, for collecting sample

1	25 m transect tape
5 per lake	1 L bottles for storing samples
2 liters per lake	95% ethanol
As necessary	Whirlpaks for misc. samples
10 per lake	Macroinvertebrate sample labels printed on archival paper
2	Squirt bottle for rinsing d-net with lake water
2	Funnel for transferring sample to sample bottle
2	White sorting tray for holding samples
1	300 µm sieve for draining sample
2	500 mL squirt bottle for ethanol
3	Archival pens or pencils for filling in labels
3	Black sharpies for labeling outside of Nalgene bottles
1 roll	Clear tape for affixing external labels to Nalgene bottles
1 gallon per lake	Distilled or de-ionized water
Vegetation monitoring (SOP 18)	
1	Copy of SOP 18
1	Viericks' vegetation classification key
3	50 meter transect tape
1	Avalanche probe
12 per transect	Ziploc storage bags
4 per transect	Plastic garbage sacks
6 per transect	All-weather labeling forms
1 per lake	All-weather notebooks
1 per lake	Large-scale lake map +/or aerial photo for mapping vegetation
	Field key for wetland plant identification
	Plant identification reference books
	Plant press
	Herbarium paper
	Blotter paper
	Cardboard spacers
	Packets (envelopes) for bulky plant structures
Water level monitoring (SOP 16)	
1	Survey rod (metric)
1	Standard survey level
1	Tripod
Photo Documentation (SOP 15)	
1 per crew	Digital SLR camera (Canon EOS or similar) with case
1 per crew	Small digital waterproof camera with case
1 per camera	Spare memory card
1 per camera	Spare battery
1 per camera type	Data transfer cord
Establishing and Marking Benchmarks (SOP 13)	
1 per new lake	Engraved monument cap and fluted aluminum stake
1	Hard rubber mallet
General equipment	
1 per observer	Chest waders and wading boots
1 per observer	Personal floatation device (PFD) or flight Personal Protective Equipment (PPE) as necessary

1 per observer	Compass
1	Tablet PC, extra batteries, cables
1 set per site	Waterproof field forms, sketch maps
1 per crew	Clipboard
1	Trimble GPS unit, cradle, cords, external battery if necessary
1	eTrex GPS unit, extra batteries
12	Pencils
Multiple	Insect repellent and/or headnet and/or bug jacket
Multiple	Sunscreen
1	First aid kit. A larger kit may be assembled for field camp use, depending on the field base conditions.
1 per crew member + 1 spare	2-way radio for communicating with other crew members
1	Park radio/satellite phone for communicating with park headquarters
1	Paddling jackets
1/ per observer	Polarized sunglasses (for viewing into water)
boxes	all-weather field notebooks
Gallons	Distilled or de-ionized water

Table 2. Chemicals and Solutions required for Shallow Lake Monitoring

Description	Unit	Quantity	Catalog number	Company
Bromcresol Green-Methyl Red Powder Pillows	100/pkg.	1	943-99	HACH
Phenolphthalein Powder Pillows	100/pkg.	1	942-99	HACH
Sulfuric Acid Titration Cartridge 1.600N	each	3	14389-01	HACH
Sulfuric Acid Titration Cartridge 0.1600N	each	3	14388-01	HACH
Deionized water	L	15	Widely available	
pH 4 buffer, 500 mL	each	2	EW-00654-00	Oakton
pH 7 buffer, 500 mL	each	12	EW-00654-04	Oakton
ph 10 buffer, 500 mL	each	12	EW-00654-08	Oakton
Conductivity standard (1500uS), 500 mL	each	12	EW-00653-15	Oakton

V. References

Suggested reference manuals for monitoring Shallow Lake Ecosystems:

- APHA. 1998. *Standard Methods for the valuation of Water and Wastewater. 20th edition*. American Public Health Association. Washington, DC.
- Cody, W.J. 1996. *Flora of the Yukon Territory*. National Research Council Press, Ottawa. 643 p.
- Collet, D.M. 2004. *Willows of Interior Alaska*. USFWS Technical Report. 111 pages.
- HACH Company, 1980-1998. Digital Titrator Model 16900 operating manual.
- Hultén, E. 1968. *Flora of Alaska and Neighboring Territories: A Manual of the Vascular Plants*. Stanford Univ. Press. Stanford, CA. 1008 p.
- YSI Environmental Operations Manual: 6-series Environmental Monitoring Systems.
- Merritt, R.W. and K.W. Cummins. 1996. *An Introduction to the Aquatic Insects of North America 3rd Edition*. Kendall Hunt Publishing Company. 862 pages.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #02: Delineation of Study Region

Version 2.0 27 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/27/2010	H. Kristenson	Updated website references Document format change	Some of the websites referenced in this document have been changed. Producing a more streamlined reference document, which is more easily served to the public.	2.0

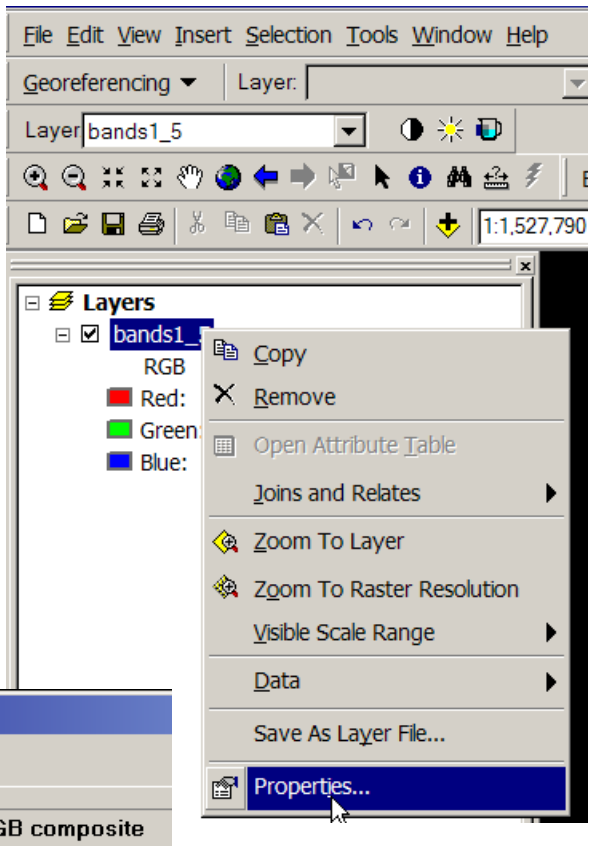
This Standard Operating Procedure explains the procedures used to delineate the study region using the most recent satellite imagery. Shallow lakes are typically not uniformly distributed across a park. For many parks in Alaska, shallow lakes occur below an elevation threshold, and may dominate on certain landscapes such as alluvial fans and floodplains. The delineation of a study area establishes a sampling universe or spatial extent from which shallow lakes will be selected for sampling (SOP 7: Sampling Frame and Lake Selection).

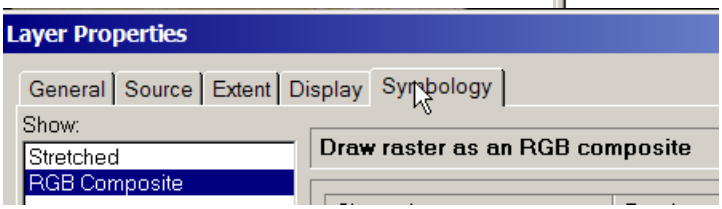
I. Procuring Imagery

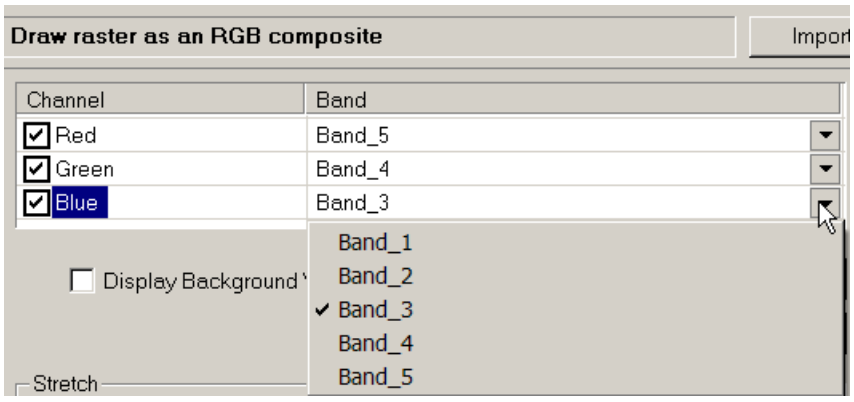
Appropriate satellite imagery should be procured, as described in SOP 3: Acquisition of Recent Imagery. Many different sources of satellite imagery are available today, and new sources frequently become available. Always make sure to check on the available sources, and determine which datasets are most appropriate for use. All imagery must be in the Alaska Albers map projection, using NAD 83 as the datum. If the imagery is not already in Alaska Albers, it must be projected properly. For more information on the Alaska Albers projection, and for detailed instructions on defining projections in ArcGIS, refer to Instruction Sheet "GIS: Alaska Albers Map Projection".

II. Searching for Regions with Shallow Lakes

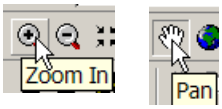
1. For imagery with RGB color bands, change the color display so that turbid water is bright blue in color and clear water is black.
    a. Right-click on the composite image theme
    b. Select Properties
    c. Click on the Symbology tab
    d. Change the band combination so that band 5 controls red, band 4 controls green, and band 3 controls blue
    e. Click the OK button







2. Use the Zoom In and Pan tools to zoom in and pan across the image searching for candidate areas that have a high density of shallow lakes. Turbid water will appear bright blue and non-turbid water will appear black on the displayed image (as Illustrated in Figure 1).



    a. Cloud shadows will also appear black on the image, but for each cloud shadow there will be an associated cloud.

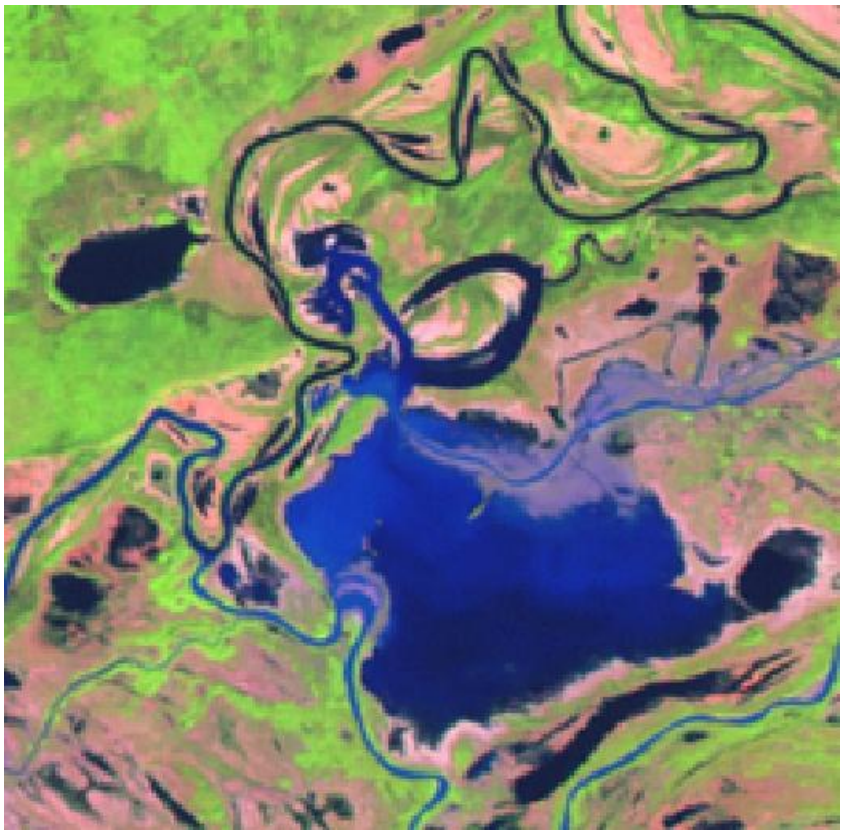
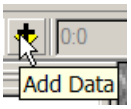
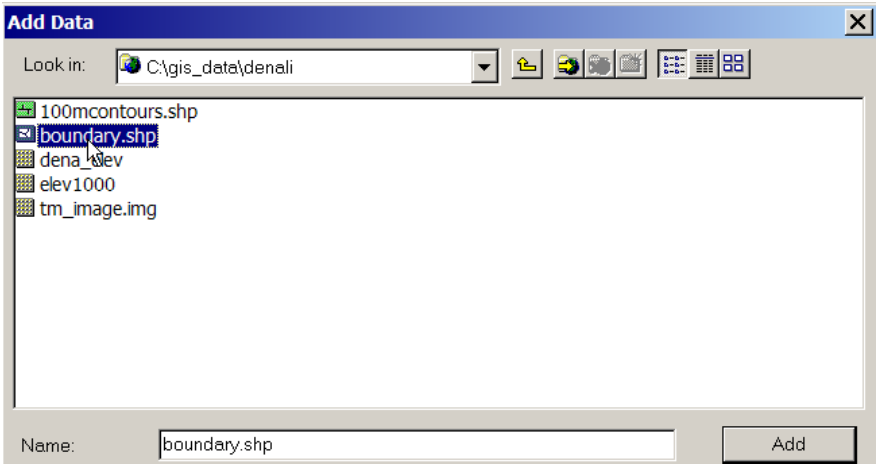


Figure 1. Example of imagery with colors enhanced for viewing of shallow lakes

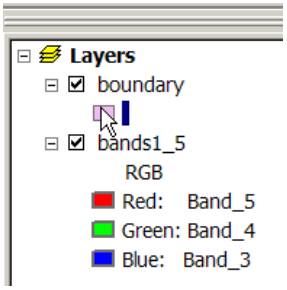
3. Use the *Add Data* button to add other GIS themes, such as park boundaries, in the Alaska Albers map projection

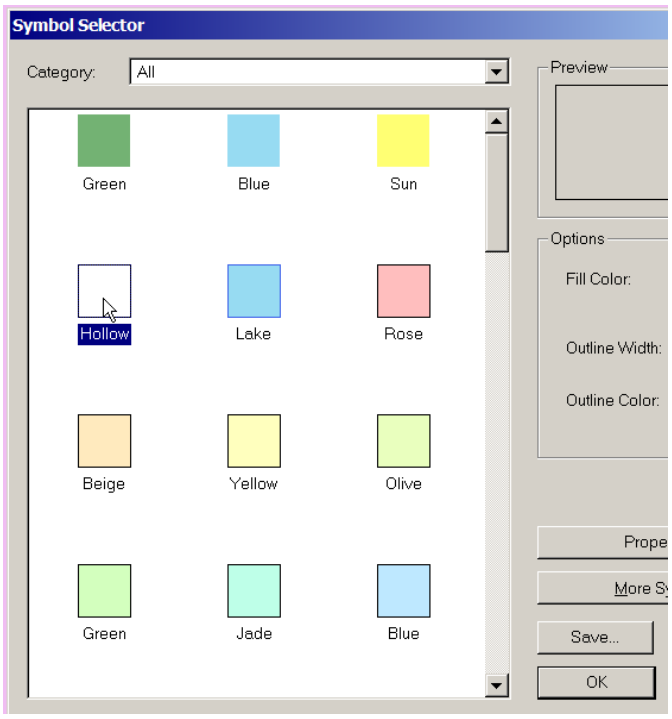




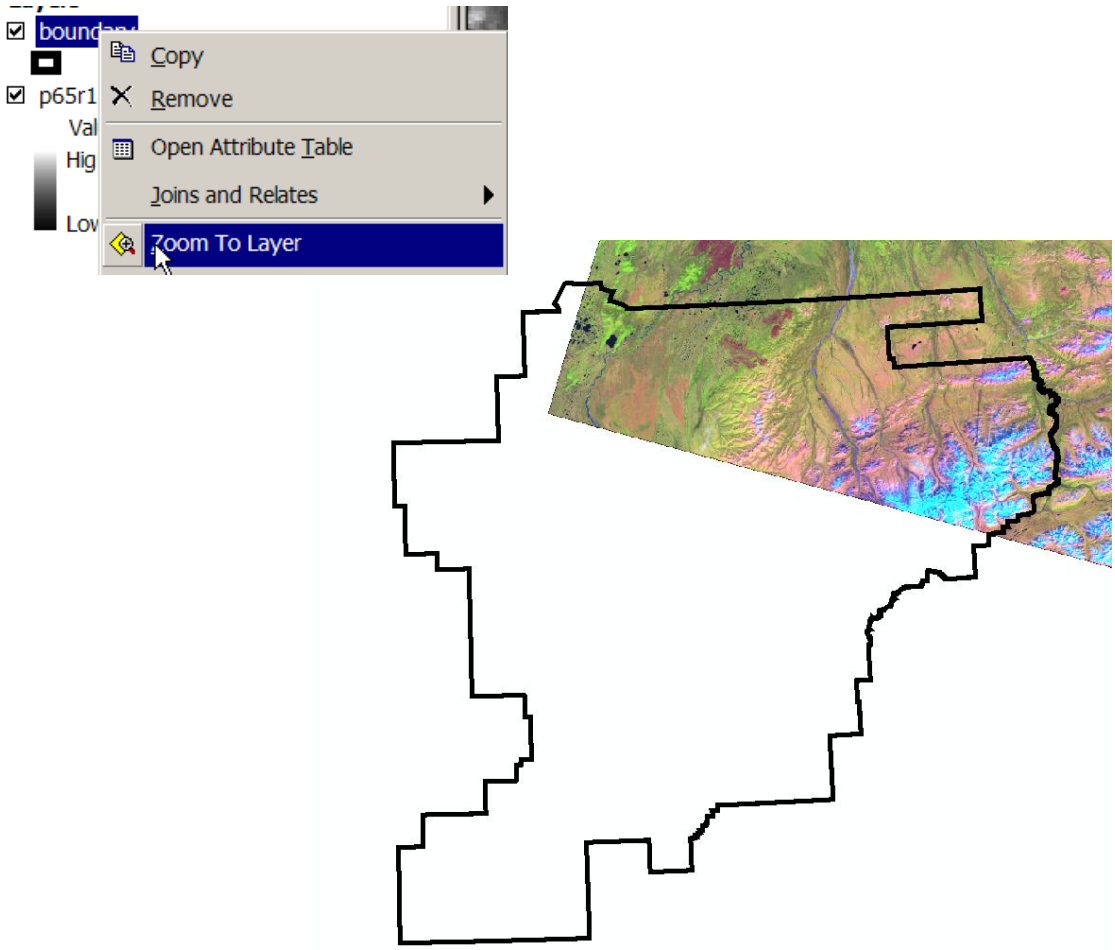
   a. Double-click on the polygon symbol of the park boundary to change it from a solid color to a hollow polygon

   b. Select the Hollow Symbol from the Symbol Selector window, then click the OK button





c. To see an entire theme, right-click on a layer, and select *Zoom To Layer*



III. Delineating Study Regions

Once the imagery has been examined, and regions including shallow lakes have been found, the study region(s) should be defined. Based on the lake distribution within each park unit, a polygon should be drawn in ArcGIS encompassing the area to be included in the study. In some park units, there may be multiple areas selected for the study; multi-part polygons may be used to indicate all of the regions to be included for that park unit. Polygon shapefiles should be retained for reference in the GIS Reference folder for each park unit (J:\Monitoring\Water_Quality_Macroinvert\GIS\PARK\Reference).

These polygons can be used as a reference to clip large state- or nation-wide GIS datasets, such as the National Hydrography Dataset (NHD), which are unwieldy to deal with in their entirety.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #03: Acquisition of Recent Imagery

Version 2.0 28 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/28/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This Standard Operating Procedure explains the procedures used for acquiring recent aerial photography and satellite imagery of a given study region. Shallow lakes can be dynamic, with some lakes draining and succeeding to terrestrial plant communities, while new lakes may be created as oxbows as river channels migrate. The periodic acquisition of recent imagery essentially sets the temporal frame of the sampling universe from which shallow lakes will be sampled.

I. Procuring Imagery

Imagery sources change frequently, as new technologies are developed and imagery is purchased by public agencies for distribution. When using satellite imagery for this project, check all available imagery and use the sources that are most compatible with the project at hand. Some common sources are:

- Base imagery included in the NPS Theme Manager program for Alaska (IKONOS, etc.)
- Imagery datasets from Alaska Mapped (Statewide Digital Mapping Initiative)
- Satellite imagery available for download from the U. S. Geological Survey (Landsat, etc.)
- Aerial photography

To access imagery from the NPS Alaska Regional Office, open the Theme Manager on any NPS computer with ArcGIS. Those without direct access to the NPS network drives can request imagery from the Alaska Regional Office GIS team. To access imagery datasets from Alaska Mapped, use their website (www.alaskamapped.org). Landsat imagery can be downloaded directly from the MRLC website (www.mrlc.gov), or from the USGS Earth Explorer website (edcsns17.cr.usgs.gov), which has numerous datasets available, including Landsat. Detailed instructions on downloading and using USGS imagery can be found in the Instruction Sheets "Imagery: Landsat ETM+" and "Imagery: USGS Datasets".

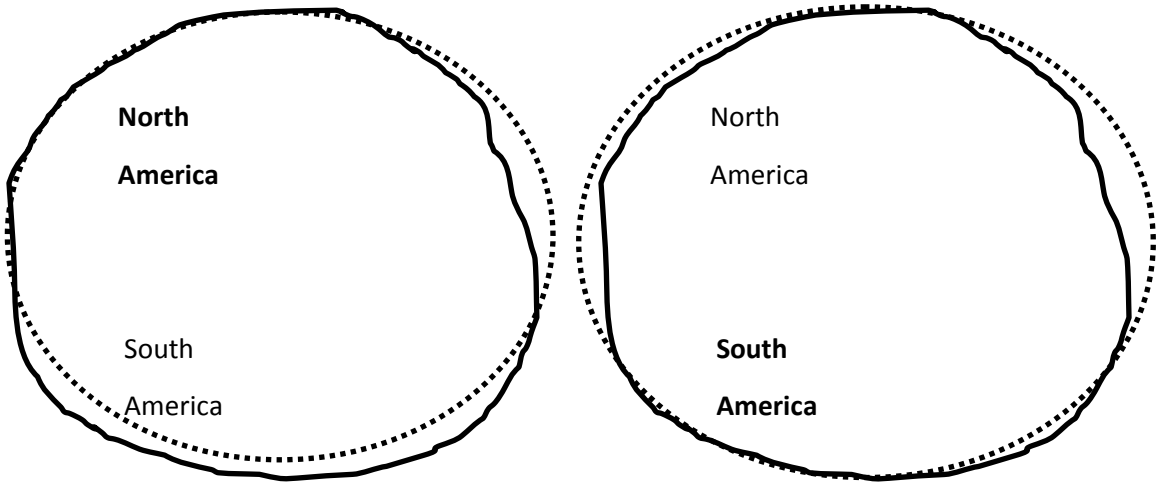
II. Spheroids, Datums and Projections

The National Park Service in Alaska uses the Alaska Albers Projection as the standard map projection and coordinate system for GIS themes in Alaska. The NAD83 datum should be used for all GIS data. Many different sources of satellite imagery are available today, but care must be taken to ensure that all imagery used is either already projected into Alaska Albers (NAD83), or is projected into Alaska Albers (NAD83) before use. Refer to the Instruction Sheet "GIS: Alaska Albers Map Projection" for details on defining projections in ArcGIS.

Spheroids

A spheroid is a three-dimensional shape that approximates the shape of the globe. There are many spheroids because the gravimetric surface of the earth (called the geoid) cannot be exactly matched in all locations on the planet by any one spheroid.

An exaggerated example is illustrated below. The solid line represents the exaggerated gravimetric surface of the earth. The dashed lines represent two spheroids that would be appropriate only for the regions for which they were developed (in bold print).



Datums

A datum is a system that provides a frame of reference for measuring locations on the surface of the earth. Using a specific spheroid, it defines the origin and orientation of latitude and longitude lines. For example, the North American Datum of 1927 (NAD27) uses the Clarke 1866 spheroid and defines the equator as the origin for latitude and the prime meridian as the origin for longitude. The North American Datum of 1983 (NAD83) uses the GRS1980 Spheroid and defines the equator and prime meridian as origins of latitude and longitude on this spheroid.

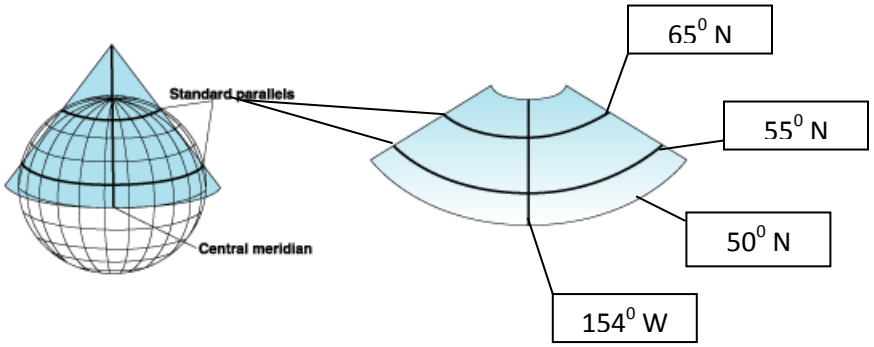
Because the two datums use different spheroids, the same longitude/latitude coordinates will represent different locations on the Earth's surface. For example, a control point near Wonder Lake in Denali National Park having the latitude of 63^0 30' 0" North and longitude of 150^0 30' 0" West based on

the NAD27 datum would have a latitude of 63^0 29’ 58” North and longitude of 150^0 30’ 8” West based on the NAD83 datum.

Alaska Albers Projection

A projected coordinate system is defined on a flat, two-dimensional surface. Unlike a longitude/latitude, a projected coordinate system has constant lengths, angles, and areas across the two dimensions. A projected coordinate system is always based on a geographic coordinate system that is based on a specific datum.

The Alaska Albers Projection is a conic projection.



The standard parallels are at latitudes of 55 and 65 degrees North. Map properties such as shape, direction, distance and area are minimally distorted in areas near the standard parallels. An X,Y coordinate system is applied to the Alaska Albers Projection with the origin at a central meridian of 154 degrees west longitude and a Y origin at 50 degrees north latitude. Therefore X values are positive east of 154 degrees west longitude, and negative west of 154 degrees west longitude. Y values are positive north of 50 degrees latitude. The units of the Alaska Albers X,Y coordinate system are meters. Typically the projection is used based on either the NAD27 or NAD83 datum.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #04: Image Rectification

Version 2.0 28 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/28/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This Standard Operating Procedure explains the procedures used for rectifying historic or future aerial photography, Landsat satellite imagery, and radar imagery to the Alaska Albers map projection. This SOP assumes a relatively flat landscape (typical of shallow lakes regions) because it uses a linear model of a flat plane for image rectification.

As an example, we will use the Minchumina Basin Study Region located in Denali National Park. In this example, ArcGIS9.0 is used to rectify a color infrared photograph (available for all National Parks in the Central Alaska Network) to a base image in the Alaska Albers map projection. These procedures will be used to compare water quantity and distribution in historic photos to modern day imagery as well as be used for future imagery analysis and comparison.

Aerial photographs, radar imagery, Landsat imagery, and other imagery sources are typically not in the same spatial coordinate system as the Park's GIS. After rectifying, an image is spatially aligned with other GIS layers in the Park's GIS, and reliable estimates of image metrics such as area, length, and directions are possible. A rectified image is required in order to use GPS navigation with the imagery for field sampling.

I. Base Imagery

Images used for comparing lake dynamics through time must be rectified to the Alaska Albers Map Projection, as described in this SOP.

In order to rectify an image, a base image is required. The base image must already be terrain-corrected and in the Alaska Albers map projection. Base images to be used should be procured and processed as described in SOP 3: Acquisition of Recent Imagery.

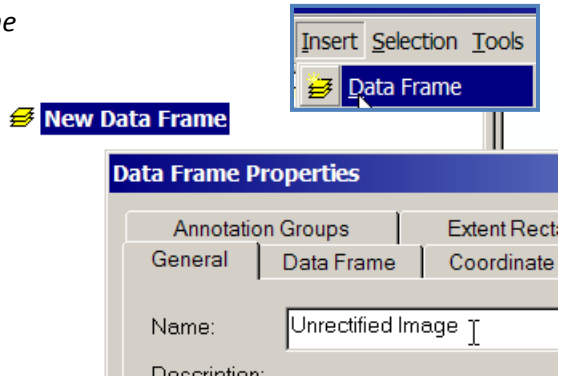
Refer to the Instruction Sheet "GIS: Alaska Albers Map Projection" for more information on the Alaska Albers projection.

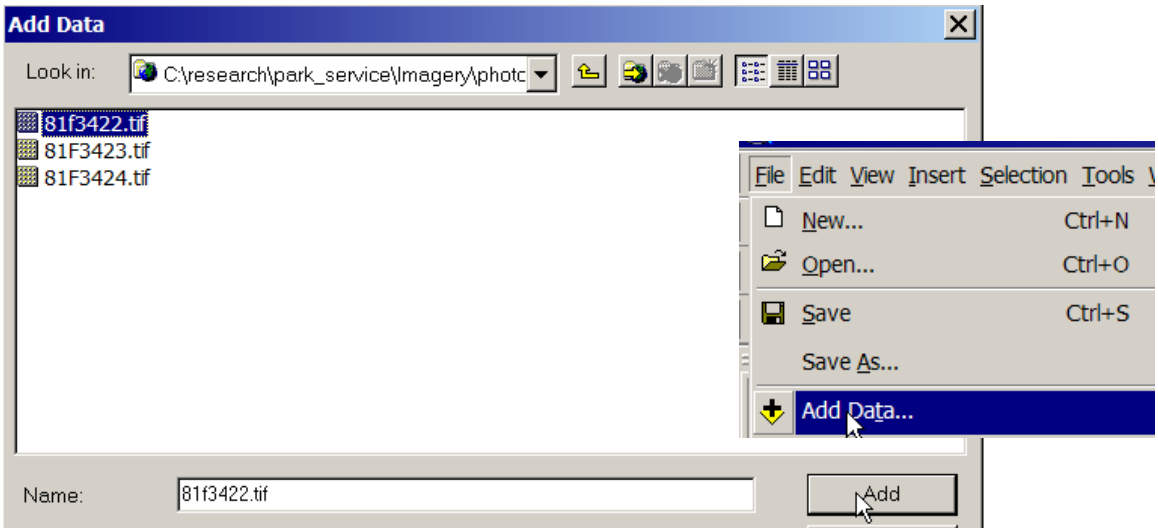
II. Rectifying Images

Unrectified images will be spatially adjusted to match the base image, which is in the Alaska Albers map projection. In this example, an unrectified color infrared aerial photograph will be spatially adjusted.

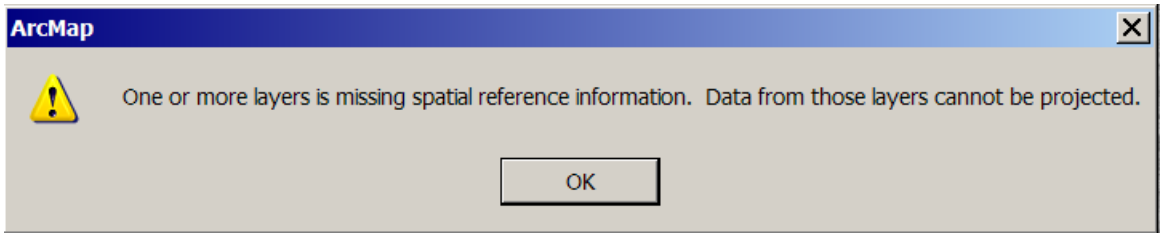
Display an Unrectified Image

1. From the *Insert* menu in ArcGIS, select *Data Frame*
2. Right-click on the newly added data frame, and open Data Frames Properties.
3. Name the new data frame "Unrectified Image", then click on the *OK* button.
4. From the *File* menu, select *Add Data...* and navigate to the folder that contains the unrectified image to be added.

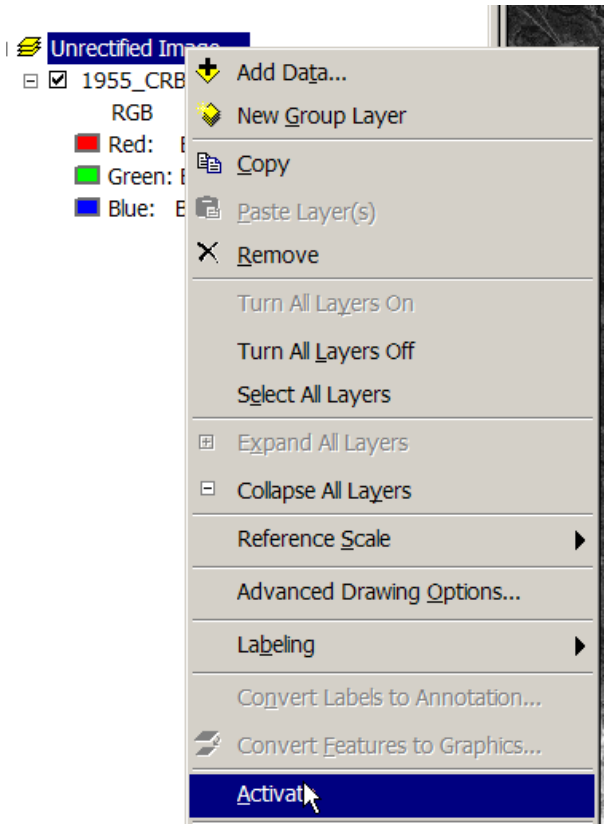




5. When the *Add* button is clicked, pyramids will be built for the image, and then the image will be added to the data frame. An informational message will be displayed, warning that the new image is not in the Alaska Albers map projection.



6. To see the unrectified image, right-click on the Unrectified Image data frame, and select *Activate*. To see the rectified image, right-click on the data frame of the rectified image and select *Activate* for that data frame instead.



7. Navigate within the two images (see Figure 1 and Figure 2) and identify locations that are clearly visible on both images. Note that North may be oriented in any direction for aerial photos.

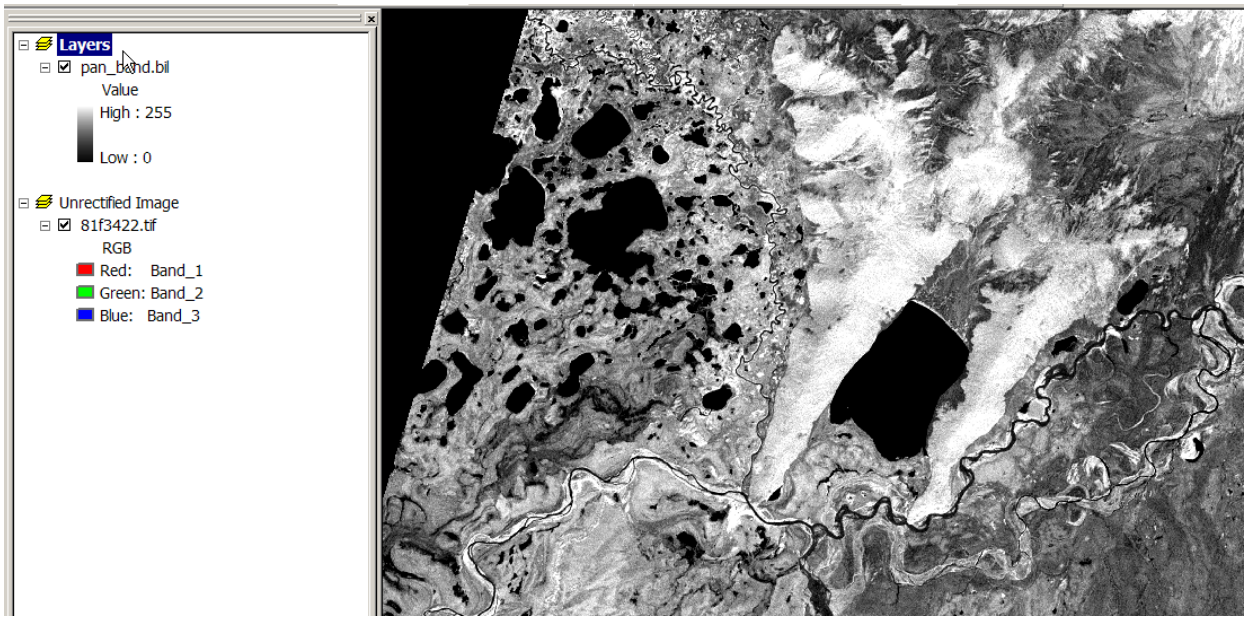


Figure 1. Sample image of a rectified Landsat ETM+ panchromatic image in Alaska Albers map projection

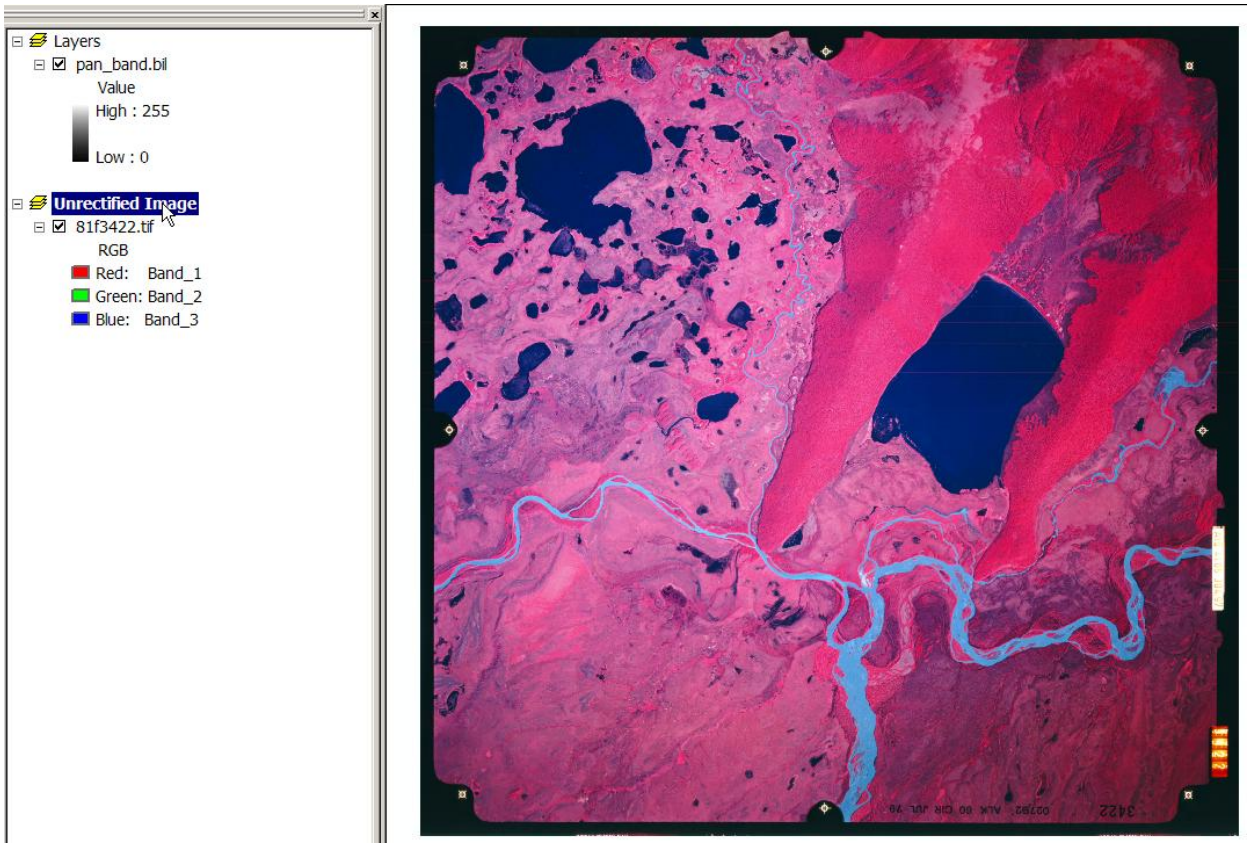


Figure 2. Sample image of an unrectified color infrared aerial photograph

Develop a Rectification Model

The rectification model used to adjust the unrectified image to the base image is an affine transformation. The affine transformation is a model for a plane and works well in the non-mountainous terrain that is typical of shallow lake landscapes. The process of developing the model is an iterative process of selecting locations on the unrectified image and their companion locations on the base image. The goal is to have at least ten well-distributed locations with a model root mean squared error of less than 1 pixel.

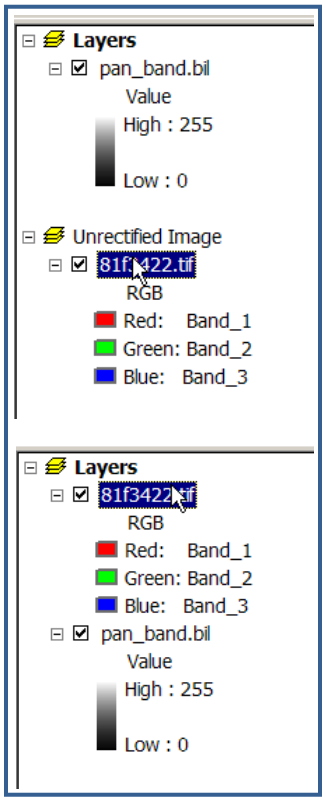
1. Add the unrectified image to the same data frame as the base image

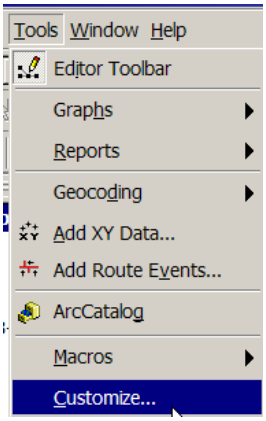
    a. Left-click the unrectified image and drag it from the Unrectified Image data layer and into the data frame containing the base image.

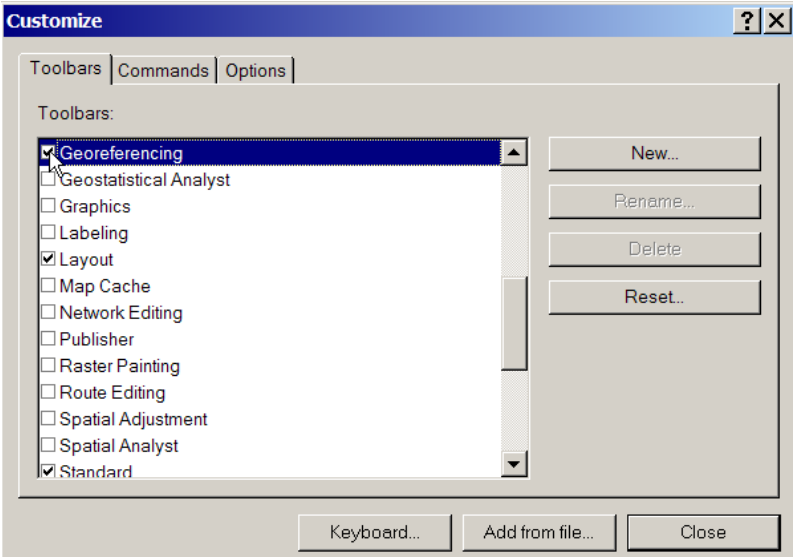
2. Add the *Georeferencing* toolbar to the ArcGIS map document

    a. From the *Tools* menu, select *Customize…*

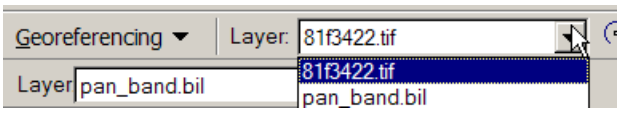
    b. Check the box next to *Georeferencing* in the list of toolbars, then close the Customize Dialog window







3. Select the unrectified image as the image to be georeferenced from the Layer list of images in the Georeferencing Toolbar.

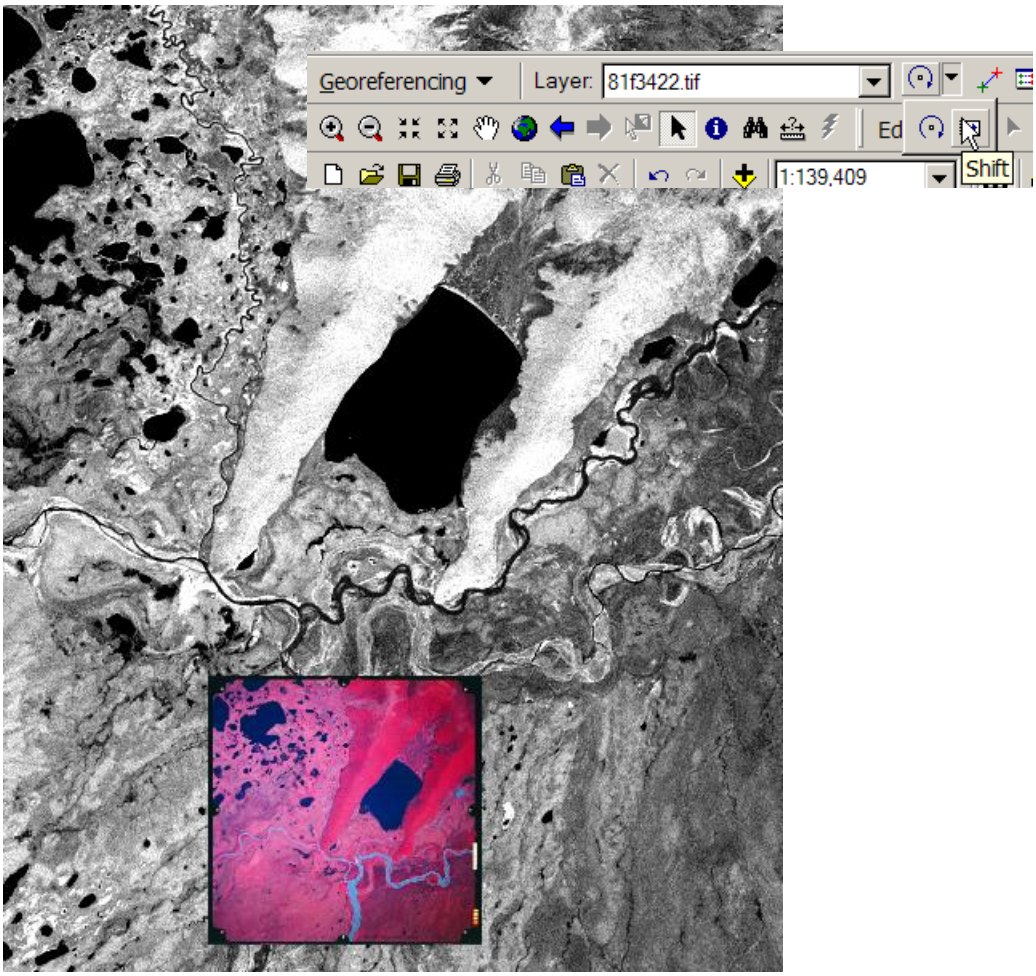


4. Develop three initial control locations

   a. Start with the base image and find a location that is also visible on the unrectified image

   b. Use the Zoom In, Pan, Zoom Out, and Go Back buttons to navigate within the base image, and within the unrectified image.

   c. Use the Shift tool in the Georeferencing toolbar to drag the unrectified photo image so that you can see the same area on the base image and the unrectified photo image



   d. In the Georeferencing toolbar, select the *Add Control Points* tool, and click on the same distinctive feature in both the rectified and unrectified images (see Figure 3).



   e. Repeat this process for the other two control point locations.

   f. After two or three points have been located on the unrectified image and the associated base image, the photo will be adjusted to match the rectified base image.

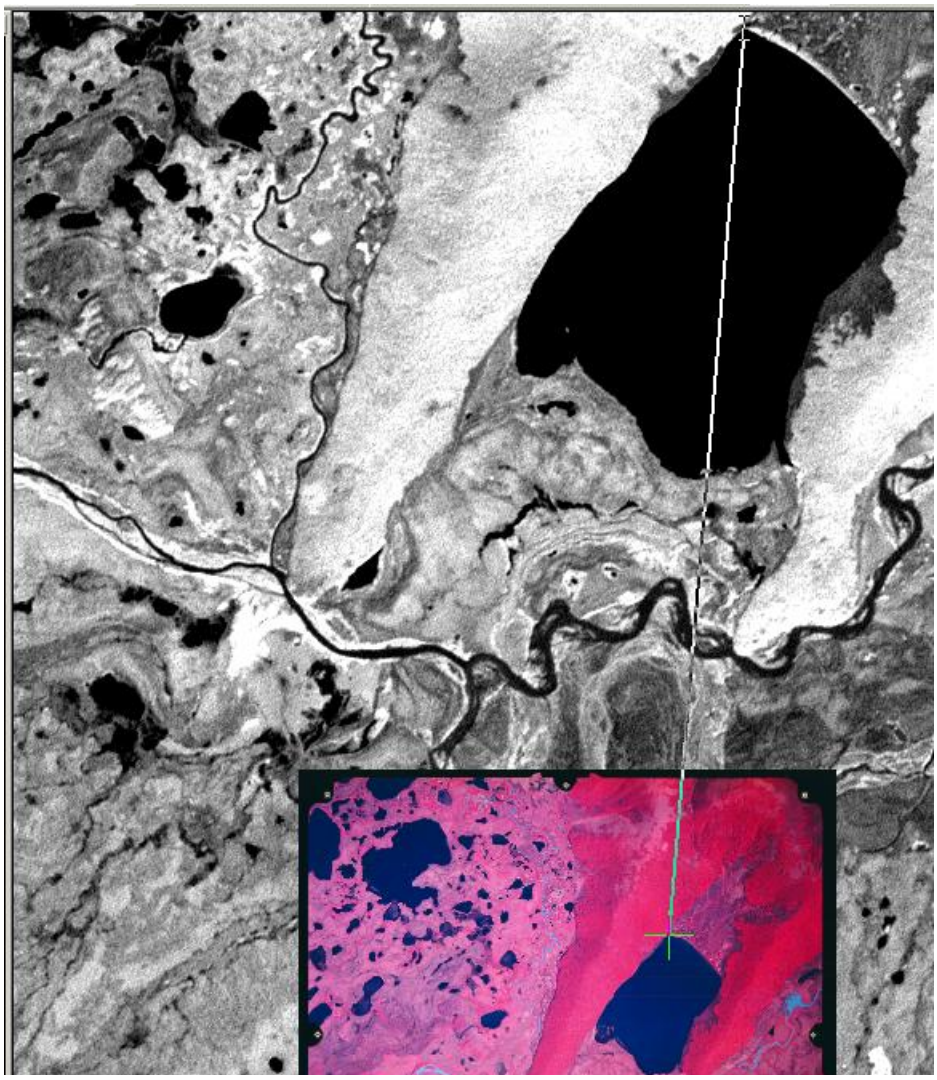
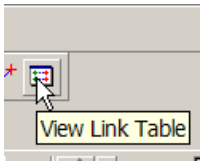
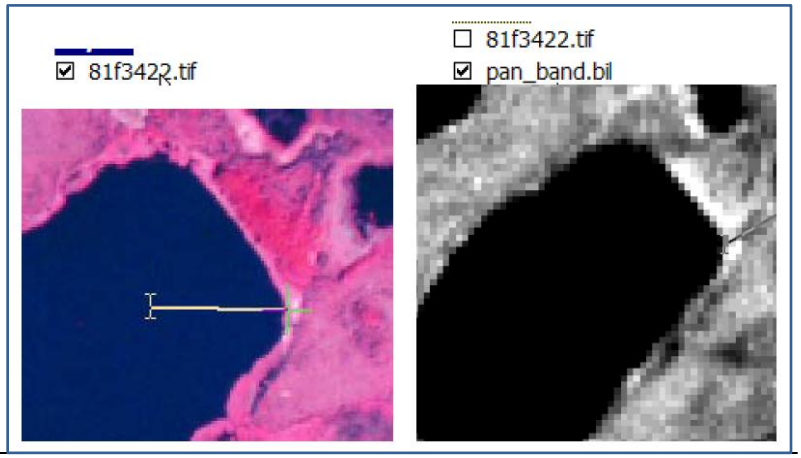


Figure 3. Screen-shot of a control point being added during georectification

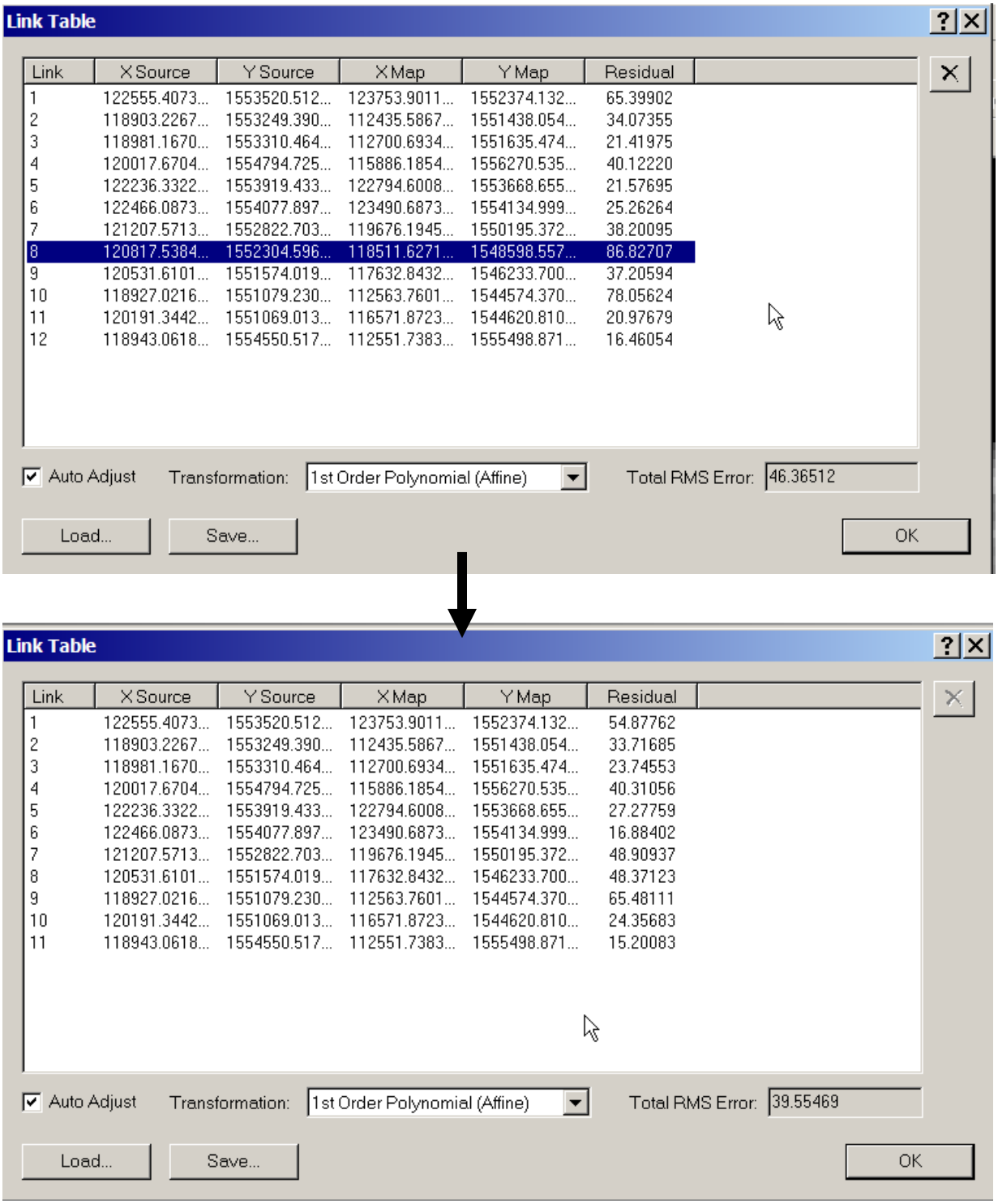
5. Develop additional links throughout the area where shallow lakes are located. Once the control points are established, additional connections between the unrectified image location and the base image map coordinates are called links. You can continue adding links by selecting a location on the unrectified image, turning the unrectified image off, and then selecting the same location on the base image.

6. After 10 to 20 additional links have been added, view the link table.



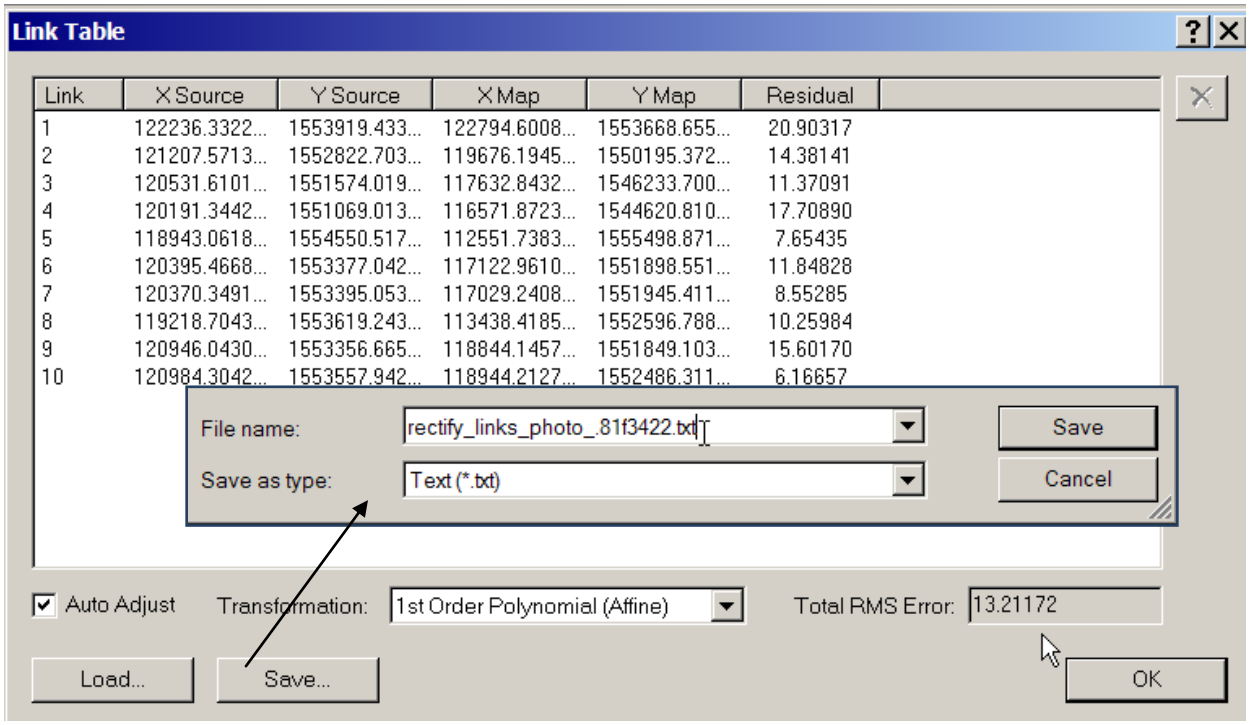


7. Select the link with the highest residual error, and press the delete key to delete that link



8. Repeat the process of selecting links with high residual error and then adding more links.
9. Every ten minutes or so, click on the Save button in your link table to save your work to a text file.

10. The best links are locations that do not change position between the two images…locations like rock outcrops, road intersections, etc.
11. The goal is to have ten links distributed throughout the area of shallow lakes on your image with a total root mean squared error of less than one pixel (15 meters when the base image is an ETM+ panchromatic image).
12. When the links are finalized, click the *Save* button to save the final version of the ten links to a text file.

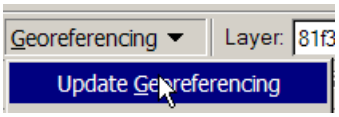


Apply the Rectification Model

Once you have developed an acceptable model with ten links and an RMS error of 1.0 pixels or less, you can apply the model to georectify or adjust the image to the Alaska Albers map projection (base image coordinates).

1. Select the *Rectify…* option from the Georeferencing Toolbar
2. Select Update Georeferencing to write the model to adjust the unrectified image to the base image. The model is written to a world file.





III. Rectification Models

Since shallow lakes typically occur on relatively flat landscapes, a simple linear model called the affine transformation can be used to adjust a rectified image to a base image.

The affine transformation can:

- Change in X, Y scale
- Translation in X,Y space
- Rotation of image X,Y space

The affine transformation predicts the map X,Y coordinates for any pixel in the unrectified image using model coefficients that are developed from the link table:

Xmap = A(image col) + B(image row) + C

Ymap = D(image col) + E(image row) + F

Where A, B, C, D, E, and F are equation parameters:

A is the scaling parameter in the X direction

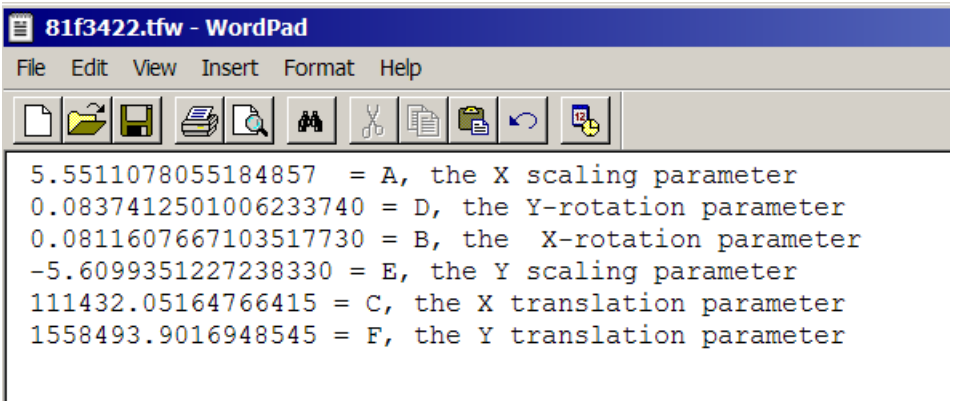
E is the scaling parameter in the Y direction

B and E are rotation parameters

C, F are translation parameters in the X and Y direction

The model coefficients are stored in a world file whenever you select *Update Georeferencing* from the Georeferencing Toolbar. This creates a new file with the same name as the raster dataset, but with an .aux file extension. It also creates a world file for .tif and .img files.

In this example, a world file was produced for the 81f3422.tif image and named with a .tfw extension:



The image is automatically adjusted to match the base image using the following equations for each pixel in the unrectified image:

Map X = 5.55107 (Image Col#) + 0.08116 (Image Row#) + 111432.051

Map Y = 0.08374 (Image Col#) + -5.609935 (Image Row#) + 1558493.901

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #05: Delineation of Shallow Lakes

Version 2.0 29 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/29/2010	H. Kristenson	Added references to new imagery Document format change	New satellite imagery has become available since the previous version. Producing a more streamlined reference document, which is more easily served to the public.	2.0

This Standard Operating Procedure explains the procedure for identifying shallow lakes within a study area. In order to develop a statistically valid sample of shallow lakes, a population of shallow lakes must be established. This inventory of shallow lakes present in each park unit will facilitate the creation of the sampling frame (SOP 7: Sampling Frame and Lake Selection), from which all lake sampling locations will be drawn for each park unit involved in the study.

I. Introduction

Two reference feature classes (or shapefiles) should be developed in GIS (Geographic Information System) for each park. One should be a point feature class, including a point location for each shallow lake in the study area (generally in the center of the lake), and the other should be a polygon feature class, with a polygon for each shallow lake in the study area. There are a number of ways these feature classes can be developed, and the process chosen should be based on the quality of datasets available for water bodies within the park unit.

National Hydrography Dataset

The National Hydrography Dataset (NHD) is a GIS theme that has been developed by the U. S. Geological Survey (USGS) to include all of the surface water features throughout the United States. Some regions of the nation have more accurate and up-to-date information in the NHD than others, and Alaska is on the low end of the spectrum for accuracy. Many of the NHD features for Alaska have been digitized from topographic maps, the most recent of which are still woefully out of date. Even so, it is still a good place to start when looking for digitized lake information, and it forms the foundation of the inventory of shallow lakes used in this project. Efforts are underway to improve the data for Alaska, so it

is always prudent to check for the most recent versions of the NHD before starting analysis using the dataset. The NHD is available through the NPS Theme Manager program in ArcGIS.

Imagery

There are many different sources of imagery for the study regions included in this project. Resources vary from park to park, region to region, and are constantly changing over time. At the start of this project, Landsat imagery was some of the best imagery available, but the purchase of IKONOS imagery for many of the park units has significantly improved the resolution of imagery available. Before beginning any analysis using imagery, check to make sure that you are using the most appropriate imagery currently available for the location.

II. Polygon Features

While the NHD dataset for Alaska is currently outdated, it is still a very useful tool to start with for identifying shallow lakes. It is currently served in a geodatabase format, including many different water body feature types, and is in 1:63,360 scale. The other option for identifying lakes is using rectified imagery, and manually tracing the shoreline of each lake in the park unit or study area to create a polygon for each lake. This method can give more accurate (and more up-to-date) information on lake location and size, but it is extremely time-consuming. As such, the NHD should generally be used for the initial stage of lake identification for each park unit, and the manual drawing of polygons can be saved for fine-tuning the inventory list, or for use in lake area analysis, which requires a high degree of accuracy.

The specific procedures for downloading and processing the NHD will change over time, as the dataset changes format and as new ArcGIS software upgrades are introduced. For detailed instructions, refer to Instruction Sheet "Lake Inventory Using NHD". The specific steps performed in the processing of the NHD, including references to any intermediate output datafiles, should be recorded in a GIS log for each park unit where analysis is performed. The GIS log should be saved in the GIS folder for that park unit on the CAKN network drive (J:\Monitoring\Water_Quality_Macroinvert\GIS\PARK). Take care to add metadata for all shapefiles generated during this process, and delete any unnecessary intermediate shapefiles when analysis is complete.

When the polygon theme has been created for the park unit, including a polygon for each lake that can potentially be sampled, it will need to be attributed with access information. Lakes may be accessed by road, lakes large enough to land on with a float plane, or rivers large enough to navigate by boat. Preference are given to lakes within 1500 meters of one of these forms of access, as they are less expensive and time-consuming to sample than lakes further from access points. Refer to Instruction Sheet "Lake Inventory Access Designation" for details on attributing access information.

III. Point Features

Once the polygon dataset has been finalized, including the attribution of each lake with access information, it can be converted into a point feature class. The GRTS sample program requires a single

location, and a set of point features can be used to generate lists for navigation. To convert polygon features to point features, refer to Instruction Sheet "GIS: Converting Polygons to Points".

IV. Manual Delineation of Lakes

In some cases, the NHD is insufficient for lake delineation. While the NHD works well for creating a polygon file for inventory, it may not be appropriate for lake area change studies. When it is vital to have very accurate representations of lake area at a given time, shorelines must be delineated manually. Refer to the Instruction Sheet "Manual Lake Delineation" for detailed instructions regarding the creation of a new polygon file with manually delineated shorelines. See SOP 6: Calculating Lake Area Change for protocols regarding the delineation of lakes for the calculation of changes in lake area.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #06: Calculating Lake Area Change

Version 2.0 01 November 2010

Revision History Log

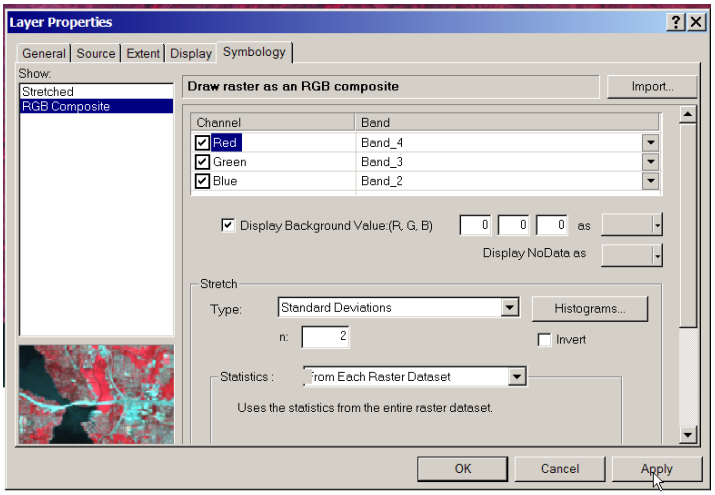
Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	11/01/2010	H. Kristenson	Change title from Locating Hot Spots of Lake Change. Document format change.	New title more descriptive of what the SOP accomplishes. Producing a more streamlined reference document, which is more easily served to the public.	2.0

This Standard Operating Procedure explains the procedures used for finding shallow lakes that have changed substantially between two time periods. In this example, ArcGIS9.0 was used with 2000 ETM+ satellite imagery to compare lakes from rectified 1979 aerial photography. Lakes that have changed substantially are digitized as polygons from the two time periods, and the change in surface area is calculated. These lakes may then be visited in the field, using coordinates from the GIS analysis.

I. Viewing Imagery

Imagery of the same area should be procured for the desired dates to be used for comparison. The periods represented will generally be determined by the dates from which imagery is available for the area. View the selected imagery in ArcGIS, with all images to be compared in the same data frame. All images used for this process *must* be rectified (see SOP 4: Image Rectification).

It may be helpful to change the image display so that the RGB channels match across the images. For example, by changing a Landsat ETM+ image so that the red, green and blue assignments are Band4, Band3 and Band2 respectively, it will simulate a color infrared photograph. If comparing a Landsat image with a color infrared photograph, the similar display may make it easier to compare images (Figure 1).



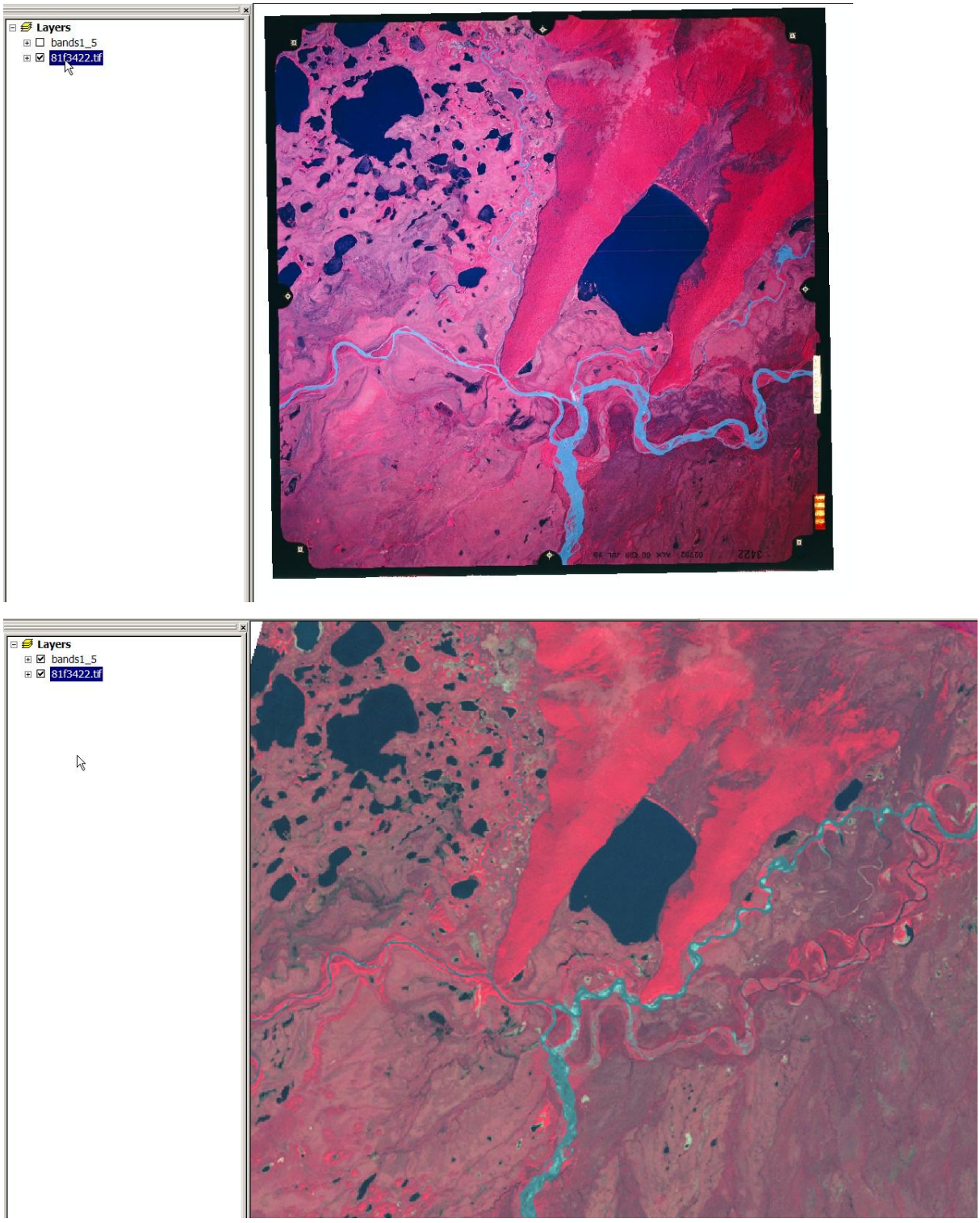


Figure 1. Comparing a color infrared aerial photo (top) to a Landsat ETM+ image with RGB settings adjusted to approximate infrared imagery (bottom).

Use the check-boxes in the TOC to toggle back and forth between the images.

The shorelines will often not match up exactly due to some positional error inherent in all rectified imagery, but lakes that have changed substantially will be evident. In addition, the grid cell size from imagery of different types will often differ; the resolution is better for some imagery types than others (see Figure 2).

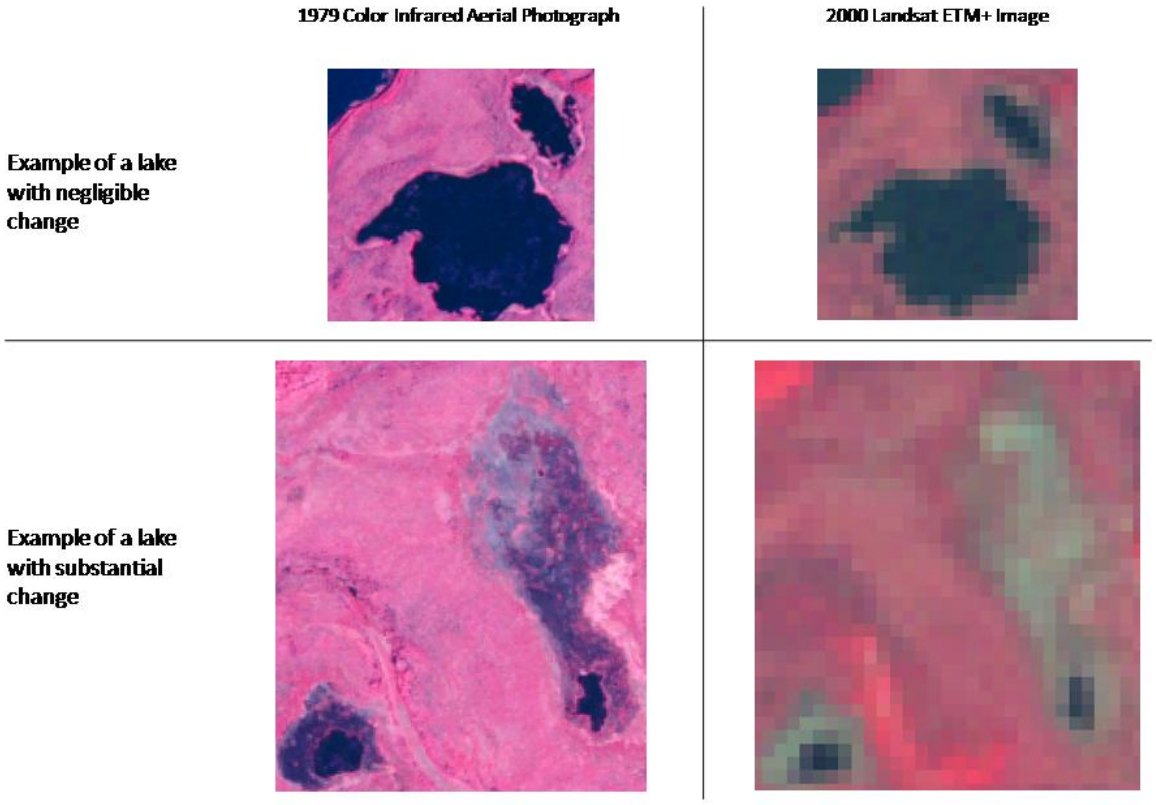


Figure 2. Comparison of different sources of imagery

II. Manual Delineation of Lake Shorelines

The lakes to be compared in this study will need to be delineated manually through the creation of polygon feature classes. The polygons will be drawn by referencing imagery to trace the shorelines of the same lake at different periods of time.

The instructions for manually delineating shorelines are found in the Instruction Sheet "Manual Lake Delineation". This protocol will require that two (or more) shapefiles are generated, each delineating shorelines at a particular point in time. The shapefiles should be named appropriately, to represent the area (i.e. park unit), and the year of the imagery used to trace the shorelines. Specific information about the imagery used for the generation of polygons should be included in the shapefile metadata, so that the same images may be referenced in the future if questions should arise. Add the newly-created empty polygon shapefiles to the same data frame as the imagery that will be used as a reference for tracing the shorelines.

Ensure that the correct source imagery is visible when tracing any shorelines, and trace the lakes of interest in each polygon shapefile (as per Instruction Sheet "Manual Lake Delineation") so that the same

lakes are included in the shapefiles for each of the different years (Figure 3). These shapefiles can then be compared to determine change in surface area over the span of the imagery used.

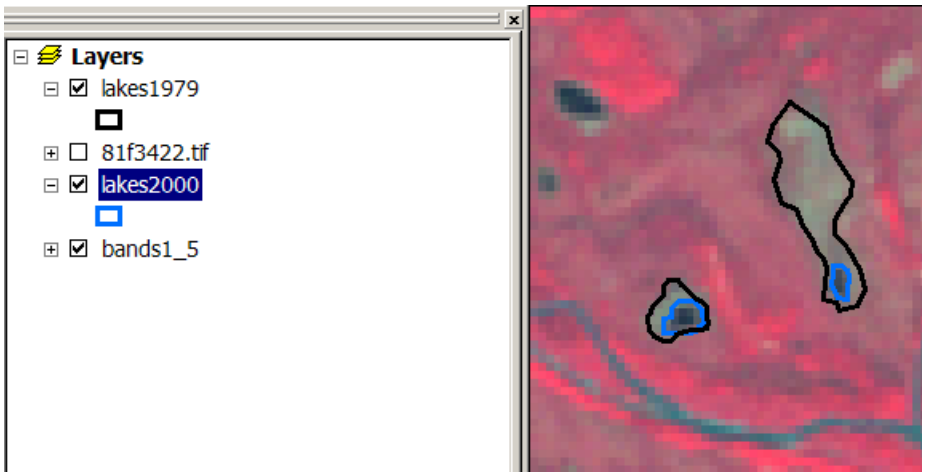
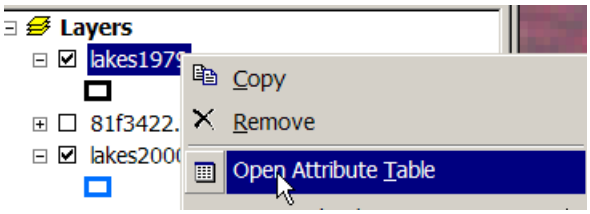


Figure 3. Lake shoreline polygons, drawn based on imagery from 1979 and 2000

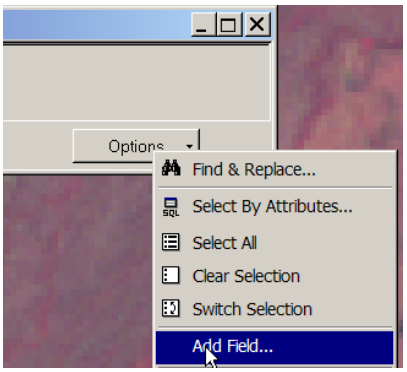
III. Calculating Change in Lake Area

To calculate lake area, a field must be added to the attribute table of each of the polygon shapefiles and populated for each lake polygon.

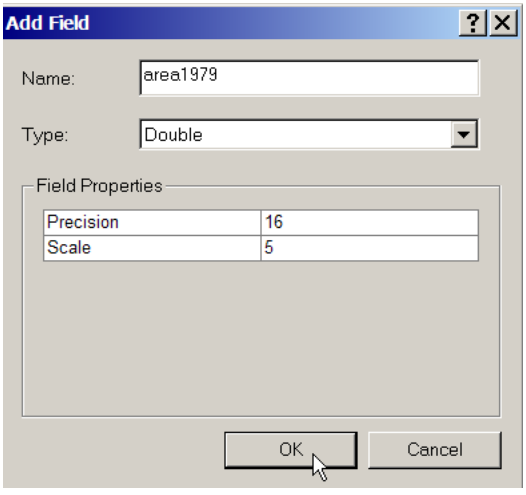
1. Open the attribute table of one of the polygon shapefiles by right-clicking the shapefile in the table of contents window and selecting *Open Attribute Table…*



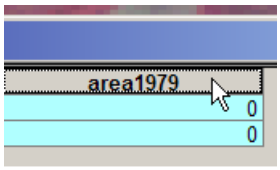
2. From the *Options* menu, select *Add Field…*

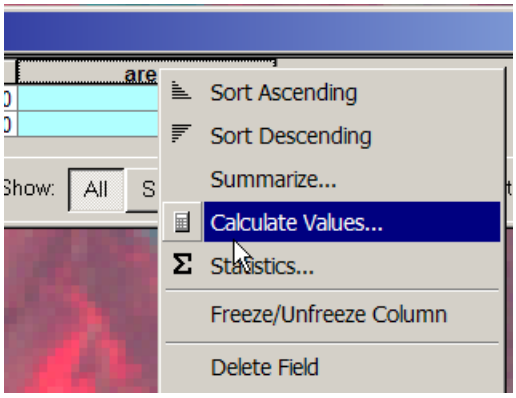


3. Name the field “area” (and include the year of the imagery from which the polygons were traced); define it as a Double field with a Precision of 16 and a Scale of 5.

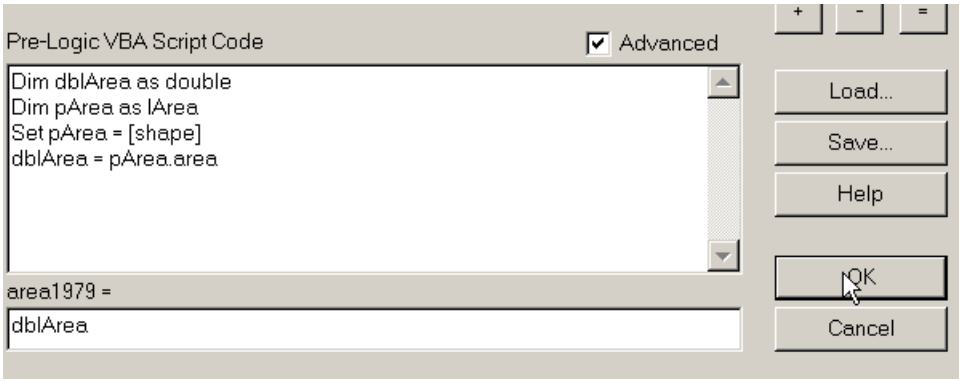


4. The field will appear in the attribute table. Right-click on the field column and select *Calculate Values…*

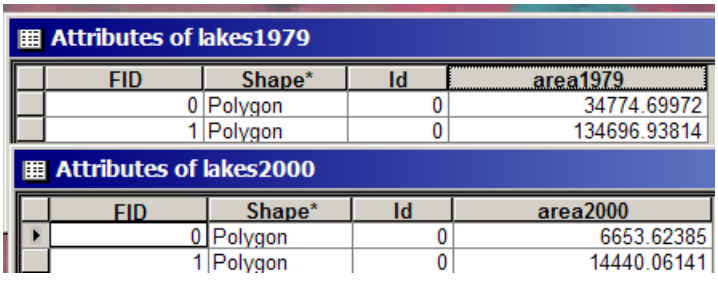




5. Enter the following VBA script for the calculation of the lake area:



6. Repeat this process for each of the polygon shapefiles.



Attributes of lakes1979

FID	Shape*	Id	area1979
0	Polygon	0	34774.69972
1	Polygon	0	134696.93814

Attributes of lakes2000

FID	Shape*	Id	area2000
0	Polygon	0	6653.62385
1	Polygon	0	14440.06141

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #07: Sampling Frame and Lake Selection

Version 2.1 18 January 2011

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	02/04/2008	A. Larsen	Added Procedures Section	Procedures were developed.	1.1
1.1	10/13/2010	H. Kristenson	Document format change. Change in rotation schedule.	Producing a more streamlined reference document, which is more easily served to the public. Sampling strategy amended to improve statistical capabilities.	2.0
2.0	01/18/2011	A. Larsen	Edited rotation schedule section	Corrected errors (references to obsolete rotation schedule)	2.1

This SOP provides an outline of the instructions for setting up the sampling frame and selecting lakes to be monitored each season in the Central Alaska and Arctic Networks.

I. Approach

Prior to the first field season of monitoring conducted in each of the three network parks, the sampling frame will be designed and the 30 lakes to be sampled will be selected. To accomplish this, the NHD Waterbody dataset and all applicable IKONOS, RadarSat2 (or other satellite) images will be compiled into a complete coverage of all parks, and processed to identify individual water bodies, their sizes, and their location (see SOP 5: Delineation of Shallow Lakes). Lake locations and all pertinent data layers will be loaded into the GIS. Following identification of water bodies in the satellite imagery, primary investigators will identify all navigable waters in the list. Navigable waters will include rivers and streams navigable by motorized boats and rafts, as well as ponds and lakes that are large enough to permit float plane landings and take offs. All lakes within 1.5 km of a navigable feature will be attributed "walk-in". All lakes larger than 0.15 km^2 or lakes within 0.5 km of a landing lake are designated "fly-in" lakes. See Instruction Sheet "Lake Inventory Access Designation" for more details on designating access types in GIS.

The overall sample design for the pond and lake monitoring study will select an un-equal probability sample of ponds and lakes from this comprehensive list of lakes based on distance from navigable water. The probability of including a pond or lake in the overall sample will be inversely proportional to its distance from the nearest navigable water. This design was chosen because of the high costs of

traveling to a particular water body on foot. Because of the time and effort required to haul personnel and equipment into sample units by foot, overall expenses will be reduced if more lakes and ponds are sampled near navigable waters than farther away. Properly weighted estimates based on data from the un-equal probability sample will apply to all water bodies in the sample frame.

The un-equal probability sample will be drawn in a way that assures a high degree of spatial balance. Spatial balance means that sampled ponds and lakes will be spread out approximately uniformly throughout each park. Spatial balance will be achieved by drawing an un-equal probability general randomized tessellation stratified (GRTS) sample (Stevens and Olsen 2004). GRTS samples assure spatial balance by recursively subdividing the parks, drawing the sample, and then reversing the ordering. The final result is a list of ponds and lakes such that any contiguous set achieve a high degree of spatial balance.

Prior to selection of the GRTS scheme, a few (< 6) ponds will be selected by principal investigators for sampling every summer. These ponds will be located close to easily navigable waters and will serve as index sites for the broader GRTS sample. These ponds will be placed in panel 1 of the pond and lake sampling study, and will not be available for selection in the GRTS sample. These lakes will be selected in 2005.

Once the index sites are determined and the un-equal probability GRTS sample is drawn, the pond and lakes membership design will allocate units to panels in groups from the ordered GRTS sample. If n_2 units are required in the 2nd panel, the first n_2 units in the ordered GRTS sample will be assigned to panel 2. If n_3 units are required in panel 3, units from the (n_2 + 1)-th to the (n_2 + n_3)-th in the ordered GRTS sample will be allocated to panel 3. If n_4 units are required in panel 4, units from the (n_2 + n_3 + 1)-th to the (n_2 + n_3 + n_4)-th will be allocated to panel 4, and so on. This membership design will assure a high degree of spatial balance in each panel.

Once each lake has been chosen and placed into a panel, they will be collated into a single list of sites. This list will then be used to organize lakes into the five following access categories: motor vehicle/foot, floatplane, motor boat, raft, or helicopter. Then lakes within close physical proximity will be grouped. For example, all lakes accessed via motor boat along the Yukon River corridor will be grouped together, or all lakes on the south side of the Alaska Range accessible by floatplane will be grouped together. This exercise will require considering how lakes are best accessed, and the timing of site sampling. Although time consuming, this exercise will help reduce logistical expenses in accessing the sites as well as help streamline the sampling process, thereby allowing us to visit more sites. At the end of this process, lakes will be assigned to a panel that will determine the sampling frequency.

The rotation design will require lakes in panel 1 to be sampled every year using continuous data recorders, those in panel 2 to be sampled 6 times annually, and those in panels 3-5, 6-8, and 9-11 to be sampled for 1 year and then not revisited for 9 years. Panel 1 will include ≤3 lakes in each park, and each lake will be monitored using continuous data recorders maintained annually. Panel 2 will consist of 3-10 lakes in each park that will be re-sampled 6 times each year. Panels 3-5 will consist of 100 lakes from one park within each network (100 in ARCN and 100 in CAKN each year), each sampled once. Panels 6-8 and 9-11 will be similar to panels 3-5, except a different group of 100 lakes per network would be selected. This would result in approximately 300 lakes being sampled within each park over each 9 year period, 100 lakes within each park every third year, re-sampled every 10 years.

II. Procedures

For more detailed instructions, refer to SOP 5: Delineation of Shallow Lakes and Instruction Sheets "Lake Inventory Using NHD" and "Lake Inventory Access Designation".

1. Load the NHD derived features for the Park/Preserve into ArcMap.
2. Select all lake features larger than 1 ha in area and smaller than 50 ha
3. Verify that the lake is still present using the most recent set of aerial photography or imagery available; delete or add lakes to the set of lakes derived from the NHD as necessary
4. Once the lakes have been verified, they need to be divided into accessibility. This is largely done in the GIS.
    a. To determine lakes accessible from navigable waters or roads, set up a 1.5 km buffer area along all navigable corridors. Attribute all lakes within the buffer zone as "walkin".
    b. Identify all fly-in access lakes. Fly-in access lakes are all lakes larger than 0.15 km^2 that have a 500 m long or longer straight section conducive to aircraft takeoff and landing. Attribute all lakes that meet these conditions as "fly".
    c. Establish a 0.5 km buffer zone around all fly-in access lakes. Attribute all lakes within the buffer zone as "fly_0.5km".
    d. Establish a 1.5 km buffer zone around all fly-in access lakes. Attribute all lakes within the buffer zone as "fly_1.5km".
    e. Attribute all remaining lakes as "helicopter".
5. Place a point in the center of each lake feature.
6. Run the GRTS program on the unique lake ID number to create the sampling order. Each lake will be attributed with a GRTS_order. This order is the order in which lakes will be sampled.
7. To draw a sample, simply arrange the lakes in ascending order based on the GRTS_order attribute. Lakes should be sampled in order, according to accessibility.

III. Lake Sampling Tables

As lakes are sampled, they will be added to the Monuments feature class within the Shallow Lakes geodatabase: J:\Monitoring\Water_Quality_Macroinvert\GIS\Geodatabase\AKShallowLakes.gdb

This feature class is the definitive list of all lakes that have been sampled for the Shallow Lakes monitoring program. At the end of each season, the monument data collected with the Trimble GPS units will be loaded into this feature class (see SOP 24: Data Management). In the event that a coordinate is not collected, the lake location will be determined from maps and records, and a point will be manually added to the feature class. All sampled lakes must be accounted for in the Monuments feature class, regardless of whether or not a permanent benchmark was installed.

J:\Monitoring\Water_Quality_Macroinvert\GIS\Geodatabase\AKShallowLakes.gdb\Monuments

This feature class will be updated annually until all sampling lakes have been established in all of the park units where shallow lakes will be monitored.

IV. References

Stevens, D. L., and A. R. Olsen. 2004. Spatially balanced sampling of natural resources. *Journal of the American Statistical Association* 99 (465): 262-278.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #08: Continuous Lake Monitoring

Version 2.0 12 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/29/2009	H. Kristenson	Added detailed protocols for deploying and retrieving dataloggers.	We have new loggers, and more sondes available than when this SOP was first developed.	1.1
1.1	10/12/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides the procedures for setting up continuous water quality monitoring on the index lakes selected for continuous monitoring in the Central Alaska and Arctic Networks. In addition to being used for long term monitoring, these data will be used to assess the validity of synoptic sampling for monitoring shallow lakes. The data will also serve as a means to calibrate synoptic samples, help determine an appropriate index sampling period, and provide data regarding spatial and temporal variation. We have relied extensively on the USGS publication Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting for the development of this protocol.

I. Approach

A multi-parameter monitoring device (sonde) is deployed during the ice-free months to monitor seasonal and diel fluctuations in conventional water quality parameters including: temperature, dissolved oxygen, specific conductance, turbidity and pH. The sonde is a single device that houses a set of sensors capable of monitoring each of the above constituents along with a data logger that stores the data. Power is supplied by conventional batteries located in a sealed compartment, and sensor data are stored within the sonde on nonvolatile, flash-memory recording devices. Two data sondes will be deployed in each park every summer. This will provide us with both spatial and temporal data regarding water quality in shallow lakes.

In addition to the sondes, temperature and water level loggers will be deployed to record the temperature profile of the lake and track changes in water level over the summer season.

II. Laboratory Preparation

YSI Sondes

1. Start preparing Sondes for long-term deployment at least 6 weeks before their planned deployment. This allows time to test the sondes, and repair or replace sensors if necessary.
2. Prior to field deployment the sondes should be carefully inspected and calibrated in the laboratory following instructions in: Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Site Selection, Field Operation, Calibration, Record Computation, and Reporting. U.S. Geological Survey, WRIR 00-4252--Contents. See also Instruction Sheet "Calibrating Sondes".
3. Follow the procedures outlined in the Instruction Sheet "Deploying YSI Sondes" to set up the MDS 650 handheld computer and the YSI Sondes for deployment.

HOBO Temperature and Water Level Loggers

1. Prior to field deployment, the HOBO loggers should all be tested to make sure that they're working properly. Set all of the loggers to log for at least 12 hours, store them all together, then download all of the test files to determine if there are any unusual readings.
2. Set the loggers to launch using a delayed start. Set the start date/time to the earliest possible time of deployment. Any data logged before deployment will be clipped during processing after the logger is downloaded. Note that once the temperature loggers are set to launch, a little red light will flash periodically to confirm that they are active; the water level loggers do not have a visible indicator light.
3. Follow the procedures outlined in the Instruction Sheet "Deploying HOBO Dataloggers" to launch the loggers for deployment.

Temperature Loggers

- Temperature loggers should all be set to take measurements every two hours. Temperature readings were originally taken hourly, but the new Hobo Pendant temperature loggers do not have enough memory to record hourly throughout the summer.

Water Level Loggers

- Water level loggers should all be set to take 2 measurements per day: one at midnight and the other at noon.
- Some of the water level loggers are deployed at the bottom of the lake, while others are left on shore to gather barometric pressure data to be used as a reference for calculating changes in depth from the changes in barometric pressure at the bottom of the lake. All of the loggers are launched in the same manner, however, and collect the same data.

III. Data Collection Procedures

Deployment

1. Select lakes to be monitored continuously (SOP 7: Sampling Frame and Lake Selection). These lakes will be selected based on their accessibility, size and bathymetry. Two lakes will be selected per park and monitored annually as "Index Lakes".
2. Deploy sensors in each of the index lakes selected for sampling within 2 weeks of ice-out. Each sonde will be suspended from an anchored buoy in the deepest section of the open water zone.
3. Conduct a brief reconnaissance of the lake and determine an appropriate location on the lake for sampling. This area should be well away from vegetation and debris, in the deepest part of the lake, yet in an area where installing the device is feasible.
4. Set the sonde to the start logging setting if it has not already been activated.
5. The sonde should be suspended directly from a #2 fishing buoy using a standard aluminum locking carabiner. This should allow the sensors to be suspended approximately 50 cm below the water. This depth was selected to mimic the collection of grab samples during synoptic sampling. The sonde bouy should be laterally displaced from the anchoring device which consists of a 10 lb kedge anchor. Lateral separation can be accomplished by running a ½ inch polyline through a ¾ inch piece of PVC tubing that is affixed to a small gillnet buoy and the anchor (see photos below). The anchor line should be set such that it allows approximately 50 cm of fluctuation in water level.



6. Attach five Hobo temperature loggers (either External Temp loggers encased in waterproof containers, or waterproof Pendants) along a heavy line or chain. Attach the line to the gillnet buoy above the anchor, and affix a 2-pound weight to the bottom of the line. The loggers should be attached to the line at the following distances beneath the lake surface: 25 cm, 50 cm, 100 cm, 150 cm and 300 cm (or at the lake bottom if it is less than 3 m deep).
7. Attach a Hobo Water Level logger (U20-001-01) to the anchor. There should also be one Water Level logger deployed on shore in each park; attach the logger to a, duckbill, and fix it firmly next to the monument of one of the continuous monitoring lakes or attach it to a nearby tree.
8. Deploy the logger array, collecting a GPS location using the Trimble GPS unit. Use the 2009_Depths data dictionary and enter the location as a regular bathymetry point (Depths feature), noting in the comments field that it is the location of the sonde deployment. Refer to SOP 17: Water Chemistry Field Data Collection for protocols for collecting bathymetry data, and Instruction Sheet "Trimble Data Collection" for instructions on collecting Depth features.
9. Fill out a Continuous Monitoring Log Form, or enter deployment information directly into the database using a Tablet PC, noting the date and time of deployment, the serial numbers or other identifiers of all the loggers deployed, the depths of the temperature loggers, and any other notes or comments.
10. Collect reference measurements with another calibrated sonde, held in the water right next to the sensors of the deployed sonde. Record the measurements for use as a check for the accuracy of initial readings of the deployed sonde. If possible, record measurements at the same time as measurements are being recorded by the deployed sonde.
11. Once the buoy and data sonde is deployed, photograph the buoy and the general area.
12. Before leaving the lake, record a detailed description of the sonde location in the Shallow Lakes database.
13. Conduct basic maintenance inspections mid-summer if logistically feasible.
    - Take a full measurement with a calibrated sonde just prior to removing the continuously monitoring sonde from the water
    - Pull the sonde shortly after a scheduled reading in the continuous monitoring sonde (every hour)
    - Inspect the site for signs of physical disruption
    - Inspect the deployment apparatus for signs of wear or possible failure
    - Inspect sensor(s) for fouling, corrosion, or damage
    - Conduct routine sensor cleaning and servicing
    - Check battery (or power) and time
    - Calibrate sensors (if needed) – See Instruction Sheet "Calibrating Sondes"

      A calibration check using known standards is performed on cleaned monitoring sensors; if the monitor sensors are outside the range of acceptable differences, the sensor must be recalibrated. If the calibration-check sensor readings for the monitor are within the

calibration criteria, the monitoring sensors are considered checked and no further adjustments are required.

A final environmental sensor reading is required after the calibration check or after recalibration. The difference between the initial sensor reading and the cleaned sensor reading is the sensor error as a result of fouling; the difference between the calibration-check reading and calibrated-sensor reading, if necessary, is a result of drift.

If a serious problem is encountered during maintenance and inspection, a thorough trouble-shooting exercise should take place

- Download data

Retrieval

1. Retrieve the loggers as late in the season as possible before ice forms on the lake.
2. Paddle out to the sonde, and take a measurement with a calibrated sonde next to the continuously monitoring sonde just before the deployed sonde is removed from the water.
3. Fill out a Continuous Monitoring Log Form, or enter retrieval information directly into the database using a Tablet PC. Note the date and time of retrieval, note or verify the serial numbers or other identifiers of all the loggers deployed and the depths of the temperature loggers, and add any other applicable notes or comments. Take particular note of any signs of disruption or damage to the sensors, and the condition of the logger.

IV. Data Management

Downloading Loggers

1. Download Sondes. This can be accomplished by transferring the data from the Sonde to an MDS 650 and then from the MDS 650 to a PC, or by downloading the data directly from the Sonde to a PC. Direct download of the data can be performed using either EcoWatch or StreamlineENV software. See Instruction Sheet "Downloading YSI Sondes" for details on downloading protocols using the MDS or EcoWatch software, and refer to Instruction Sheet "Using StreamlineENV" for instructions on downloading Sondes using StreamLineENV.
2. Download HOBO Dataloggers. See Instruction Sheet "Downloading HOBO Dataloggers" for detailed instructions. Note that HOBO dataloggers can also be downloaded in the field, using a HOBO Waterproof Shuttle. These files can later be transferred to a PC for storage on a network drive.
3. All files should be named and stored in accordance to the guidelines described in Instruction Sheet "Continuous Monitoring File Storage"

StreamlineENV

StreamlineENV software can be used to view, analyze, and QA/QC data. The extent to which StreamlineENV will be used in this project is yet to be determined.

Aquarius

Aquarius software can be used to view, analyze, and QA/QC data. The extent to which Aquarius will be used in this project is yet to be determined.

V. Demobilization

Once the equipment has been brought in from the field and downloaded, remove the loggers from the ropes, and clean and store any of the gear used for deployment (buoys, lines, anchors, hardware). The loggers should then be prepared for long-term storage, following the guidelines below.

YSI Sondes

Each model of YSI Sonde requires slightly different treatment in preparation for storage. Detailed instructions for preparing Sondes for long-term storage are listed in the Instruction Sheet "Preparing Sonde for Longterm Storage". A Sonde Longterm Storage Form should be filled out for each Sonde, and filed in the Sonde Log Book.

HOBO Dataloggers

Pendant Temperature Loggers

1. Wash and dry the pendants.

External Temperature Loggers

1. Remove the External Temp loggers from their canisters.
2. Remove the moisture absorber and foam disc from each canister and store them separately.
3. Remove the O-rings from the canisters. Wash both the canisters and the O-rings thoroughly, dry them, and store them separately. Note that the O-rings should be lightly lubricated before being fitted back on to the canisters before the next deployment.

Water Level Loggers

1. Wash and dry the loggers.
2. Check that the O-ring in the cap is in good condition. Lubricate or replace if necessary.

VI. Equipment

Deployment and Retrieval

Alpacka raft, paddles, pump, PFD
Calibrated sonde with MDS 650 and connector cable
Trimble GPS, Garmin eTrex
Tablet PC or Continuous Monitoring Logbook
Instrument array
Depth sounder (Speedtech)

Data Management

StreamlineENV and YSI connector cable
BoxCar and HOBO connector cord for External Temp loggers
HOBOware and HOBO connector cables for pendants and level loggers
EcoWatch and YSI connector cable

YSI Sonde Maintenance

pH buffers – 4, 7, 10 (Oakton, from Cole-Parmer)
Conductivity standard solution - 1500 uS (Oakton, from Cole-Parmer)
2M Potassium Chloride Solution - Teknova (VWR Cat # 100219-982)
Tap water
YSI DO probe maintenance kit
Scissors
Lens-cleaning tissues (dry, with no cleansers/chemicals added)
Compressed air (for cleaning connections)
YSI replacement o-rings
Sponges and scrub brushes
Deionized or distilled water

VII. Quality Control

This section of the SOP is still in development. The project is developing protocols for the use of Aquarius and/or StreamlineENV software for continuous monitoring data management, including quality control. The quality control procedures currently in use are outlined below, but may be amended as decisions are made concerning the use of software for identifying probe malfunctions, sensor drift, and other potential errors within the continuous monitoring dataset. The following guidelines were adapted from the USGS publication Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting.

1. Assess accuracy of sensors
    a. This is accomplished by recording the initial sensor readings, cleaning the sensors, recording the cleaned sensor readings, performing a calibration check of sensors by using appropriate standards, and if the readings of the monitoring sensor are outside the range of acceptable differences, recalibrating the sensor. All information related to the sensor inspection must be recorded on a field form or in a field notebook. The sensor readings in the field notes become the basis for corrections (shifts) during the record-processing stage; thus, a complete and thorough documentation of the sensor inspection is important.
    b. Take a final reading on the field meter. Subtract the field meter after reading from the initial reading. These numbers reflect lake change over the calibration period. Transfer data to the database.

2. Conduct station analysis

    a. An individual station analysis is required annually and includes an analysis of each constituent monitored at a site. The purpose of the station analysis is to compile information annually from the field notes, instrument log, and station description that bear directly on the accuracy and completeness of the record. At a minimum, the station analysis must include the instrumentation, period of record, sampling procedures, special conditions, and any variations from normal procedure. In addition, the station analysis includes information relating to the accuracy of the instrumentation and the record produced for the year, dates that probes were changed or replaced, procedures and methods used in the calibration process, a statement of how corrections or shifts were applied to the data, and any unusual events (including weather data) that may have affected the record. Reasons are given for how data were validated or why anomalous record was removed.

    b. Synthesize continuous station data with information above to generate a story of the station monitoring season and history.

    c. Overlay point sampling data from synoptic sampling lakes on the relevant continuous sampling lake data records. Note instances where point samples should be flagged as potentially showing a trend that is actually the result of an anomalous event that is represented in the continuous data record for that season.

VIII. References

Wagner, R. J., Boulger R. W., Jr., Oblinger, C. J., and Smith, B. A. 2006. Guidelines and standard procedures for continuous water-quality monitors: Station operation, record computation, and data reporting. U.S. Geological Survey Techniques and Methods 1-D3, 51 p. http://pubs.water.usgs.gov/tm1d3 or http://pubs.usgs.gov/tm/2006/tm1D3/pdf/TM1D3.pdf

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #09: Training Field Personnel

Version 2.0 14 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/14/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP describes the annual training procedures required for personnel involved with shallow lake monitoring. Training is carried out well in advance of the upcoming field season and should be completed by the end of May. This training includes both federally-required safety training and training specifically designed for shallow lake monitoring. Training includes the proper use and calibration of the YSI multi-parameter sondes, the GPS unit, and Tablet PC, locating a lake and installing benchmarks, measuring water level, collecting and analyzing water quality samples, and macroinvertebrate and vegetation sampling techniques. We have designed a three-stage observer training program that includes orientation, skill development, and practical testing.

I. Official NPS Required Safety Training

Our primary concern in monitoring shallow lake ecosystems is the health and safety of our personnel. To ensure crew safety, we require a high degree of training before crew members are allowed into the field.

Field Personnel

The following safety courses are required of all personnel involved in the sampling. Each crew member must be able to show that they possess current certification in the following federal training programs:

1. Shotgun training – certified annually
2. CPR/First aid
3. B-3 aircraft safety – if aircraft of any kind are scheduled for use during the field season (required every three years)
4. Helicopter crew member training (S-271) – if helicopters are to be used during the field season

Project Manager

The project manager is responsible for the general safety and welfare of the crew while in the field, and is required to take the following training in addition to the training required of all field personnel:

1. CPR/First aid
2. Helicopter manager (S-372) – if helicopters are to be used during that field season (3 year recertification program)

II. Training Program for Shallow Lake Monitoring

Effective training of crew members is the single most important component of maintaining a viable and effective long term monitoring program. Having properly-trained personnel reduces inter-observer error, helps to streamline sampling in the field, reduces sampling errors, and increases our ability to monitor aquatic ecosystems during the short summer field season. Being able to properly collect data, use equipment, troubleshoot equipment malfunctions, and complete the data collection are essential to the Shallow Lakes monitoring effort.

We are committed to developing a high quality training program that ensures observers are competent and confident in the monitoring process and will guarantee the success of the project. Typically, we think of training as that time spent in a classroom or out in the field demonstrating particular methods to new volunteers. However, in order to be truly effective, it is crucial to integrate training into the entire program. The program has three basic sections: orientation, skill development and practical testing.

Orientation

Observers are required to attend a basic orientation discussion that will outline the training process, schedule, and required readings. The orientation session will cover the following topics:

1. Program overview: discuss goals and measurable objectives of shallow lake monitoring
2. Basic program information – contacts etc.
3. How to Monitor: general techniques we'll be using in the field
4. Current Monitoring Schedule: the generalized sampling schedule for the upcoming field season
5. Training schedule: the safety and monitoring training required and when training will be offered
6. Required readings: observers are asked to read through the monitoring procedures handbook which includes a narrative of the shallow lake monitoring protocol and all the SOPs for the project. Each observer should also familiarize themselves with the wetland plant species that may be encountered during field work (refer to the current list of plant species for the project).

Skill Development

After orientation and careful review of the necessary documents, the observers will begin skill development training. This portion of the training program is primarily conducted in the laboratory and on a local training lake. The emphasis is placed on learning and practicing the skills necessary for

completing the in-lake sampling. Observers are introduced to monitoring techniques; maintaining, using, and storing equipment; and managing field data. We also introduce common problems and solutions that are frequently encountered while using each of the pieces of equipment. At this time basic proficiency will be tested by comparing measurements among observers and trainers during training sampling trips.

General Sampling

1. Trip and Daily General Procedures (see SOP 10: Field Trip Mobilization and SOP 11: Daily Field Startup)
2. Locating sites (see SOP 14: Relocating Lake and Sampling Locations)
3. Installing permanent benchmarks (see SOP 13: Establishing and Marking Benchmarks)
4. Sampling Procedure
5. Review data sheets
6. Use of Database and Tablet PC
7. Photography (see SOP 15: Documenting a Lake Using Digital Photography)
8. Field Supplies (see SOP 1: Field Season Preparation)
9. Field Checklist
10. A Glossary of Terms
11. Supplemental Information

Water Level

(see SOP 16: Water Level Determination)

1. Surveying technique
2. Water depth measurement techniques

Water Chemistry

(see SOP 17: Water Chemistry Field Data, Bathymetry and Sample Collection)

1. Water sample collection
2. Proper labeling of water samples
3. Water Quality measurements
    a. Calibration of multiparameter water quality meter (YSI Sonde or similar)
    b. Using multiparameter water quality meter for in-situ sampling
    c. Collecting water quality profiles
    d. Saving water quality measurements to the field computer (YSI MDS or similar)
    e. Maintenance and care of the multiparameter water quality meter
4. Water sample analyses (see SOP 21: Processing of Water Chemistry Samples)
    a. Filtering water samples in the field
    b. Alkalinity

i. Personnel will be trained in the use of a digital titrator to obtain reproducible results. Since pH color indicator changes can be subtle, analysts must be able to visually distinguish the titration endpoint, which only comes with practice, or use a pH meter.

5. Handling & transporting water samples
6. Laboratory analysis (including kits)
7. QA/QC for water samples

Physical Lake Characteristics

(see SOP 17: Water Chemistry Field Data, Bathymetery and Sample Collection)

1. Water clarity (using the Secchi Disk)
2. Using Speedtech Depth Sounders and Trimble GPS units to record bathymetry

Vegetation

(see SOP 18: Vegetation Sampling)

1. Installing transects
2. Using Trimble GPS units
3. Field data collection (mapping, line samples, rake samples, quadrat sampling)
4. Identification of common aquatic and riparian plants (review species list)
5. Preparing voucher specimens

Macroinvertebrates

(see SOP 19: Aquatic Invertebrate Field Sampling)

1. Installing transects
2. Sample collection - standardized sweep
3. Macroinvertebrate sample processing- sieving, rinsing, storing and labeling
4. Sample handling and transport

Data Check and Quality Control

1. Data checking
2. Quality Control procedures (QC charts, handling data that do not meet QC standards)

Data Entry

(see SOP 24: Data Management)

1. Use of datasheets
2. Database protocols (on Tablet PC and in the office)

GPS

1. Using Trimble GPS units (see SOP 12: Using the GPS)
2. Trimble GPS training (Alaska Regional Office Training Program)

3. Collecting project-specific data (see Instruction Sheet "Trimble Data Collection")

Practical Testing

Field training is critical for developing the skills and confidence that observers will need to be successful. Observers will be tested by performing a mock sampling event at a nearby lake ecosystem. The newly trained observers will be required to demonstrate proficiency in each aspect of the protocols.

1. Briefly review what water quality parameters do and do not tell us about the resource
2. Review safety considerations
3. Review the monitoring procedures the observers will be using
4. Demonstrate the procedures
5. Observers practice the procedures until they are comfortable with them, and trainers are satisfied
6. Summarize monitoring steps
7. Observers and trainers do a monitoring run-through at a local lake, including data check and entry. Results are compared and discussed. Objective is to ensure that similar observations and results are obtained by all teams and that, to the extent possible, discrepancies are resolved before they are discovered in a remote field situation.
8. Answer final questions and concerns regarding field procedures.
9. Return to lab and review lab procedures and data entry, including data check procedures. Project manager reviews results with field crew personnel to ensure consistency and that any discrepancies are resolved and required modifications to the SOP can be made prior to actual field work.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #10: Field Trip Mobilization

Version 2.0 01 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	03/17/2010	H. Kristenson	Added pack list and SOP references	A pack list was developed and calibration instructions incorporated into an existing SOP.	1.1
1.1	10/01/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides instructions for preparation of all supplies, equipment, and personnel for each field trip made during the monitoring season. Sampling trips are multi-day missions in remote sites and hence require forethought and careful planning to ensure all parameters can be appropriately sampled or measured safely. The monitoring season runs from the spring break-up until mid-September, or when the lakes begin to freeze.

I. General Preparation and Review

1. Coordinate field transport. This includes helicopters, trucks, boats, and float planes. Consider the location and nature of the lakes to be sampled to determine the optimum combination of transportation modes. This may also affect communications.
2. Copy the equipment list shown in SOP 1: Field Season Preparation. Also refer to the Pack List.
3. Inspect all sampling equipment for damage, dirt, etc. Check off each item as it is packed to verify that all required items are packed.
4. Pack a satellite phone and telephone number directory and park radio with sufficient batteries.
5. Check equipment batteries including GPS, YSI Sondes, Tablet PC, SpeedTech, radios, and digital camera; replace if expired and carry extras.
6. Calibrate and adjust all field equipment as necessary. Perform diagnostic tests on each, according to the manufacturer's instructions, to ensure each piece of equipment is functioning properly.
7. Calibrate the multi-probe unit in the lab. See Instruction Sheet "Calibrating Sondes" for details.
8. Pack equipment and supplies (food, camping equipment) in containers compatible with the planned modes of transportation.

9. Ensure that necessary regional and local maps, photos, and necessary GPS coordinates are accessible.
10. Each member of the field team will be certified in shotgun safety and counter-bear measures and other necessary safety training (according to federal agency standards). See SOP 9: Training Field Personnel for additional information.

II. Prior to Leaving the Office

1. Conduct health and safety review, per Health and Safety Plan (or equivalent). Review NPS policies and procedures for on-water work and backcountry first aid.
2. Verify first aid certifications. Make sure each field crew leader has current first aid and CPR certifications.
3. Make sure each crew member has read all relevant SOPs and completed necessary training (see SOP 9: Training Field Personnel).
4. Compile and review checklist of personal equipment and supplies.
5. Plan out all lines of communication. Establish a crew leader who is responsible for managing field operations. Establish a health and safety officer, potentially the same as the crew leader.
6. Hold a pre-trip field meeting to discuss the planned route and activities with all participants.
7. Establish field trip plan, including contingencies. Dates for pickup and drop-off of personnel and supplies must be established. The duration of the field trip will be determined based on the requirements of water sample preservation, on logistics of field support, weather forecasts, and personnel availability.
8. Submit trip plan to park headquarters and appropriate park liaisons (chief of resources, inventory and monitoring coordinator etc.)
9. Review SOP 11: Daily Field Startup and verify that all preparation has been completed.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #11: Daily Field Startup

Version 2.0 14 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/14/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides step-by-step instructions to prepare for daily field activities as part of the Shallow Lake sampling program in the Central Alaska and Arctic Networks. This procedure is carried out before the start of each sampling day.

I. Procedures

The following preparations should be made in base camp before departing for a day of sampling.

Evening Before Sampling Day

1. Assemble the field crew to talk through the desired agenda for the sampling day.
    a. Lakes and stations to be sampled
    b. Crew assignments
    c. Sequence of sampling
    d. Special conditions associated with the locations to be sampled. Alert all personnel to any environmental or safety issues: wildlife of concern such as bears, sensitive nest areas to be avoided, ice or high wind conditions that may complicate field work.
2. Plug in electronics to charge
    a. Tablet PC
    b. Trimble GPS unit
    c. Rechargeable camera batteries (if necessary)
3. Inspect all sampling equipment for damage, dirt, etc.

4. Check that the raft is in good working order and PFDs are available for all personnel.
5. Prepare Water Chemistry bottle kits for each lake to be sampled.
6. Ensure that the YSI MDS has been downloaded and there is adequate space for the files to be collected during the sampling day.
7. Prepare the Map Packs and other navigational aids to be used for sampling.

Morning of Sampling Day

1. Assemble field equipment required for each individual sampling activity to be performed.
    a. Review check lists for establishing benchmarks, measuring water level, water quality sampling, vegetation sampling, macroinvertebrate sampling, and general supplies.
2. Check function of all meters to be used.
3. Check the batteries for equipment including GPS, Sondes, Tablet PC, and digital camera; replace if expired and carry extras.
4. Perform daily calibration check on water quality multiparameter meters.
5. Pack all gear into dry bags/backpacks for transport to lake.
6. Prepare cooler with ice packs/dry ice for storing samples throughout the day.
7. Establish safety communication plan if the crew is to be split to work in separate locations.
    a. Check function of 2-way radios and agree on channel to be monitored.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #12: Using the GPS

Version 2.0 25 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/25/2010	H. Kristenson	Updating protocols to reflect to current hardware and software. Document format change.	New Trimble GPS units and software have been purchased since the previous version of the SOP. Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP explains the procedures that all observers should follow to learn how to use GPS units to collect spatial data and navigate to locations. For detailed instructions on collecting and attributing specific features using Trimble GPS units, refer to the Instruction Sheet "Trimble Data Collection".

I. Trimble GPS Units

The Shallow Lakes project currently owns a Trimble GeoXT 2008 series GPS unit. This is the primary unit used for field work, but when multiple crews are deployed in the field, it may be necessary to borrow Trimble GPS units from other projects or from the Alaska Regional Office of the National Park Serivce. Some of these units may be different model types, but as long as they have comparable accuracy ratings to the GeoXT and use the same version of TerraSync software as is installed on the Shallow Lakes Trimble unit, it should not be a problem to use these different model types. Acceptable models currently include the Trimble GeoXT 2005, GeoXH 2005 or 2008, and ProXT with a Recon data recorder.

Trimble software programs used for this project include TerraSync for the GPS units, and Pathfinder Office for desktop applications involving data collected on Trimble units. These programs are subject to frequent updates, and it is important to keep current software installed both on the GPS units themselves and on the desktop computers that will be used to process the data. In some cases, updates effected in the TerraSync software require that Pathfinder Office software also be up-to-date in order to process the data properly. It is generally not a good idea, however, to update software mid-season. The Trimble software should be updated before the start of the field season, and then the same software versions should be used throughout that season to ensure that all data is collected and processed in the

same manner. Any Trimble units borrowed from other sources should be checked to make sure that is running the same version of TerraSync software as is being used on the Shallow Lakes Trimble unit.

User guides and detailed manuals for each Trimble product are available online at the Trimble website (www.trimble.com). Contact the NPS Alaska Region GIS program if in doubt of the appropriate software versions, for recommendations on the most appropriate settings, or to borrow equipment.

Receiver Configuration

There are settings on the Trimble GPS units that can be customized, some of which are critical to the correct collection of data for this project, and others that only affect display and are mainly a function of user preference. It is essential that all Trimble GPS receivers are configured with the same critical settings before being used for this project. Receiver configuration files can be created to help with this; once the settings are determined, they can be exported as a configuration file, which can then be loaded onto any other Trimble GPS units being used for this project. Configuration files should be stored on the CAKN network drive: J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\Configuration Files. To configure a Trimble GPS unit, refer to the Instruction Sheet "Trimble Receiver Configuration".

Scheduling Field Days

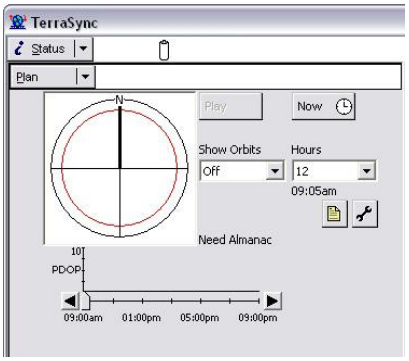
For your GPS unit to function properly and collect accurate geographic locations, there must be at least 4 satellites overhead and preferably more. In addition, PDOP (the measurement of relative accuracy) must be less than 6. If possible, fieldwork should be scheduled at a date and time when the PDOP is <6 and the number of available satellites is $\geq$ 4, but in reality the Shallow Lakes project does not generally have the luxury of planning field data collection around satellite availability.

Trimble Planning

To check on projected satellite status during field data collection, use the Trimble Planning software included in the Trimble Office package (it installs along with Pathfinder Office). This accesses data on the signal quality and availability of satellites using an Almanac downloaded from Trimble, and displays graphics for easy visualization of the best times for GPS data acquisition. For detailed instructions on using Trimble Planning to examine satellite conditions, refer to Instruction Sheet "Using Trimble Planning".

Short-Term Planning

It is possible to view the current Almanac on the actual GPS unit as well. Open TerraSync on the unit, and select *Status* from the drop-down menu in the upper left corner. By selecting Plan in the lower menu, you can display the PDOP and availability of each satellite for up to 12 hours. This may be helpful if you are already out in the field and have some flexibility in the planning of the schedule for the current field day.



Data Collection

Specific data is collected for a variety of features sampled in the Shallow Lakes monitoring program. The spatial information collected with the GPS is attributed with details about the data being collected

at that point, and each different feature has a data form that is filled out with the appropriate information. For details on collecting points and attributing features, refer to the Instruction Sheet "Trimble Data Collection". The digital forms used for attribution, which are called "Data Dictionaries", are created before going to the field, and are standardized for consistency in data collection.

Data dictionaries must be loaded onto Trimble GPS units being used for data collection, as described in the Instruction Sheet "Trimble Data Dictionaries". It is very important to ensure that the most recent version of the data dictionaries being used are loaded onto each GPS unit before sending crews to the field to collect data. The master versions of data dictionaries are kept on the CAKN network drive: J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\Data Dictionaries. Previous versions of data dictionaries are moved to a folder labeled with the appropriate year.

The Shallow Lakes project uses three different data dictionaries: Lake_Depth, Lake_Mon, and VegMat. The Lake_Depth data dictionary is used for collecting data while out on the water, including bathymetery measurements, Secchi depth entries, vegetation patches, location of water samples, and any comments noted while out on the water. The Lake_Mon data dictionary is used for reference markers, including the location of benchmarks, and reference points for specific photographs. The VegMat data dictionary is for the entry of data collected during vegetation profiles.

Data dictionaries can be created and edited either by using the Data Dictionary Editor included in Pathfinder Office, or in TerraSync on the GPS unit. It is generally easiest to create or edit data dictionaries before the start of the field season, using Pathfinder Office software, but in some cases, changes will need to be made to data dictionaries while out in the field. Errors may occur when data dictionaries are loaded onto Trimble GPS units; a common error is that range values for numeric fields are all changed to 0, which prevents any numeric data from being entered. If you are in the field, and find that a data dictionary requires editing, or if you need to create a new data dictionary, these functions can be performed in the field directly on the GPS unit. Refer to Instruction Sheet "Trimble Data Dictionaries" for details on creating or editing data dictionaries in either Pathfinder Office or directly in TerraSync.

Map Display

It is possible to display background files or data files in the Map window of the Trimble GPS units. The files need to be transferred to the unit using the Data Transfer Utility, as described in the Instruction Sheet "Trimble Data Transfer". Once the images or data files have been transferred to the Trimble GPS unit, they can be displayed in TerraSync as follows:

1. Select *Map* from the drop-down menu in the upper left corner of the screen
2. Click *Layers* and select *Background Files*
3. Select the desired background file(s) from the list by checking the appropriate box(es), then click the *OK* button
    a. It is also possible to view data contained in Data Files in the map view. To include Data Files in the list of available background files, check the box next to *Show Data Files* in the Background Files dialog.

Navigation

To navigate to a point, there must be a target coordinate. This can either be from a file captured by or loaded onto the Trimble GPS unit, or can be manually entered. These instructions are also detailed in the Instruction Sheet "Trimble Navigation".

Navigating to a File Location

1. Turn on the Trimble GPS unit, and open TerraSync
2. Select *Data* from the drop-down menu in the top left corner of the screen, and select *Existing File* from the lower drop-down menu
3. Highlight the file that includes the desired location, and click the *Open* button
4. Confirm the antenna height, then highlight the feature that will be the navigation target
5. Click the *Options* button, and select *Set Nav Target*
6. Confirm the feature to be selected, which will then be marked with a navigation icon
7. In the upper drop-down menu, select *Navigation*
8. The navigation screen displays the bearing, heading, distance, and turn, allowing navigation to the feature
9. To de-select the navigation target, click the *Options* button and select *Clear Nav Target*

Entering a Navigation Target Manually

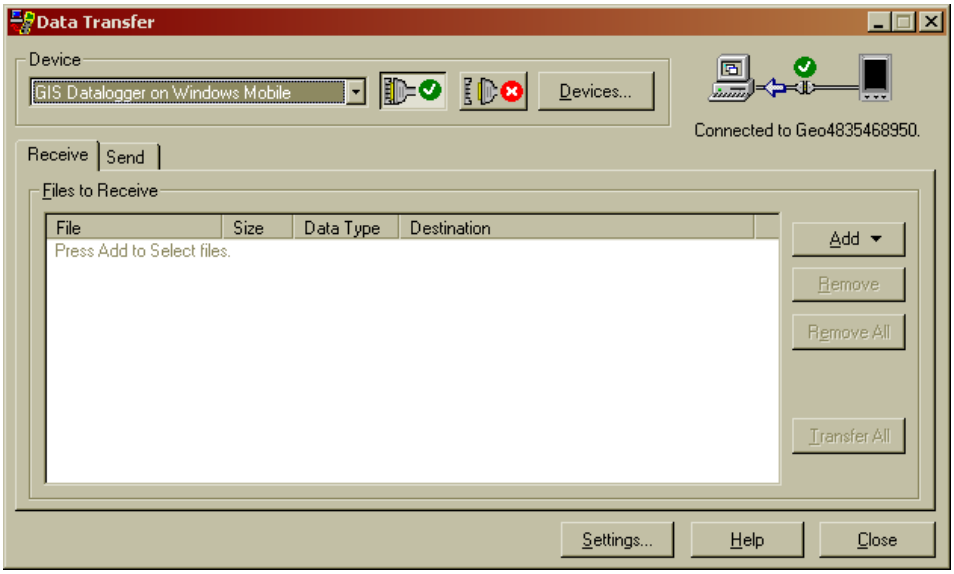
1. Turn on the Trimble GPS unit, and open TerraSync
2. Select *Navigation* from the drop-down menu in the top left corner of the screen, and select *Waypoints* from the lower drop-down menu
3. Click the *New* button, enter a file name, and click *OK*
4. Click the *Options* button, and select *New*
5. Enter a name, the latitude and longitude, and the approximate altitude, and click *OK*
6. Several waypoints may be entered into the same waypoint file, which can be convenient if entering multiple locations to be visited.
7. Select the desired waypoint, click the *Options* button, and select *Set Nav Target*
8. Select *Navigate* from the lower drop-down menu to display the bearing, heading, distance, and turn, allowing navigation to the waypoint.

Data Transfer

In order to properly transfer data between computers and Trimble GPS units, Microsoft ActiveSync and Pathfinder Office must be installed on the computer. It is also important to ensure that the versions of TerraSync on the Trimble GPS units and the version of Pathfinder Office on the computer are compatible. In some cases, certain functions become incompatible if one form of software is updated and the other is not. This information is also available in the Instruction Sheet "Trimble Data Transfer".

1. Connect the Trimble GPS unit to the computer
    a. Place the Trimble unit on its cradle, and connect the cradle to the PC with a USB cable
    b. Microsoft ActiveSync must be installed on the PC for recognition of the Trimble unit. Note that the ActiveSync need not be configured for use; cancel out of the Pocket PC Sync Setup Wizard when prompted.

2. Open Pathfinder Office on the computer, select the appropriate Project, and select *Data Transfer* from the *Utilities* menu.
3. Check that the Device field is set to *GIS Datalogger on Windows Mobile*



Transferring Data from Computer to Receiver

1. Select the *Send* tab in the Data Transfer window, and click the *Add* button
2. Select the file type (Data File, Data Dictionary, Waypoint, Background, Configuration, Coordinate System, Coordinate System Export File, Other)
3. Navigate to the desired files and double-click individual files to add them.
   a. Many different files, even files of different types, can be added into the *Files to Send* list in the Data Transfer window.
   b. The *Add* button can be clicked repeatedly to add many different files from different folders or locations to the list.
   c. To add several files from one folder at once, the Ctrl button can be held down while each of the desired files are selected.
4. Once all files to be transferred have been added to the list, click the *Transfer All* button

Transferring Data from Receiver to Computer

1. Make sure that the Project settings in GPS Pathfinder Office are appropriate for the data to be transferred. Data should be transferred one park at a time, and the Project should match the Park and the Year of data collection. If there is not an appropriate project, take time to create a project, as described in Instruction Sheet "Trimble Data Processing".
2. Select the *Receive* tab in the Data Transfer window, and click the *Add* button
3. Select the file type (Data File, Waypoint, Almanac)
4. All of the files of the selected type that are currently on the Trimble unit will be displayed in the Open window (the program automatically looks in GIS Datalogger on Windows Mobile)
   a. The files that have never been transferred will be highlighted
5. Select the files to be transferred (the Ctrl button can be used to make multiple selections)
6. Once all files to be transferred have been added to the list, click the *Transfer All* button

7. The files (.ssf) will be transferred into the project folder selected in step 1, and uncompressed versions of the data will automatically be backed up in the Backup folder for the selected project. It is very important to keep these backup files secure in the proper location, as they allow for the data to be re-accessed in the case of any type of corruption caused during transfer or future processing.

Processing Trimble Files

When Trimble files are transferred from the Trimble GPS unit to the appropriate project folders, they are in uncorrected .ssf format files. These files must generally undergo a series of processing to make the data useful and available. The detailed instructions for post-processing Trimble data files are available in the Instruction Sheet "Trimble Data Processing". The data files are first differentially corrected against proven base stations, using Pathfinder Office, and are then Exported into shapefiles for use in ArcGIS. In addition, the database files created during the creation of these shapefiles are very convenient targets for scripts written to import key data from the Trimble files into the Shallow Lakes SQL Server database, as described in the Instruction Sheet "Data Import: Trimble Files".

Icons

The following icons are key in understanding the GPS functioning:



Real-time WAAS: indicates that the GPS is picking up real-time corrections from WAAS satellites



Battery Power: shows the status of the battery life



Logging: shows that the GPS is logging positions, and how many positions have been logged so far. A pause sign will be displayed if logging is not active.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #13: Establishing and Marking Benchmarks

Version 2.0 30 September 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	02/2008	A. Larsen	Removed the use of permanent transects	Too difficult to carry out given the high variability among lakes.	1.1
1.1	03/17/2010	H. Kristenson	Updated protocol for preparing navigation aids and collecting GPS points	Changes in available imagery and GPS units.	1.2
1.2	09/30/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP describes step-by-step instructions for establishing and marking permanent monitoring plots within the Central Alaska and Arctic Networks. The steps in this SOP are followed for the initial establishment of the benchmark(s) for each lake and for the initial water quality monitoring. Notes, data, and photographs taken during this initial establishment must be sufficiently detailed to allow a different observer to relocate the benchmarks precisely for future sampling.

I. General Preparation

The following tasks should be completed in the office before the field season.

1. Identify all lakes to be sampled during the upcoming field season. Refer to SOP 7: Sampling Frame and Lake Selection, where the lake localities and mode of access can quickly be ascertained in the lake sampling schedule.
2. Once this list is compiled, locate the general locality of the lake and compile the necessary 1:63000 and 1:250000 topographic maps. The majority of topographic maps can be found in the natural resources department within each park. If you are unable to locate a particular map contact the map office at the University of Alaska Fairbanks.
3. Create Map Packs for all of the lakes on the sampling list. Map Packs consist of high-quality imagery and a topographic map. Each of the lakes on the sampling list should be included in at least one Map Pack, but there may be many lakes included in one Map Pack. See Instruction Sheet "Creating Map Packs" for detailed instructions.

4. Create a list of all of the sampling lake locations, including the latitude and longitude in Degree Decimal Minutes, and include the letter of the Map Pack with the best coverage for each lake. Print several copies of the list.
5. Download the lake localities into the Garmin eTrex and/or Trimble GeoXT. Forward a list of coordinates to the pilots who will by flying for the project so that they can enter them into the aircraft GPS units.

II. Navigating to Lake

1. Use the topographic maps, aerial photographs, and basic orienteering skills and equipment to get to the general location of the lake.
2. Once within the general vicinity of the lake, use the Garmin eTrex to find the specific lake locality. The Trimble GeoXT may also be used for navigation, but the eTrex is light and convenient, and not using the Trimble for navigation saves battery life as well as wear and tear to the instrument.

III. Installing the Benchmark

1. Visually assess the vegetation conditions surrounding the lake and select a location that is likely to be near the deepest part of the lake, a good sampling area (see below) and safe for entering the **w**ater or anchoring the floatplane. Once this has been done, unpack the field equipment. Minimize impacts along the lake margin by staging sampling gear in the riparian zone well above high water. Emergent vegetation surrounding shallow lakes in Alaska is extremely sensitive to trampling and is easily flooded. These effects can be seen months later. It is especially important to the long-term repeatability of the project that artificial disturbance along the transect lines be minimized because this type of sampling error may mask effects of natural change in the vegetation.
2. Use a round, domed benchmark monument that is pre-stamped with the name of the Park, the project, and the site identifier code. Attach this monument tightly to the end of a 0.5-inch diameter, fluted, aluminum stake so that it will be unlikely to come off. The appearance of these monuments is very similar to benchmarks used by USGS and others for marking permanent locations on the landscape. Inside the head of each 3-inch diameter monument is a magnet that will assist in future relocation efforts. Use a hard rubber mallet to firmly attach the monument cap to the stake, and to install the stake in the soil. In general, the monuments will protrude no more than 5 inches above the surface of the ground. Using a sharpie or other permanent marker draw a line around the fluted stake at the top of the vegetation mat. This will help future observers determine if the stake was heaved out of the ground.
3. Acquire the location of the benchmark using a Trimble GPS unit. See Instruction Sheet "Trimble Data Collection" for detailed instructions.
4. Photograph the benchmark and the relative location of the benchmark (refer to SOP 15: Photo-documentation for additional instructions) to assist future observers in benchmark relocation.

5. In the event that a permanent physical benchmark cannot be placed at a site, a carefully collected GPS point may be used for permanent reference. Ensure that the location is collected with a Trimble Geo Series GPS unit, or another unit with similar accuracy specifications.
6. After installation of the permanent benchmark, proceed to conducting the water level and water quality sampling.

IV. Equipment Required

- Monument cap with the site and program names engraved on it (one per benchmark)
- Stake to fit the cap (one per benchmark)
- Extra stake and cap (sometimes the caps do not fit the stakes)
- Trimble GeoXT GPS unit (or similar)
- Garmin eTrex (or similar)
- Hard rubber mallet
- Compass (1 per technician)
- Tripod or other elevation device for the GPS unit
- metric tape, a minimum of 100 meters length

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #14: Relocating Lake and Sampling Locations

Version 2.0 22 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	02/04/2008	A. Larsen	Modifications to reflect changes in vegetation and macroinvertebrate sampling	Sampling has been streamlined.	1.1
1.1	10/22/2010	H. Kristenson	Removal of references to permanent transects. Document format change.	Permanent transects are no longer used for sampling. Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides step-by-step instructions for relocating and navigating to lake monuments and established monitoring points on lakes being monitored in the Central Alaska and Arctic Networks. Since the sampling protocols are dependent upon relocating the benchmark, it is critical to carefully assemble and organize all materials that will aid in this process.

I. Field Preparation

The following steps should be accomplished before the start of the field season.

1. Identify all previously sampled lakes to be reseampled during the upcoming field season. Refer to SOP 7: Sampling Frame and Lake Selection for information regarding sampling lake localities and mode of access.
2. Once this list is compiled, determine the general locality of the lake and compile the necessary 1:63000 and 1:250000 topographic maps. The majority of topographic maps can be found in the natural resources department within each park. If you are unable to locate a particular map contact the map office at the University of Alaska Fairbanks.
3. Locate or create Map Packs, which consist of a high-quality aerial photo or satellite image along with a topographic map, for each lake to be revisited. Refer to Instruction Sheet "Creating Map Packs" for detailed instructions on creating new Map Packs.
4. Ensure that all maps and imagery are housed in a waterproof covering (plastic zip bags or lamination).

5. All field staff should read the most recent previous field notebooks and trip reports referenced in the ShallowLakes database. Be sure to review all notebooks, photographs, and transect descriptions from previous surveys, if available, to identify any unique events that may have been encountered. These notes may suggest additional equipment or discuss unusual environmental issues that need to be considered before revisiting the site. These resources may provide observers with useful information regarding site logistics and other information that may influence the site revisit.
6. Create a list of all the lakes to be sampled, including information about the monument location at each site. Detailed notes regarding monument position, along with the latitude and longitude, can be found in the tblPonds table in the Shallow Lakes database. Make several copies of this list to take to the field, making sure that there is at least one per crew and one per pilot.
7. Print and laminate copies of key digital images from previous lake visits. Images that show distinctive features, particularly those associated with the monument location, can be extremely helpful in locating the benchmark.
8. Download the monument locations into the Garmin and Trimble GPS units to be used for navigation. See SOP 12: Using the GPS for more information.
9. Organize all of the assembled materials by lake. It is critical that all this information be carefully labeled and organized to facilitate relocating the lake.

II. Procedures

1. Although the Trimble GPS units are excellent logging and attributing accurate spatial data, they can be cumbersome to use for navigation. As such, it is easier to use a small Garmin GPS unit to navigate to the vicinity of the monument, and then use the more accurate Trimble GPS for the final location of the monument if necessary. This has the added benefit of saving wear and tear and battery life on the more expensive Trimble units.
2. Navigate to the Lake monument coordinates and locate the benchmark, using the topographic maps, aerial photographs, GPS units, and site photographs
3. When approaching the general area of the monument, walk slowly and deliberately. . If there has been a permanent survey benchmark installed, often it is visible from some distance, and can be located without the use of the Trimble GPS unit. If no permanent benchmark has been installed, or if the benchmark has been disturbed or removed, use the Trimble GPS unit to navigate to the *exact* position listed for the monument. Check the accuracy readings of the GPS unit, and make sure that the unit has had sufficient time to accurately determine its current location.
4. Once the benchmark has been located, transects may be established as described in SOP 18: Vegetation Sampling and/or SOP 19: Aquatic Invertebrate Field Sampling.
5. Sample the lake as described in SOPs 15-21.

III. Equipment List

- Garmin GPS with spare batteries
- Trimble GPS unit with ample battery supply or recharging method
- List of all lakes to be sampled, including benchmark coordinates
- Map Packs with coverage for each lake
- Notes and photographs regarding benchmark location
- Topographic maps
- Compass

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #15: Documenting a Lake Using Digital Photography

Version 2.0 01 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	03/18/2010	H. Kristenson	Change in camera models and equipment list, addition of photo management and geotagging protocols	Changed to different camera models. Protocols reflect changes in field practices and software for data management.	1.1
1.1	10/01/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This Standard Operating Procedure (SOP) explains the methods for photo-documentation of shallow lakes. There is a set of minimum requirements for the photo-documentation for each lake. However, each lake is different, and creativity is encouraged in crew members (especially the Lead Technician for this SOP) in deciding the best ways to add to these minimum requirements.

I. Introduction

Photo-documentation functions to provide the following:

1. A graphical depiction of aspects of the vegetation mosaic and the landscape context of each plot.
2. A graphical depiction of any nearby features that might prove significant in understanding changes that potentially could occur within a plot, such as ecotones, potential sources of disturbance, and conspicuous landmarks.
3. After the first iteration of sampling, the images are an invaluable tool for accurately setting- up transects and relocating sample points, thereby increasing the accuracy and overall repeatability of our measurements.
4. Once out of the field, plot or quadrat photographs provide a way to 'revisit' a plot if questions arise during data entry or analysis – that is, if something seems amiss or unusual with some aspect of the data, the photographs provide the ability to assess whether this is a mistake, or that the plot truly was an "outlier" of some sort.

5. A method to actually analyze and graphically display apparent changes in the vegetation cover of a plot – sometimes a picture will capture changes that have occurred when other sampling measurements do not capture the change.

In general, one technician will be assigned the lead role for photo-documentation. Often other technicians will shoot some of the required photos, but the lead technician for this role is responsible for ensuring all required photos for the plot are taken, and any good photo opportunities to illustrate the overall sample layout or individual plots are utilized.

The project currently uses Canon Rebel EOS cameras (either XTi or XS) as the main camera, and small waterproof cameras (either Olympus Stylus 550 or Sony Cybershot TX5) for use in the raft for additional photographs.

II. Procedures

Responsibilities of the Lead Technician

1. Each observer must become proficient in the operation and features of the digital cameras prior to going into the field but a lead technician will be identified during training (SOP 9: Training Personnel) to be responsible for oversight of the photo-documentation procedures.
2. In particular, the lead technician will be skilled at the following functions of the camera: image resolution, image file size, zoom or wide-angle capabilities, the 'stitch' feature that allows multi-image panoramic photos to be stored and stitched together, and the 'macro' feature. The lead technician also makes sure that the photo-log is completely and correctly filled out.
3. The lead technician ensures the proper gear is assembled and packed for sampling trips (see equipment list below). He or she also ensures that a sufficient number of charged batteries and storage cards are brought into the field each day: spare batteries in camp are of little use.
4. The lead technician ensures that the equipment is well-cared for, and that the camera is stored in dry conditions during inclement weather.
5. The lead technician must be familiar with the methods, hardware and software required to download the images following a trip, and is responsible for recharging the batteries such that they will be ready for use during the subsequent field excursion (see SOP 22: Field Trip Demobilization).
6. The lead technician will make recommendations at the end of the field season about lessons learned and improvements to this procedure.

Shooting Photos

1. Take photos during the entire sampling process to document the entire sampling event.
2. Use a medium resolution format for photos. The typical file size of photos ranges between 400 KB – 2 MB. Rarely will you need to store images in the highest resolution format for routine photo-documentation. Because field excursions typically last for 10-days, do not exceed the storage capacity for images or some plots will go un-documented, which is not acceptable.

Aerial Photos

1. Keep a GPS track log for use geotagging aerial photos.

a. Set up a Garmin eTrex GPS to collect a track log. Navigate to the main screen of the GPS unit, select the Tracks menu, and verify that the Track Log option is set to "On". This will allow photographs taken from the air to be tagged with their GPS location.

b. Turn on a Garmin eTrex unit whenever airborne with a camera. If multiple cameras are being used on different flights, either one unit can be used for all travel (the unit is left with the aircraft at all times), or each camera bearer can have a different unit. If there are different units being used for different cameras, care should be taken to keep the same GPS unit/camera pair consistent for all days in the field, in order to limit problems with matching GPS coordinates to photos.

c. At the start of each sampling day, navigate to the Main Menu page, where the time/date is indicated including seconds, and take a picture of the GPS unit with the camera used for aerial photography. If multiple cameras are being used with the same unit, take a picture of the unit with each camera. If multiple units are being used, make sure that an identifying mark is also captured in the photo (i.e. for the ARCN eTrex units, include the label including the unit number written on the top of the unit).

2. When approaching a sampling lake from the air, take a picture of a sketch map or datasheet labeled with the lake name before taking any photos.

3. Take photos of the lake from the window of the plane or helicopter at an elevation that allows the entire lake to be captured in one photo.

4. Take photos of any inlets/outlets, thermokarst, and important or unusual features.

Site Photos

1. At the first sampling site of the day, start the Trimble GPS unit, and double-click on the date and time line on the start page so that the time is displayed to the second. Take a photograph of the unit so that the time is clearly visible in the image.

2. Collect the monument feature at the site using the Trimble before taking any pictures.

3. Photograph each macroinvertebrate/vegetation transect from the shore towards the center of the lake, making sure to frame the tape so it is as visible as possible. If the macroinvertebrate transect is laid out perpendicular to the vegetation transect be sure to carefully document the relationship between the two transects. If possible, take a photograph of each vegetation transect from the end back towards the upland.

4. Photograph all vegetation communities that occur along the vegetation transect.

5. Photograph the site benchmark monument(s) from above and obliquely. Frame the pictures so that they will be useful in aiding future technicians to find the monument during subsequent sampling iterations, especially if it is located in dense brush.

6. Photograph each nested frequency quadrat. Position the camera to maximize the resolution of the vegetation in the quadrat. The easiest way to do this is to hold the camera high over the

quadrat and point it downwards. Make sure you frame the image so that all 4 corners of the quadrat and its entire area are documented.

7. If possible, take two to four photos at some distance from the vegetation transect showing the landscape context and vegetation mosaic in the vicinity of the transect. The distance and direction of these photographs will obviously be dependent upon what aspect gives the best overall picture of the area. These photos are not required but are highly recommended if the opportunity is available.
8. Opportunistically shoot photos that illustrate the lake, individual quadrats, or interesting plant species. Images that illustrate the lake in a large panoramic vista are useful; also opposite-facing slopes close to, or above the site area are often excellent vantage points to get useful images of the site, with the tapes laid out and a quadrat in place.
9. Take a series of photos that capture the entire lake, which can be stitched together into a panorama.

Geotagged Photos On-Site

When on-site at a lake, there may be specific features that should be geotagged. The presence of a rare plant, an unusual landscape feature, or other specific features can be documented by a photograph including geographic location information. Use the Trimble GPS unit to record the location of the photograph as follows:

1. Start the Trimble GPS unit, and double-click on the date and time line on the start page so that the time is displayed to the second. Take a photograph of the unit so that the time is clearly visible in the image.
2. Start TerraSync if necessary, and open the monument file created for that sampling site. If no monument file exists, create one. Use the lake number followed by an "m" for the filename, and select the Lake_Mon data dictionary (see Instruction Sheet "Trimble Data Collection").
3. Select PhotoPt from the Feature Name column, and tap the Create button.
4. Enter information about the photo, check that sufficient positions have been collected for the feature (at least 5 positions), then tap OK to close the feature.
5. Take a photograph of the item or feature.

III. Downloading Digital Cameras

All of the various cameras used for this project should be downloaded in the same manner: the camera should be treated as an external drive. Do NOT use any of the proprietary software that is provided with the cameras, as they alter the date/time stamp. This makes cataloging the photos more difficult. Photos can be downloaded using one of the following methods:

1. Use the cable provided with the camera to connect the camera to a USB port on the computer. Open the My Computer window of Windows Explorer, and scroll down to the "Scanners and Cameras" section of the window (Figure 1). Double-click on the Camera, and copy the files. Paste them into an appropriate storage folder (either the final destination, as outlined in Section

IV, or in a folder on the field computer, as outlined in the Instruction Sheet "Field Data Backups").

2. Use a card reader to treat the memory card as a jump drive. Again, simply copy and paste the photo files into the appropriate folder.

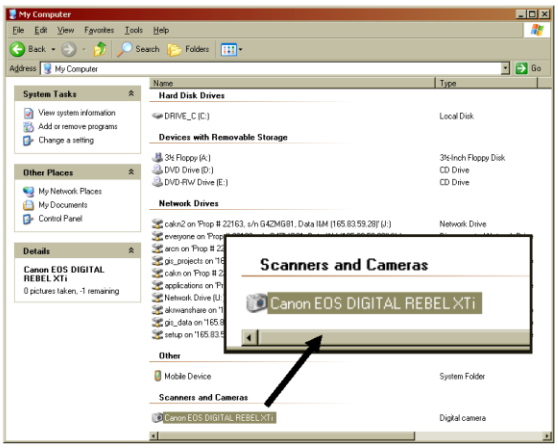


Figure 1. Screen shot of Scanners and Cameras section

IV. Photo Storage and Management

Organization on Disk

The photographs taken for the Shallow Lakes project are stored on the CAKN network drive in the folder J:\Monitoring\Water_Quality_Macroinvert\Photos\Photos. Within this folder, there is a folder for each year (see Figure 2).

For each year, there should be a folder for each park in which photos were taken. Within each park folder, there should be a folder named LakeSites, with a subfolder for each lake site, labeled with the site name (i.e. WRST-001). Take care when labeling the folders, as the labels can be used for automatic metadata generation, and it reduces future processing time if the labels are correct. If there are several sampling trips in one park, additional folders can be added for each trip for general camp, scenery, travel, etc. photos specific to that trip.

Sort the photos by lake site, including aerial and all on-site photos, and move them into the folders labeled with the lake numbers. Be sure to *move* the files rather than copying them into these lake folders; copying just takes up space and causes confusion with cataloging later on. For photos of lakes or locations other than sampling sites, create an appropriate folder (i.e. Camp_Photos, Aerial_Photos, etc.), and store it in the root park folder, or under the sampling trip folder if appropriate. If editing is required, retain the original unedited, and save changes into a file clearly marked as edited.

Select any photos to be geotagged for use in ArcGIS, Google Earth, etc., and save a copy in the GIS folder for the appropriate park (J:\Monitoring\Water_Quality_Macroinvert\GIS\PARK\GPS_Photo_Link). A subfolder should be added for each year, and there needs to be a separate folder for each group of photos to be processed into one GPS-Photo Link shapefile. The originals should all be maintained in the Photos folder; all photos used for geotagging should be copies.

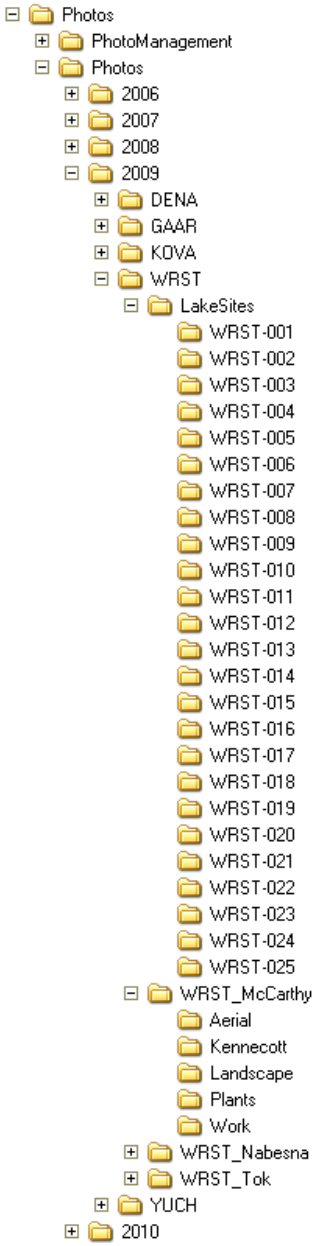


Figure 2. Organization of Photo Folders

Extensis Portfolio Software

The photo management software Portfolio 8.5 from Extensis is currently being used for photo management. The catalog file is called ShallowLakes.fdb, and is stored in J:\Monitoring\Water_Quality_Macroinvert\Photos. The protocol for using this software is for the Shallow Lakes project is detailed in Instruction Sheet "Using Extensis Portfolio". In the future, the software may be updated to an Enterprise version, but the basic cataloging protocols should not be greatly impacted. The differences will mostly be in processing speed and the ability to integrate SQL capabilities.

Photos should be downloaded and sorted into the appropriate folders on the network drive before they are cataloged. Once images have been cataloged in Portfolio, any changes to file location should be performed through Portfolio. This includes any changes to the structure of the file folders, any deletion of original photographs, and the movement of any photos from one folder to another. By performing these tasks through Portfolio, all cataloguing efforts are retained with the file or folders being moved, and it minimizes broken links within the catalog.

Once photos have been downloaded to their permanent location, they should be added to the catalog right away. Additional metadata (generally entered into custom catalog fields) can be added as time allows, but the images should at least be imported with the Park Unit field completed and "Shallow Lakes" listed as a keyword.

V. GPS-Photo Link

The software GPS-Photo Link GIS Pro, from GeoSpatial Experts, is used for geotagging photographs with GPS locations. The program requires that all the photos that will be processed together into one shapefile are housed together in the same folder. That folder should also include the eTrex tracklog, or the point shapefile from the Trimble GPS unit that will be used for assigning geographic locations. In addition, any photographs taken for the purpose of synching the time of the camera and GPS unit should be added to the folder. Note that if there was more than one GPS unit being used, keep the photos associated with each GPS unit in separate folders, along with the matching GPS file.

Photos used for GPS-Photo Link should be copies of the originals, and should be stored in the GIS folder rather than in with the rest of the photos (see Section IV for details). Detailed instructions for using GPS-Photo Link software are available in Instruction Sheet "Using GPS-Photo Link".

VI. Equipment List

- Cameras: one Canon EOS and one small waterproof camera for each team
- Spare storage cards (CF cards for EOS XTi, Olympus cards for Stylus, SD cards for all others)
- Battery chargers
- Cords for downloading
- Carrying cases
- Spare batteries
- Spare lens caps
- Lens cleaning cloths

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #16: Water Level Determination

Version 2.0 30 September 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	02/04/2008	A. Larsen	Modifications of the survey technique	Included bathymetry data and streamlined the survey techniques.	1.1
1.1	10/30/2009	H. Kristenson	Removed bathymetry	Bathymetry was moved to SOP 17	1.2
1.2	09/30/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP gives step-by-step instructions for measuring the water level of shallow lakes and ponds in the three National Park units in the Central Alaska Network (CAKN). This SOP describes the procedure for collecting data and entering the information into the database or onto a data form.

I. Procedures

General Preparation and Review

1. Before leaving for the field, assemble the following gear along with all necessary equipment listed in SOP 1: Field Season Preparation:
    - Survey Stadia Rod (metric)
    - Trimble GPS unit (as specified by SOP 12: Using the GPS)
    - Standard survey level and tripod, or Abney level
    - Tablet PC, backup Waterproof field forms, pencils
2. Review the surveying technique by reviewing this SOP in its entirety.

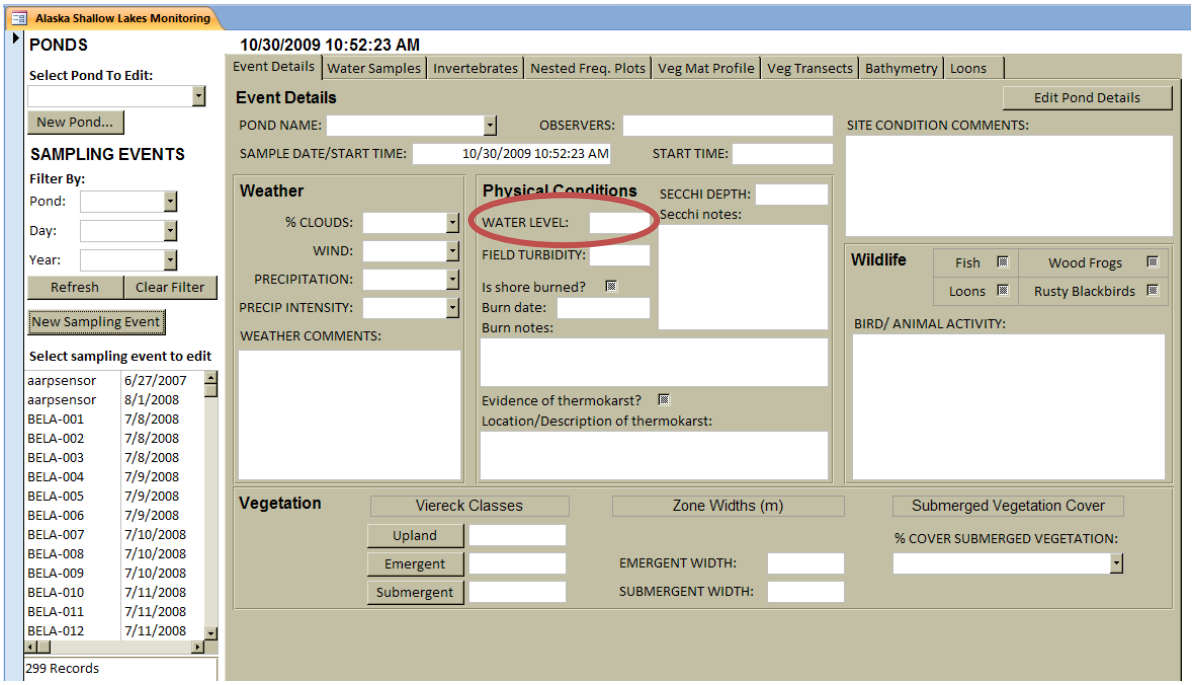
Lake Level Measurement

Lake level is measured along the longitudinal transect used for vegetation monitoring. This will be done using a standard survey (or Abney) level. The distance from the benchmark to the lake shore will dictate the exact procedure. If the distance is greater than 40 meters, turning points must be added. A turning point is an intermediate mark between two survey points. The goal is to minimize the number of turning points necessary to accurately measure the relative elevation of the water surface.

1. Locate the lake benchmark.

2. Have one observer set up the tripod at the lake monument so that the standard survey level is plumb and level. The first observer records the height of the survey level in cm (as measured at the center of the site) above the lake monument. The second observer (the "rod" person) stands at the lakeshore and rests the bottom of the survey rod on the lake surface at the edge of the water. The rod person, upon the instrument person's signal, moves the top of the rod back and forth while on top of the lake surface. The instrument person then reads and records the lowest value that the cross-hairs intersect on the survey rod. This eliminates potential error due to the rod not being held in the true vertical position.

3. The lake level relative to the benchmark is calculated by subtracting the height above the monument reading from the lakeshore reading. This is then recorded in the Lake Level field in the ShallowLakes database using the Tablet PC as shown in this screen shot:



4. If the Tablet PC is not available, the water level can be recorded on the front side of the Pond Data Datasheet.

Pond Data Sheet

Pond Name:	
Sample Date:	
Start Time:	
Observers:	

Latitude:	
Longitude:	
Elevation:	
GPS Type:	
Datum:	

Lake Description/Comments:

Continuously Monitored Site? **Y / N**

Hydro Regime:	
Hydro Class:	
Genesis:	
Shoreline:	
Salinity:	

Emergents: **Y / N**

Islands: **Y / N**

Precipitation:	
Intensity:	
% Clouds:	
Wind:	

Substrate Texture:

Weather Comments:

Site Condition Comments:

Birds/Animals:

Secchi depth:	
Water Level:	
Field Turbidity:	

Fish present? **Y / N**

Wood Frogs present? **Y / N**

Shore Burned? **Y / N**

Burn Date:

Thermokarst evidence? **Y / N**

Thermokarst location:

Map Lake Number:

Viereck Information:

	Type	Widths (m)
Upland		
Emergent		
Submergent		

Notes:

Shallow Lake Limnology Monitoring Protocol
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Standard Operating Procedure (SOP) #17: Water Chemistry Field Data, Bathymetry and Sample Collection

Version 2.0 30 September 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	02/05/2008	A. Larsen	Updated chemical analysis and filtration procedures to reflect a laboratory switch from Analytica to CCAL	Changed to a better, less expensive laboratory that focuses on ecological samples as opposed to water quality standards so we are able to get more analytes.	1.1
1.1	10/29/2009	A. Larsen, H. Kristenson	Updated field procedures	Included additional samples collected on behalf of the USGS. Other changes reflect the integration of new technologies (new GPS, datalogger and database protocols).	1.2
1.2	09/30/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides step-by-step instructions for collecting water quality data and water samples that will be analyzed by the laboratory for the three National Park units in the Central Alaska Network (CAKN). This procedure is carried out after the lake is located and before any biotic sampling has commenced. It is essential that the sediment remain undisturbed during the collection of these water samples. This SOP only describes how to collect and label the samples when at the lake. The procedures for filtering, titrating, analyzing, and preserving samples at the end of the day are described in SOP 21: Processing of Water Chemistry Samples.

I. Introduction

We will be monitoring the following variables:

- **Conventional water quality parameters** (which include temperature, pH, specific conductance, and dissolved oxygen – field measurement by multi-meter)
- **Water clarity** (Secchi depth)
- **Total Nitrogen** (TN - sample collected for lab analysis)
- **Total Phosphorus** (TP - sample collected for lab analysis)

- **Acid Neutralizing Capacity** (sample collected for lab analysis)
- **Total Dissolved Nitrogen and Phosphorus** (sample collected for lab analysis)
- **Base Cations and Base Anions** (sample collected for lab analysis)
- **Dissolved Organic Carbon** (DOC - sample collected for lab analysis)
- **Silica** (sample collected for lab analysis)
- **Chlorophyll-*a*** (sample collected for lab analysis)
- **Delta O18/Delta H2** (sample collected for USGS laboratory analysis)
- **Dissolved Inorganic Carbon** (sample collected for USGS laboratory analysis)
- **UV and SUVA radiation** (sample collected for USGS laboratory analysis)
- **Methane and Carbon Dioxide** (sample collected for USGS laboratory analysis)
- **Alkalinity** (sample collected for on-shore analysis)
- **Total hardness** (calculated from laboratory results)

Water quality sampling will generally occur only at the deepest part of the lake. In cases where replicate water samples are collected, sampling will occur at three disparate locations in the lake (designated as A, B and C). The Secchi depth will only be measured once at the deepest part of the lake, and samples collected for analysis by USGS are also only collected once per lake. The locations need not be extremely precise, but should be deep areas and the last areas to become exposed should the pond go dry. If multiple water samples are collected, they should be in deep portions of the lake, but also reflect the variability in the lake, including bays or regions with different physical characteristics, to the extent possible. The sampling locations will be recorded in the Trimble GPS unit. If in future visits the sampling locations are significantly altered this should also be noted; such changes will be an important indicator of conditions or natural variability in the lakes.

Although some ponds will be shallow enough to sample by wading, it is important that some form of boat be used in order to avoid disturbing the lake bed and distorting the water quality readings. Most shallow lakes will be bedded in fine sediments that are easily entrained in the water column. Once entrained, they can take a very long time to settle, greatly increasing the sampling time at each lake. In very small and shallow ponds, it may even be desirable for someone on shore to pull the water quality sampling person into position in order to avoid disturbing sediments by poling or paddling. (*For safety reasons, these ropes must NEVER be affixed to a person!*)

II. Raft-based Sampling Procedures

Boat and Sampling Gear Preparation

1. While one observer inflates the Alpacka Raft, the other labels all water sample bottles. Label bottles with the site ID, date, sample parameter and the initials of the sampler.

2. Assemble the water sampling gear: YSI Sonde and MDS 650, Secchi disk, Trimble or paper datasheets for recording bathymetry and Sonde readings, Depthmate depth sounder, methane sampling kit, and the following sample bottles:

    - 1 1L amber Nalgene bottle for grab samples at each sampling location on each lake

- 1 500mL translucent Nalgene bottle for TN/TP at each sampling location on each lake
- 2 iChem amber glass bottles for DOC, taken at one site
- 1 acidified serum bottle, taken at one site
- 1 non-acidified serum bottle, taken at one site
- 1 glass bottle for $^{18}O/^{2}H$, taken at one site

3. Load the gear into the Alpacka raft, and attach the Sonde and its handheld computer unit (MDS 650) to the rings on the front of the raft using the locking links attached to the instrument cords.

4. Don PFDs.

Bathymetry Data Collection

1. Paddle across the lake, taking at least 10 depth measurements and recording them in the Trimble GPS unit. See Instruction Sheet "Trimble Data Collection" for details on collecting spatial bathymetry data.

2. If size allows, make another transect across the lake perpendicular to the first, so that the lake has been bisected in 2 directions. Again, take at least 10 measurements. Note the deepest areas of the lake.

3. If the Trimble is not available for collecting bathymetry, the list of depths can be entered directly into the Bathymetry form in the database (without spatial data) on the Tablet PC, or noted by hand on a Sketch Map and later entered into the database.

Water Chemistry Sample Collection

1. Once the bathymetry measurements are complete, return to the deepest part of the lake and begin the water sampling procedure. Grab samples should always be taken from the deepest areas in the lake regardless of where previous samples were taken.

2. In cases where multiple water samples are collected, the Conventional Variables Data Collection and collection of Grab Samples will be performed at three sampling locations on each lake, while the Water Clarity and USGS measurements will only be performed once on each lake.

Conventional Variables Data Collection using the YSI Sonde

1. Make sure that the Sonde and the Sonde computer unit are each attached to a ring on the front of the raft, and put the Sonde into the water over the side of the raft once the boat is in the water. The instrument should extend 50 cm into the water when properly attached to the raft.

2. Turn on the YSI MDS 650 handheld computer unit, and select Sonde Run from the menu.

3. When in place at a sampling site, collect a bathymetry point using the Trimble, and enter the sample site ID (A in most cases, B or C for replicate sampling sites) in the sample number field.

4. Disconnect the Sonde from the boat, and hold it in the water so that the water surface is at the level of the first marking on the cable. Allow the readings to stabilize, and then select "Log one sample" from the 650 section on the Run screen. Select the appropriate site from the Site list, or add the site if it is not already present:

    a. Press the right arrow button to highlight "Configure", press enter, and select "Edit site list"

    b. Scroll down to an empty line, and add in the lake name (PARK-XXX) for the Filename; A, B or C for the Site name; and 1, 2 or 3 for the Site Number (1 for A, 2 for B, 3 for C). It is **very important** to include the Site Number, as this will be the only field that differentiates the different sites at that location. Most lakes will only have one site (A or 1), but for clarity this information should still be entered.

    c. Press Esc twice to return to the Site list menu, and select the appropriate site.

5. Press enter to log the sample to that file. The MDS will return to the Run screen, and "Sample logged" will flash in the top left.

6. Lower the Sonde to the next mark on the cable (increments are in 50 cm). Wait for the readings to stabilize, and then take another reading, saving it to the same file as the first. Continue to lower the Sonde 50 cm at a time, taking a reading at each level, until you reach the lake bottom. Do not take a reading if the Sonde is resting on the bottom.

7. Collect grab samples from the site as described below, then move to the next sample site on the lake (if replicate samples are to be collected), take another bathymetry point (designated with a Site Name), and take another profile, using the appropriate file (same lake name used as the Filename, but with a different Site Number).

8. If the readings at one location are considerably different from other readings in the lake (25% or more different) or appears anomalous for any reason, additional readings should be taken and notes written into the comment field of the tablet PC. Retrieve probe and affix the protective cup over the sensors when sampling is complete.

Grab Samples

After completing the conventional water quality parameter measurements at a site, collect the water for the water chemistry samples into one 1 L amber Nalgene bottle and one 500 mL translucent Nalgene bottle. These samples should be collected from three sites at every lake, in the same locations where the chemistry profiles were taken.

1. Rinse each of the bottles three times with lake water.

2. Fill the bottles full of water from approximately 50 cm below the water surface by reaching into the water until the container mouth is at 50 cm depth and opening it. Try to prevent floating vegetation or other large detritus from entering the bottles during filling. If the water is less than one meter deep, collect the sample from one-half the depth and record the fill depth on the data sheet and the sample bottles.

3. Fill the bottles completely and cap tightly prior to raising them to water surface. Avoid excessive agitation or prolonged exposure to air.

4. Once collected, samples should be kept cool and in the dark until filtration and preservation can be completed (SOP 21: Processing of Water Chemistry Samples).

USGS Samples

These samples are collected for laboratory analysis by the USGS. They are collected only once at each lake. The protocol for the collection of gases, DOC and ^{18}O was prepared by the USGS, and is summarized in Instruction Sheet "USGS Sample Collection".

Water Clarity

Water clarity (Secchi depth) measurements are taken only once at each lake.

1. Navigate to the deepest part of the lake.
2. Lower the Secchi disk into water until it just disappears. Read depth from calibrated line.
3. Once first reading is taken, lower the Secchi disk an additional 0.5-1.0 m.
4. Raise the Secchi disk until it just reappears. Read depth from calibrated line.
5. Add readings from step 1 and 2. Divide by 2.
6. Record the Secchi depth in a Secchi feature within the Trimble GPS Depths file. See Instruction Sheet "Trimble Data Collection" for detailed instructions. Be sure to record if the Secchi disk can still be seen on the lake bottom.
7. If the Trimble is not available for recording Secchi data, make a note of the Secchi Depth on the Pond Data Sheet, or record it directly into Events tab of the Shallow Lakes Database.
8. Clean the Secchi disk of all sediment and vegetative matter. Rinse with clear water prior to leaving the lake to avoid cross-contamination with other lakes.

III. Lakeside Sample Processing

Place the sample bottles in a dark-colored stuff-sack or dry bag, and store them in a cool location out of direct sunlight.

Upon returning to camp at the end of the day, begin processing by following the water filtration, titration, and analysis procedures outlined in SOP 21: Processing of Water Chemistry Samples. Samples should be analyzed as soon as possible after collection but can be stored at least 24 hours by cooling to 4 °C (39 °F).

IV. Decontamination

Instrument Cleaning and Storage

1. Be sure there are no bits of vegetation or sediment on Sonde prior to leaving lake.
2. If electrodes are fouled or dirty, gently clean with a moistened tissue or a soft brush.
3. During storage or transport, always use the calibration cup/cap or the storage cup filled with 1/4" of tap water or containing a wet sponge to protect the sensors from damage and drying out.

Cleaning Other Equipment

When finished filling sample bottles, rinse any other equipment not yet cleaned (including rafts, paddles, wading boots, etc.) with clear lake water to prevent cross-contamination between lakes.

V. Quality Control

Data Completedness

Before leaving the field site, data sheets will be checked for completeness and readability. Data sheets will be checked by a different field crew member than the one who filled it out. That person marks each page "checked", with their initials and the date.

Conventional Water Quality Parameters

The YSI Sonde multi-meter sensors for pH, conductivity and dissolved oxygen (DO) should be calibrated before leaving for the field, and then calibrated every few days while out in the field. If there are fluctuating or otherwise unexpected readings occurring, additional calibrations can be performed as necessary. On sampling trips where there are large changes in the barometric pressure, more frequent calibration may be required, particularly for the DO sensors.

Calibration procedures are detailed in the YSI Environmental Operations Manual, copies of which are kept in the lab, which is the primary reference for the following instructions for calibration. The steps for calibration are detailed in Instruction Sheet "Calibrating Sondes".

Grab Samples

1. Collect field duplicates in the course of repeat-sampling the duplicate lakes.
2. Once on each field trip, fill one set of lab sample bottles with deionized water as field blanks. Label them with a phony lake name and affix sample labels to the bottles. Enter the sample IDs on a field form set up for the phony lake; note that the lake is a blank on the field form.

VI. Equipment

General Equipment

2-way radios
Copy of SOPs 15, 21 and 30 and associated Instruction Sheets
Copy of YSI Sonde user manual
Tablet PC
Trimble GeoXT handheld GPS unit
Field forms
Sample labels
Sharpie pens
Alpacka raft
Raft pump
Raft patch kit
Paddles/oars
PFD
Speedtech depth sounder
Compass
Extra line
Deionized water

Conventional Parameters

YSI Sonde and MDS 650 handheld computer
Sonde connector cable marked in 50 cm increments
Sonde calibration check standards

Clarity

Secchi disk on line marked in decimeter and meter increments

Grab Samples

Sample bottle kit (supplied by laboratory)
3 1L polyethylene sample bottles
Black stuff sack
Cooler with ice packs or dry ice

USGS Samples

60 mL syringes with stopcocks
0.45 µm syringe filters (one for each lake, plus some extras)
Needles for the syringes (two for each lake, plus some extras)
Container for storing used sharps
2 serum bottles per lake
2 40 mL amber glass vials (iChem) per lake
1 60 mL glass bottle per lake

VII. References

EPA Method 415.1. Methods for Chemical Analysis of Water and Wastes.

Standard Methods for the Examination of Water and Wastewater (APHA), Method 4500-N.

Standard Methods for the Examination of Water and Wastewater (APHA), Method 10200-H Chlorophyll.

Standard Methods for the Examination of Water and Wastewater (APHA), Method 2120 Color.

Standard Methods for the Examination of Water and Wastewater (APHA), Method 2320 Alkalinity.

VIII. Supplemental Material

YSI Sonde Manual

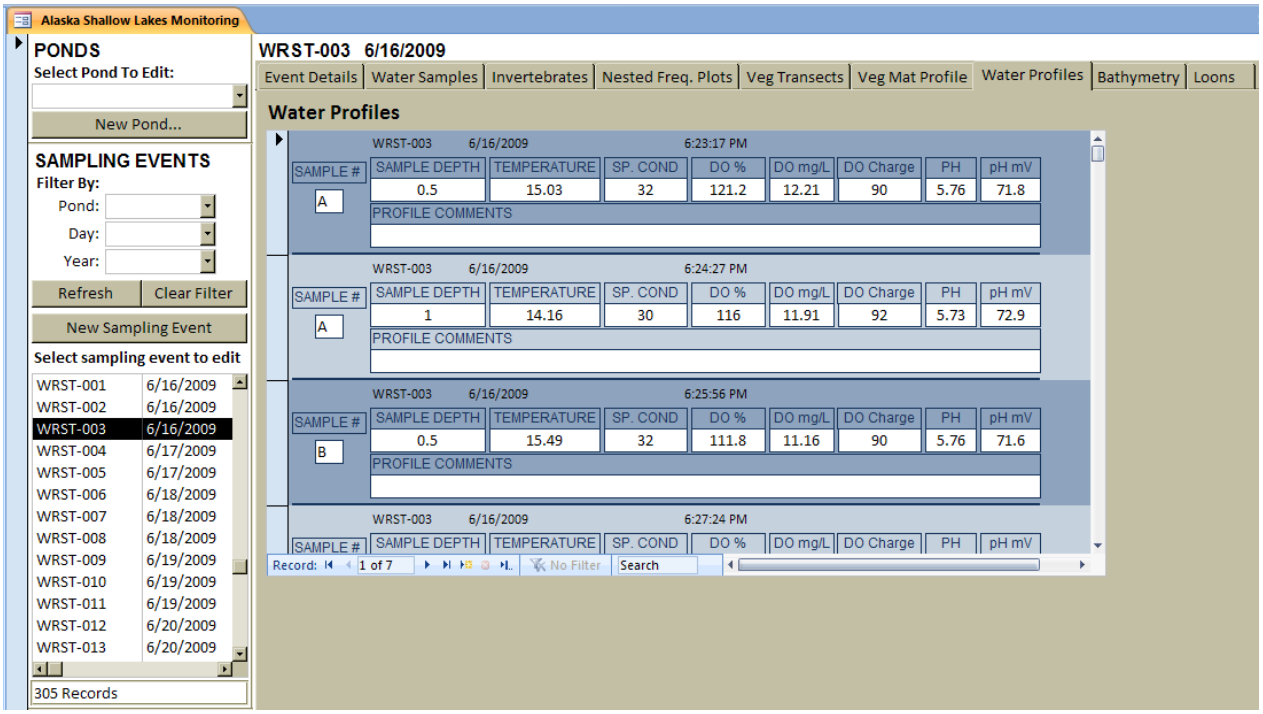
Extra copies are stored in the lab

Datasheets

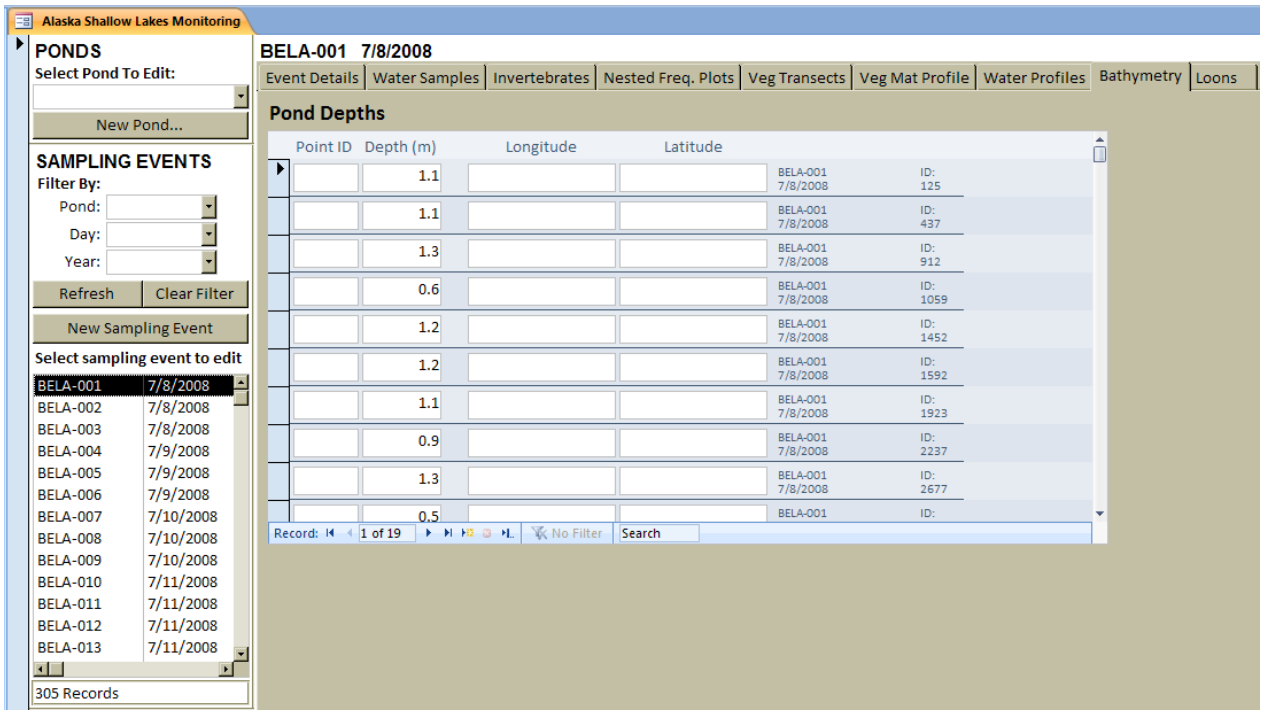
In 2008, a new Pond Data datasheet was developed, which includes on the back a section for filling in Sonde data by hand if necessary. This can be used as a backup in the event of technical difficulties with the MDS 650. It has not been amended for the inclusion of profiles.

Database

There is a form in the database (Water Profiles) that can also be used for manual entry of water sample data into the database in the event that the data cannot be recorded electronically in the YSI MDS650.



There is also a form in the database (Bathymetry) for manual entry of bathymetry data if the Trimble is not available. Fill in the depth field for each bathymetry measurement. The longitude and latitude fields can be left blank, and the Point ID is automatically generated.



Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #18: Vegetation Sampling

Version 2.0 01 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	02/05/2008	A. Larsen	Reduced the complexity of the sampling efforts	Vegetation sampling was too cumbersome and time consuming. Streamlined efforts.	1.1
1.1	03/22/2010	H. Kristenson	Added Tablet PC and Trimble GPS instructions	New database and GPS platform for data collection.	1.2
1.2	10/01/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides step-by-step instructions for sampling vegetation in shallow lakes under the Shallow Lake Monitoring protocol. Vegetation sampling is initiated once the lake has been located and the benchmark has been installed (SOP 13: Establishing and Marking Benchmarks). Most of the data for vegetation surveys is entered directly into the Shallow Lakes database using a Tablet PC, although Trimble GPS units and paper forms are used for recording some data.

I. Introduction

Vegetation is assessed along a set of three transects from the permanently installed lake monument at the edge of the upland habitat to one of any of the following: the open water zone, the point along the transect where vegetation represents less than 50% cover, or the point to which it is safe to walk without flooding your waders. Nested frequency plots and line intercept techniques will be used to assess vegetation structure, composition, percent cover and frequency along each of the three transects (Figure 1). Using this combination of approaches will allow monitoring of changes in spatial distribution of vegetation communities in reference to a fixed location (benchmark). We will also be able to monitor expansion or contraction of vegetation zones, and changes in species composition and frequency. As time allows we will also conduct rare plant surveys and survey for exotic plant species.

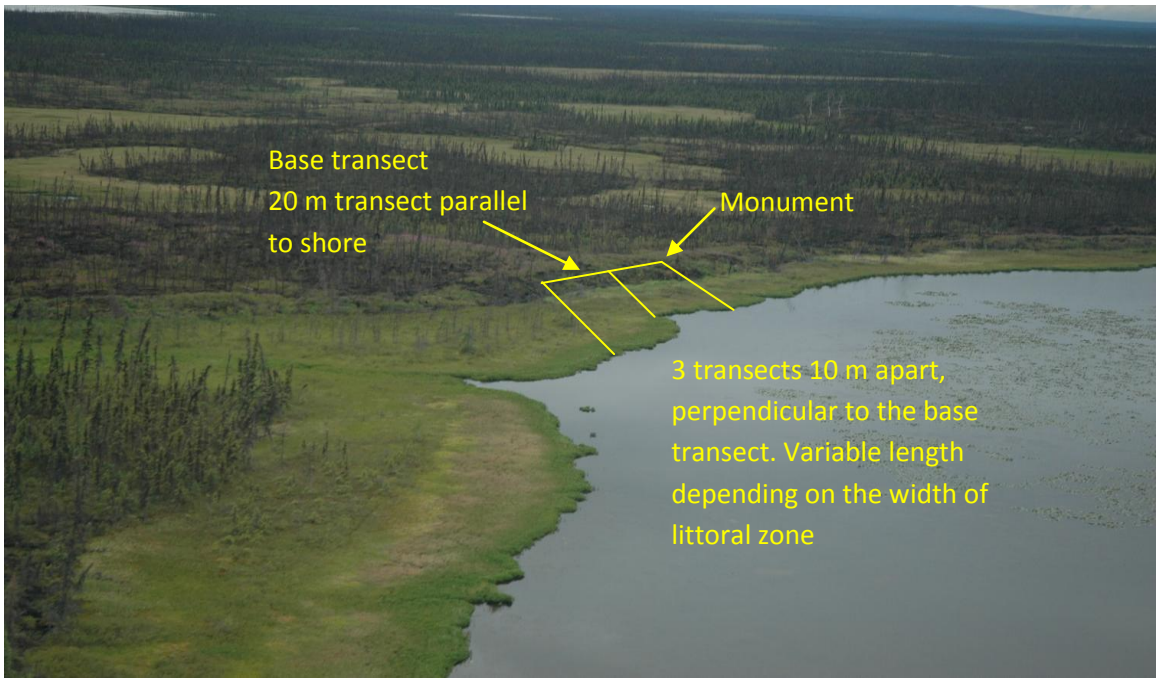


Figure 1. Layout for three wetland vegetation monitoring transects along the base transect.

II. Aerial Reconnaissance, Mapping and Photo Documentation

1. Once the crew has located the lake via GPS (see SOP 13: Establishing and Marking Benchmarks and SOP 14: Relocating Lake and Sampling Locations), the person responsible for vegetation sampling will sketch a map of the lake on a waterproof Sketch Map form and note the basic vegetation communities in the vicinity of the lake, documenting the wetland margin and any distinct vegetation patches. This can be accomplished by air or on foot. The map should include the emergent and floating vegetation in the lake and on its margins, as well as the near upland vegetation. Any areas of disturbance or suspected thermokarst, drunken forest or areas indicating low water should also be noted on the map.
2. During aerial reconnaissance, whenever possible, take photographs of the lake and the lake margin, thermokarst, and any indications of lake level (see SOP 15: Documenting a Lake Using Digital Photography)
3. Select a site for vegetation sampling. For monitoring lakes, this is also where the Benchmark will be placed (see SOP 13: Establishing and Marking Benchmarks). This is best done from the air but can be accomplished by foot when the lake is accessed via rivers or road corridors. Site selection is extremely important. The site should be on the main lake basin and if possible should be in a direct line to the deepest portion of the lake. The crew member responsible for collecting vegetation data will identify a small region of the lake that meets these criteria and that represents the most common wetland vegetation.

III. Vegetation Sampling

- Once the vegetation sampling plot has been identified, the crew will identify the position of the monument and/or install the monument as detailed in SOP 13: Establishing and Marking Benchmarks. The plot will be laid out using the four transects shown in Figure 1. Sampling gear should be deposited outside the plot to avoid vegetation trampling.
- Using the level IV Vierick et al vegetation classification system, define zones by visual estimates of plant type *cover* dominance, and enter the classes in the Sampling Events form in the Shallow Lakes database on the Tablet PC.
- Take photographs of the sampling site, as detailed in SOP 15: Documenting a Lake Using Digital Photography. Be sure to capture photos of the transects and the vegetated margin.
- Vegetation sampling consists of five different tasks in order:
    1) Transect Installation
    2) Maintaining a Species List
    3) Nested Frequency Plots
    4) Line Intercept Survey
    5) Vegetation Profile

Transect installation

(See Figure 1)

1. The base transect originates at the lake monument and runs parallel to the lake shoreline for 20 meters. It does not matter which direction the transect runs from the monument. The direction will be illustrated in photographs of the sampling site (see SOP 15: Documenting a Lake Using Digital Photography), and should be drawn on the Sketch Map or noted in the Sampling Events section of the database. This transect serves to separate the three transects where vegetation will be monitored.
2. Lay out the three vegetation monitoring transects. These transects run perpendicular to the base transect and are parallel to one another. The transects originate at 0, 10 and 20 m along the base transect (Figure 1). Take care while setting up and sampling the transects to always walk on the same side of the transect, and to minimize disturbance of vegetation.
3. From shore, photograph the vegetation sampling transect lines, showing their relative positions.

Maintaining a Species List

1. Keep a running list of all the plant species encountered during each visit at each lake. This list will be used to track uncommon taxa and any exotic species that might be seen and to add to the park species list. For each rare species encountered, record a detailed description in the Sampling Events notes field of the database on the Tablet PC about the habitat in which the plant was found including soil type, water depth, associated species, the size of the community and the approximate number of individuals in the area (abundant, rare etc.).

2. Collect representative samples of species present and especially for which identification is uncertain. Insert the specimen into a small plastic bag for storage and insert a label into the collection bag with the site ID, date/time, and collector's initials, along with any identifier that was used in data collection (i.e. carsp1). If the unknown taxa is encountered on succeeding days the identifier can be used for that taxa until the specimen can be identified/verified. Once the specimen has been identified the identifier should be replaced with the correct specific name. It is essential that all crew members be sure to track the use of unknown identifiers and ensure that they are accurately annotated.

Nested Frequency Plots

1. Open the Nested Freq. Plots form in the Shallow Lakes database on the Tablet PC.

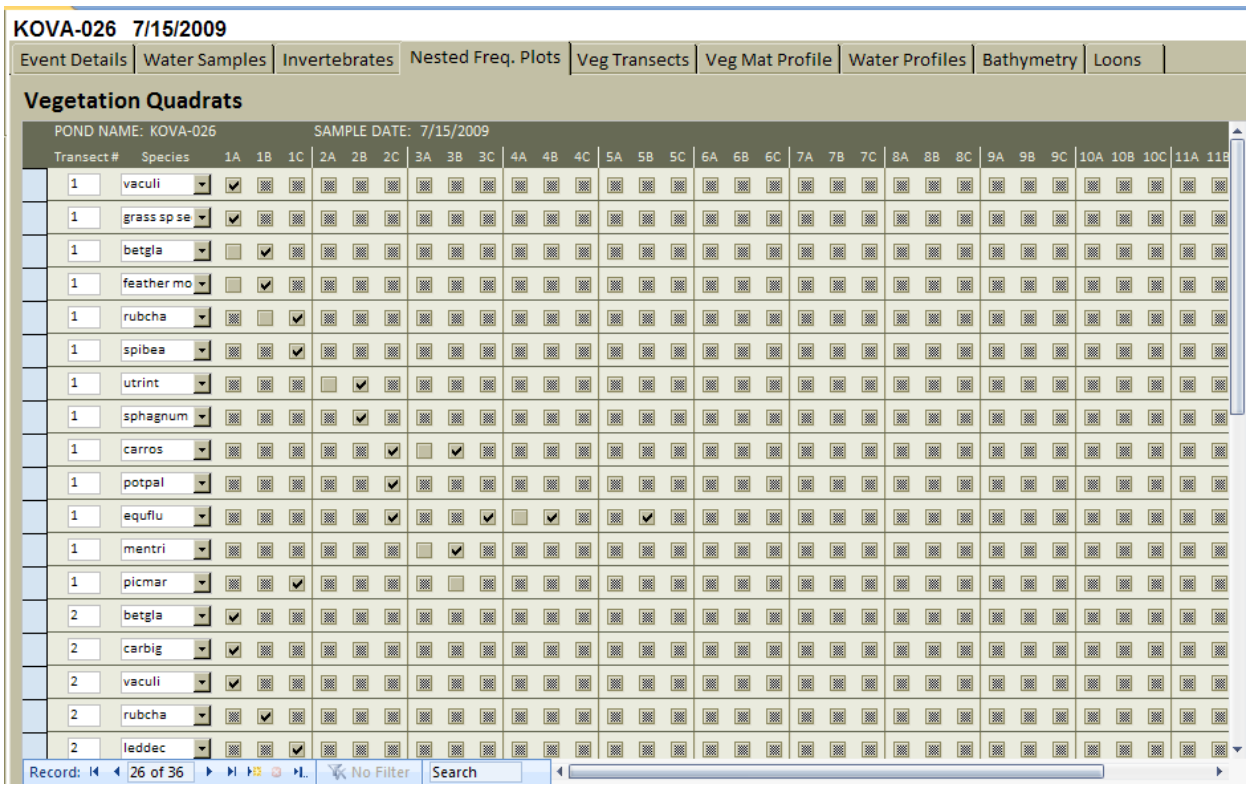


Figure 2. Screen-shot of database form used to enter Nested Frequency data

2. Assemble the PVC nested frequency quadrat according to Figure 3.

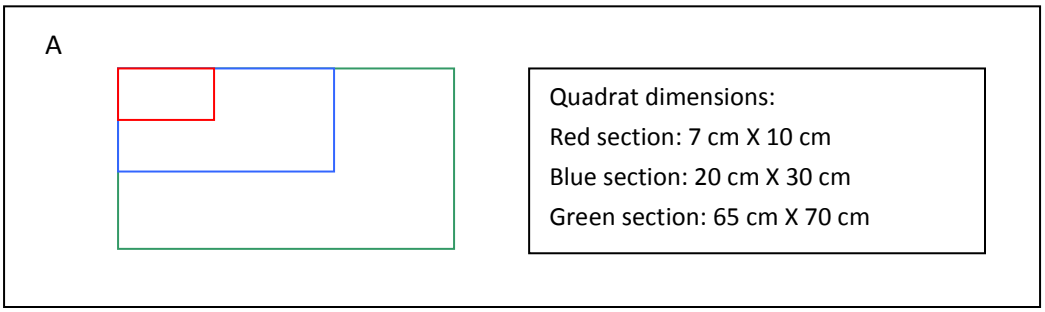


Figure 3. Screen-shot of database form used to enter Nested Frequency data

3. Nested frequency plots are completed every 4 m along each of the three transect (see Figure 4). The first measurement is taken with the quadrat corner at the start of the first transect tape (at 0 m on the tape), which is generally at the monument, and with the shorter side of the quadrat along the tape. Measurements are taken with the proximal corner of the quadrat (labeled A in Figure 3) at 0 m, 4 m, 8 m, 12 m, etc., until the water is too deep to sample or the vegetation ends. At each sampling point, place the quadrat perpendicular to the transect line and parallel to the elevation contour line.

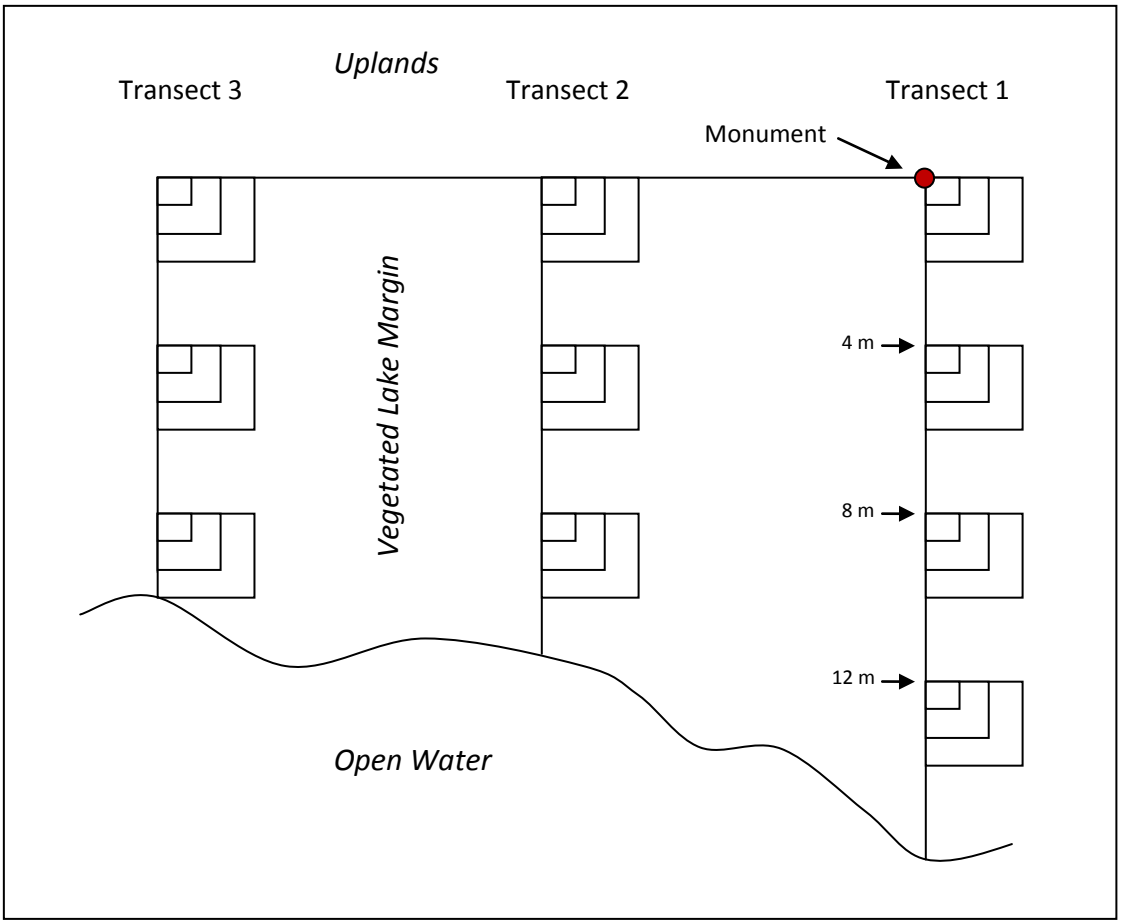


Figure 4. Layout for nested frequency plots along the three vegetation monitoring transects.

4. Once the quadrat is in place, photograph the entire quadrat. It is helpful to include the meter tape with the measurement increments showing in the picture.

5. List each plant species found in the smallest quadrat (red in Figure 3) in the data entry form, and check the box under 1A to indicate that it's at the first sampling point along the transect (1) in the smallest quadrat (A).

6. List each plant species found in the mid-sized quadrat (blue in Figure 3) in the data entry form, and check the box under 1B to indicate that it's at the first sampling point along the transect (1) in the mid-sized quadrat (B). Only enter species that were not found in the smallest quadrat.

7. List each plant species found in the largest quadrat (green in Figure 3) in the data entry form, and check the box under 1C to indicate that it's at the first sampling point along the transect (1) in the largest quadrat (C). Only enter species that were not found in the smaller two quadrats.

8. Move to the next sampling point and position the quadrat. Repeat steps d-g, but use the next set of check boxes (2A, 2B, 2C). Note that each species encountered in the transect should only be listed on the species list once; once it has been encountered, all the check boxes can be filled out on that one line. Continue on until the transect is complete.
9. For the second transect, enter 2 as the transect number, and start a new species list. Repeat steps d-h, then move to the third transect and do the same.
10. Collect any plants not collected during the transect survey for which the identification is questionable.

Note that it may be most efficient to do a nested frequency transect, and then do the Line Intercept sampling starting from the end of the same transect and moving back towards 0 on the line. Just be sure that the values for Stop are always the larger number (enter the first value in the Stop field, then move backwards up the transect and enter the value for the ending point of the species as the Start value), as the distances are calculated by subtracting the Start value from the Stop value.

Line Intercept Survey

1. Open the Veg Transects form in the Shallow Lakes database on the Tablet PC (see Figure 5). If the Tablet is not available, a paper Vegetation Transect Datasheet can be used to record the data for later entry into the database.

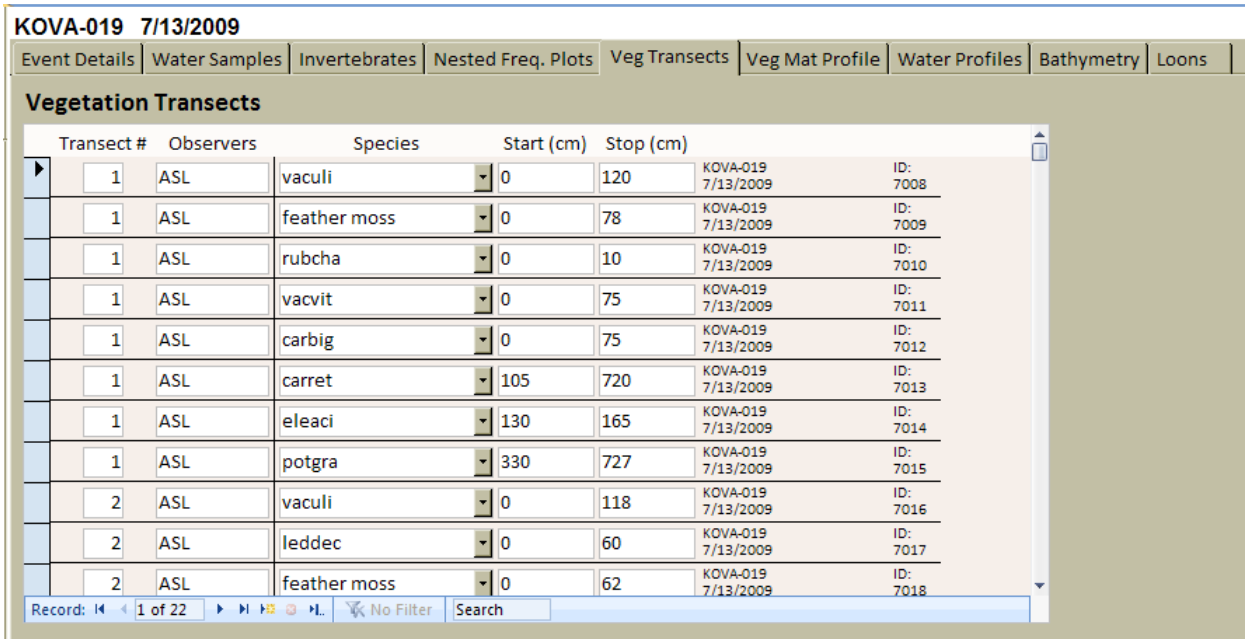


Figure 5. Screen-shot of database form used to enter Vegetation Transect data.

2. Walk on the same side of the transect tape as when the transect was laid out (to avoid trampled areas), and record the start and stop points for every vascular plant species and major group of lichen or moss within 10 cm of either side of the transect tape (see Figure 6). Each patch of a species is logged on a separate line in the Vegetation Transects database form or in a different set of boxes on the paper form. Record the species as continuous unless each individual is more than 10 cm apart along the transect. If there is a gap of more than 10 cm, that species will need to be logged as stopped, and a new line started when it is next encountered.

3. The transect will run from where it intersects the base transect to the point at which it is no longer safe to stand.
4. Repeat process along transects 2 and 3, making sure that the transect is identified properly when making a data entry in the database form. Once the transect number is changed, it is automatically populated in the next entry, so it only needs to be changed manually at the beginning of each new transect. Once the Observers field is filled in, it is also automatically populated for future entries.
5. Percent cover will be assessed for each species by adding together the lengths of all its entries along the transect and dividing the total by the length of the transect. It is very important that each entry has both a start and stop entry, and that they are in the correct order.

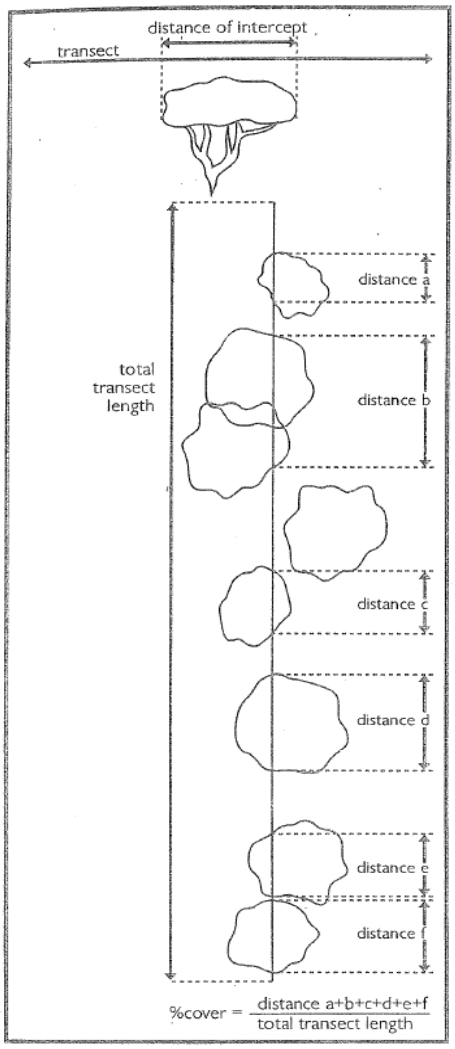


Figure 6. Diagram of line intercept method of measuring cover, from Elzinga et al 1998.

Vegetation Community Profiles

1. Assemble the avalanche probe, which is marked in cm increments. The probe will be used to measure the depth of various layers of vegetation, water and sediment along the lake margin. This information will create a profile of the vegetated zone.
2. Create a new Trimble file to collect the profile data. See Instruction Sheet "Trimble Data Collection" for detailed instructions.
3. If the Trimble is not available, enter the data in the Veg Mat Profile tab of the Sampling Event form in the Tablet PC. If a different GPS unit is available (such as an eTrex), record the lat/long periodically, otherwise just record the depths for each point.

IV. Rare Species Investigation (Intuitive Controlled Survey)

1. If the lake is considered likely to have habitat indicated for particular rare plants or indicator species, note any areas that might support rare plants during the lake circumnavigation.
2. As time allows search those noted habitat areas for the species of interest. If any plants are found, mark the location. In this case, no samples are collected.
3. Using the GPS, record the location, the size of the area searched, and the number of plants found or the approximate density.

4. If rare species are found, collect a PhotoPt feature with the Trimble GPS, then photograph the plants to be geo-tagged (see SOP 15: Documenting a Lake Using Digital Photography).

V. Collecting Vouchers

1. Store plants to be preserved in individual Ziploc storage bags with a label form (see Figure 7) filled out and the bag labeled.
2. At end of day, preserve vegetation samples according to SOP 20: Preserving Vegetation Samples and store appropriately for the type of sample.

Central Alaska Network Herbarium
Fairbanks, Alaska

Sample ID	***V-LakeID-Yr-#### (V-DENA-007-01-001)***
Plant Name	***Glyceria grandis***
Site Description	**DENALI NATIONAL PARK AND PRESERVE. Kantishna River Quad. Minchumina Basin Lowlands, N shore of lake 4.5 km NE of N Beaver Log Lake. Growing by a large lake with convoluted margin; extensive Calamagrostis meadow surrounding lake.**
Collector's Name and Date collected	**Amy Larsen, Carl Roland, Alan R. Batten** **07 Aug 2001**

Figure 7. Example of a Sample Label.

VI. Quality Control

1. Check and cross-check all data entry on field forms and field data recorder.
2. Enter sample IDs onto appropriate sample tracking sheets from field data forms.
3. Check and record that all samples are accounted for at camp.

VII. Equipment and Supplies

- PVC Nested Frequency Quadrat
- Measuring tapes (1- 30 m and 3-50 m)
- Avalanche Probe
- Tablet PC
- Trimble GPS unit
- Zip-top plastic storage bags (many)
- All-weather paper
- All-weather labeling forms
- Sharpie pens
- Pencils
- Digital camera
- Vegetation identification references

- Plastic garbage sacks (several) to store large plants
- Vegetation sampling field forms on all-weather paper (back-up in case of Tablet PC malfunction)
- Sketch map forms on all-weather paper
- Large-scale lake map for mapping vegetation beds; preliminary beds sketched in from aerial photos if available

VIII. References

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IX. Supplemental Material

Aquatic Plant Lists and Identification Resources:

Washington State On-line Version of an Aquatic Plant Identification Manual for Washington's Freshwater Plants: http://www.ecy.wa.gov/programs/wq/plants/plantid2/index.html

Identification Keys to the Aquatic Plants of British Columbia:
http://srmwww.gov.bc.ca/risc/o%5Fdocs/aquatic/029/index.htm

P.D. Warrington Ph.D., Water Quality Branch Water Management Division
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Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #19: Aquatic Invertebrate Field Sampling

Version 2.0 14 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	02/05/2008	A. Larsen	Modifications made to placement of transect	Highly variable nature of lakes.	1.1
1.1	03/24/2010	H. Kristenson, A. Larsen	Minor changes, addition of illustrations	Clarification of protocol, new database entry form.	1.2
1.2	10/14/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This Standard Operating Procedure explains the procedure for aquatic invertebrate sample collection within the littoral zone of shallow lakes in the Central Alaska Network National Parks and Preserves. These methods have been modified from Oswood et al. 2001. Macroinvertebrate sampling should be conducted after aquatic vegetation transect sampling (SOP 18: Vegetation Sampling). The basic approach involves sampling invertebrates within the water column with a standard D-net equipped with a 0.5-mm mesh bag. Ideally one person will collect all invertebrate samples in a season to reduce inter-observer effects. If this is not possible, at least ensure that one person collects all invertebrate samples for a single lake.

I. Procedures

Establish Sampling Transect

1. At the shoreline in the general vicinity of the vegetation sampling plot establish a 20 m transect that bisects the littoral zone in the opposite direction of the other two vegetation transects (see Figure 1). This line may run perpendicular to the shoreline if the observers can safely navigate the shoreline. If the littoral zone is floating and it is too difficult to access the submersed zone, run the transect in an oblique angle along the shoreline being sure to bisect the emergent and submergent zones if possible. Frequently the sediment is too mucky to allow safe access to the submergent vegetation zone. If this is the case, simply extend the transect along the emergent vegetation zone. For effective sampling with the D-net, the transect should transect an area where the minimum water depth is 0.25 m and the maximum water depth is 1.5 m.

2. When establishing the transect and accessing the sampling points for invertebrate sampling, always walk back and forth along the same side of the transect line so you do not disturb the sediment in the sampling area. The samples will then be collected from the undisturbed side of the tape, while the collector is standing on the disturbed side.
3. Take careful notes of how the macroinvertebrate transect was set up and how the macroinvertebrate samples were collected. Be sure to photograph, sketch, and record the angle of the transect line when using the oblique sampling strategy.

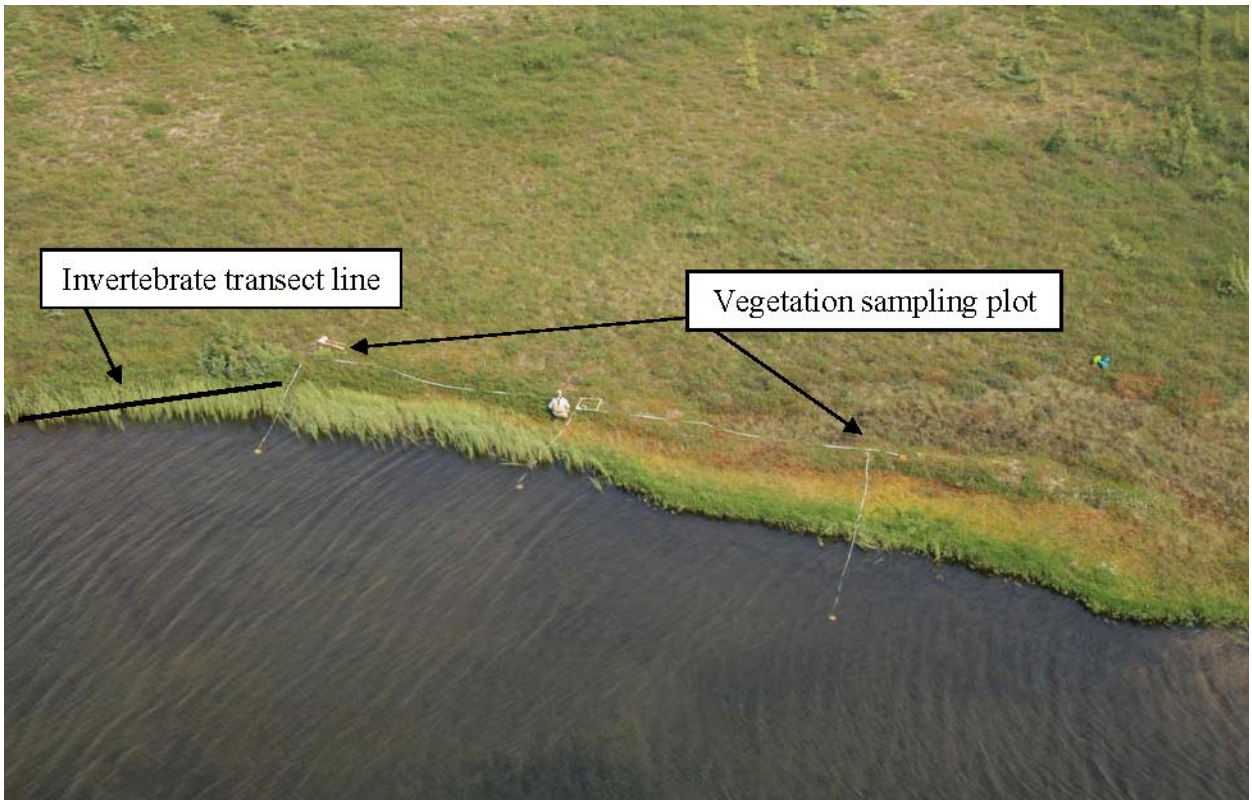


Figure 1. Illustration of how and where to set up an Invertebrate sampling transect

Sample Collection

1. When accessing the sampling point along the transect, always walk back and forth along the same side of the transect line.
2. Three samples are collected along the transect, approximately 5 m apart. The first sample point should begin at the first meter mark after the water is deep enough to take a sample (the water should be deeper than the net is wide). The sample sweep spans one meter (the sweep is detailed in step 4 of this protocol), and the next sample should start 5 meters after the end point of the previous sweep. For example, if the first sweep starts at the 3 m mark and ends at the 4 m mark, the next sweep would start at the 9 m mark and end at the 10 m mark, and the last sweep would start at the 15 m mark and end at the 16 m mark.

3. Once you reach the starting point for a sample along the transect line, enter Invertebrate sampling data into the Invertebrates form of the Shallow Lakes database on the Tablet PC (See Figure 2). This record includes the water depth (measured using a meter stick), the distance from shore, and the dominant plant species at the sampling point. If the sample is too large to fit in one bottle, note the number of bottles used to contain the sample in the "# of Bottles" field of the form. Also, note the dominant habitat of each sample point using categories listed in Table 1 (modified from Merritt & Cummins 1996). These categories and descriptions are also listed in a dropdown box in the Dominant Habitat field of the database form.

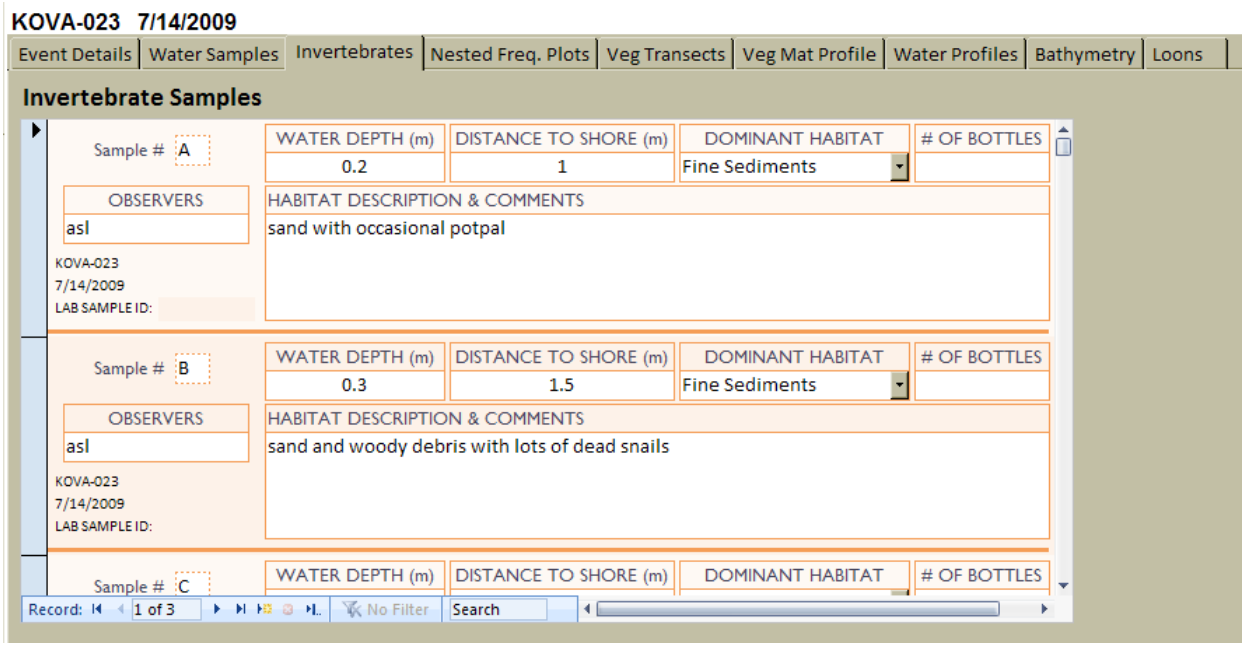


Figure 2. Screen shot of the Invertebrates tab of the data entry form in the Shallow Lakes database

Table 1. Dominant Habitat categories and their descriptions as used to characterize invertebrate habitat

Littoral Habitats	Description
Erosional	Wave-swept shore; substrates usually coarse inorganic sediments (gravels and cobbles); macrophytic vegetation sparse but substrates may have film or bed of attached algae
Fine sediments	Fine sands, silts and clays or organic muds; macrophytic vegetation sparse but substrates may have film or bed of attached algae
Emergent zone	Plants have most of their leaves above water
Floating zone	Rooted plants with large floating leaves
Submergent zone	Rooted plants with most of their leaves below water

4. Collect the invertebrate sample from the opposite side of the transect tape. Use a D-frame aquatic net to collect the samples reaching away from the sample transect line. Use an arc motion to sweep the net from the water surface, being sure to align the net so it captures neuston (animals on water surface), down through the water column, sweeping through any macrophytes to the substrate. Do not dig into the bottoms substrate; rather, sweep along the substate, skimming the surface for approximately 0.75 m; then sweep back to the surface, exiting the water approximately 1 m from where the sweep began. Drain water from the net.
5. Return to shore for sample processing.

Sample Processing

1. Use a white plastic tray/tub to collect the sample as it is dumped and rinsed (using lake water in a Nalgene squirt bottle) from the collecting net. Remove any pieces of large debris after rinsing and inspecting them for organisms; place any organisms found into sample container.
2. Use a brass soil sieve or sieve bucket with a mesh size equal to that of the D-net (500 μm; No. 30 mesh) to drain water from the samples before preserving.
3. Rinse the samples into Nalgene collection bottles using 95% ethanol in a Nalgene squirt bottle and a wide orifice funnel. Forceps may be needed to remove organisms from the dip net or the sieve. Add additional alcohol to sample container to insure a minimum of 80% ethanol concentration after dilution from water in the sample.
4. Label the outside of bottle with the following information: location, date, names/initials of collectors. Location information should include the lake name (i.e. DENA-010), and sample number along the transect (a, b, c). Bottles may be labeled in advance, either with grease pen or solvent-resistant pen, or with paper labels affixed and completely covered with clear tape. Paper labels may also be written in pencil and placed inside the sample bottle.
5. Record observational data on insects that are hatching during the sampling session, as well as any adult aquatic insects that have hatched.
6. Repeat for remaining 2 samples.
7. Verify that lids are securely tightened, and store sample bottles in a safe place where they are not likely to be disturbed or damaged.
8. Record any observations of birds feeding on the water (e.g., phalaropes, terns, grebes) and any fish seen in the water in the Sampling Events form of the Tablet PC.
9. Check all data entry in the Tablet PC.

II. Quality Control

Labeling

Assure that sample labels are completely secured to the outside of the sample container and are written with the proper writing utensil.

Equipment

Rinse all nets, pans, sieves, etc. that came into contact with the sample after completion of each sampling station. Examine equipment carefully and remove any remaining organisms or debris. Any additional organisms should be placed into the appropriate sample container.

Sample Collection

Methods used to collect samples should be the same at every site.

Sample Replicates

A different investigator should collect replicate samples at approximately 10% of the lakes to evaluate precision or repeatability of the sampling technique and sampler. Choose one sample point on every tenth lake and have a different investigator collect a replicate sample side by side with the regular sample.

Training/Group Calibration

Evaluation of sampling teams is completed by the program manager at the beginning of the sampling season and again during the sampling effort. This is to insure that the sampling methods are adhered to and that collection methods are consistent among samplers. The program manager records any method anomalies in a field notebook and makes recommendations to the samplers to improve the consistency of sample collection.

III. References

Oswood, M., T. Simpson, L. Saperstein & S. Nelson. 2001. *The freshwater benthos of the Kanuti National Wildlife Refuge.* U. S. Fish and Wildlife Service.

Merritt, R. W. & K. W. Cummins. 1996. An Introduction to the Aquatic Insects of North America, Third Edition. Kendal/Hunt Publishing Company, Dubuque, IA.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #20: Preserving Vegetation Samples

Version 2.0 22 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/22/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides step-by-step instructions for pressing, mounting, labeling, and handling vegetation samples, including aquatic species.

I. Materials Needed

Most of these items are available from biological supply companies.

Plant Press

A plant press may be purchased or built. It consists of alternate layers of corrugated cardboard, absorbent (blotting) paper or newspaper, and equal-sized pieces of plywood with straps or some other method of applying even pressure.

Herbarium Paper

Acid-free, 100% rag paper is best. If you would rather buy paper locally, try to use heavy stock, relatively acid-free paper with high rag content. High grade thick typing paper will work, and is usually found at quality stationery stores. University bookstores generally sell "biology paper", which is 8½" by 11" white paper of good quality.

Packets

For extra plant structures (such as seeds), use small envelopes or a piece of folded paper (2" by 3").

Herbarium Paste

This is available from biological supply companies. White glue may also be used, but should have a polyvinyl acetate base.

Linen Tape

Book binding tape works best. Cellophane tapes should be avoided.

Labels

Labels (see Figure 1 for a sample label) should be sized to fit in the lower right corner of the herbarium paper upon which the sample will be mounted.

	Central Alaska Network Herbarium Fairbanks, Alaska
Sample ID	*V-LakeID-Yr-####*
Plant Name	*Sparganium angustifolium*
Site Description	Kenai Peninsula Borough: Txx Rxx Sxx Freshwater pond xx miles northwest of Brooks Camp in Katmai National Park. Growing in shallow water (8-10 inches) along the edge of pond with *Potamogeton gramineus*.
Collector's Name and Date collected	**E. Burnett July, 1991**

Figure 1. Sample herbarium label for a preserved vegetation specimen

Waterproof Notebook or Paper

Notes should be recorded on site when the sample is collected, using pencil and waterproof paper.

II. Procedures

Plant Collection

1. If identification of a plant requires verification, collect a duplicate sample of the plant. One sample will be included in the herbarium for the Shallow Lakes project, and the other will be sent to specialists for identification. *It is vital to ensure that the duplicates are both the same species.*
2. Collect as much of the plant as possible, including roots, stems, leaves, flowers, and fruits. Plants may be collected by pulling by hand, or by using a steel rake to gather aquatic plants in deeper water. For riparian shrubs or trees, collect terminal branches with leaves, flowers, fruits, or seeds, as available.
3. Write as much information about the plant as possible on waterproof notepaper (the information will be used later for aid in plant identification and for labeling the plant). Include the plant sample ID; date; collector's name and address; location (name of the waterbody as

well as the location of the waterbody); depth of water; flow rate of water; substrate (sediment) description; whether leaves and/or flowers are submersed (below the water surface), floating, or emergent (above the water surface); color and odor of flowers; and names of the plant species associated with the collected plant. For riparian shrubs or trees, describe the entire plant, its height, stem diameter, bark texture and color, branching pattern, etc.

4. Wash the plant in clean water to remove algae, debris, and sediment. Keep the plants moist until they can be pressed by placing into a plastic zip bag.
5. Complete an ID tag on all-weather paper with the plant's Latin (scientific) name (if known), location, and site description, name of collector, and the date collected. Place the tag inside the bag with the sample.
6. Complete a label with the plant's Latin (scientific) name, location, and site description, name of collector, and the date collected. Attach the label to the outside of the bag.
7. If additional reproductive parts (seeds, fruits, flowers) or vegetative parts have been collected, these are placed in the bag with the rest of the sample.

Pressing Plants

It is easiest to identify aquatic plants before pressing. If this is not possible, press the plant while it is fresh, then send it to an aquatic plant expert as instructed below. Photographs of the plant in-situ may also be helpful for identification.

Preparing Plants for Pressing

Submersed plants

The easiest way to get a nicely prepared aquatic plant specimen is to briefly run the plant through a standard kitchen salad spinner. This will remove all the water from the plant and the leaves of the plant will be less sticky. Once the plant is run through the spinner carefully lay it out on the sheet so that all flowers and leaves can be easily seen.

Plants with whorled or finely divided leaves

When pressing plants with whorled or finely divided leaves, it is useful to separate one node (the stem section where the leaves are attached) and lay that onto a small portion of the paper. This yields a cross section showing the leaf pattern.

Plants with large or bulky stems, roots, or leaves

For plants with large bulky stems, roots, or leaves, the bulky portion can be split before pressing. This facilitates drying and prevents uneven pressure in the press.

Extra flowers, fruits, or vegetative parts

If extra flowers, fruits, or vegetative parts are collected along with a plant sample, these should be pressed, dried, and later placed in a packet and glued to the herbarium paper with the corresponding plant specimen.

Pressing Plant Samples

Press the plant material by placing the plant between multiple sheets of newspaper and/or absorbent paper, then sandwiching this between two sheets of corrugated cardboard. Several prepared specimens can be stacked in this manner. Be careful to label or number the plant specimens as they are placed in the press, so that it is easy to correctly match specimens with their field notes.

Put the stack of samples (including the paper and cardboard layers) between two firm pieces of wood (the plant press) and apply an even pressure using straps, bolts, or a heavy weight. Place in a warm, dry area. To avoid mildew, change the newspaper and/or blotting paper periodically until the plants are dry. The plants will dry more rapidly if placed over a heat register, a fan, or incandescent light bulbs.

Preparing Plants for Identification by a Specialist

Duplicate plant samples collected for identification or verification by a specialist should be pressed, but not mounted. These specimens should be labeled thoroughly and stored in a cool, dark place; batches of specimens will be sent to the Botany Department of the University of Alaska for identification. They will keep this specimen for their collection and notify the Shallow Lakes project of the plant's name. Be sure the two specimens are of the same species.

1. Make a list of specimen ID numbers and source for all plants sent to outside taxonomists. Send a copy of this list to the taxonomist with the shipment, and maintain the original list in the project files.
2. Send plants to the taxonomist snugly packed in a plant press or rigid container. Several plants can be shipped together.
3. Once identifications are provided by the taxonomist, update appropriate data sheets and the overall database with this information. Write the confirmed ID on the herbarium sheet for the retained specimen of each species along with the name of the specialist providing the ID.

Mounting Plants

Once the plant has dried and is identified, mount it for future reference as follows:

1. Arrange the plant(s) on a piece of herbarium paper. If the plant is too long, it may be cut into several sections and placed lengthwise on the paper.
2. Either glue or tape the specimen to the paper (the use of glue or paste will sometimes tend to cause delicate submersed plants to curl; tape may be preferable in such cases).
3. Complete a label with the plant's Latin (scientific) name, location, and site description, the name of the collector, and the date collected. Attach the label (see Figure 1) to the lower right corner of the paper.
4. If additional reproductive parts (seeds, fruits, flowers) or vegetative parts have been collected, place them in a packet and tape it to the top of the herbarium paper in such a way that the contents may be accessed.

Storing and Transporting Samples

Pressed samples can be stored and transported in the plant press. To avoid damage to dried specimens, herbarium sheets must be kept rigid. Store mounted specimens in herbarium cabinets in a heated area with low humidity. Several specimens may be stored in a stack.

Specimens should be stored arranged by Park, sub-region and family.

III. Quality Control

Sample Tracking

Enter sample IDs and collected purpose ("archive" or "to be identified") onto the Vegetation Sample Tracking Sheet in the field at the end of the field day. Cross-check these with the field data forms to verify that all samples collected are accounted for in camp at the end of the day.

Check samples in at the lab by dating the "lab" column on the data tracking form for each sample unpacked. Mark samples to be sent to out for identification with the date in the "store for ID" column and store in a place/container that is identified as destined for off-site identification. Mark samples to be archived with the date in the "store for archive" column and store in a separate place/container that is appropriately marked.

Samples that are sent off site may not be returned. Note on the sample tracking sheet the date results are returned for each sample sent out for identification. After the end of the season, go through the sample tracking sheets to verify that all samples are appropriately stored and that results have been returned for all samples sent out for identification.

IV. References

Washington State Department of Ecology
http://www.ecy.wa.gov/programs/wq/plants/plantid/press.html

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #21: Processing of Water Chemistry Samples

Version 2.0 30 September 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	03/30/2007	A. Larsen	Updated chemical analysis and filtration procedures to reflect changes	Changed to a better, less expensive laboratory that focuses on ecological samples as opposed to water quality standards so we are able to get more analytes.	1.1
1.1	03/22/2010	A. Larsen, H. Kristenson	Minor updates to procedures, removed True Color protocols	Optimizing efficiency, adjusting to new database structure, no longer analyzing True Color	1.2
1.2	09/30/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP gives step-by-step instructions for analyzing and processing the various water quality samples collected in the field. The samples should be processed at the end of each sampling day. If it is not possible logistically to process the samples that same day, they should be kept cool and in the dark until circumstances allow for the samples to be processed.

I. Introduction

The following samples will be stored, filtered or analyzed at the end of the day in the field camp:

- **Total Nitrogen, Total Phosphorus and Alkalinity (HCO_3-)** are decanted into 500 mL sample bottles, and should be frozen ASAP.
- **Chlorophyll-*a*** samples are filtered onto a 0.45 μm glass fiber filter and frozen ASAP for off-site laboratory analysis.
- **Dissolved organic carbon (DOC) and Silica** 125 ml samples are filtered using a 0.45 μm membrane filter after pre-filtering on a glass fiber filter (for chlorophyll-*a*) and kept at approximately 4°C for laboratory analysis.

- **Base Cations (NA, K, Ca, Mg, NH_3^+), Base Anions (NO_3^-, PO_4^-, SO_4^-, Cl^-)** 225 mL of sample is filtered using a 0.45 μm membrane filter after pre-filtering on a glass fiber filter (onto which chlorophyll-a is also filtered), and stored frozen for laboratory analysis.
- **Total alkalinity** is analyzed at the field camp at the end of the sampling day.

II. Sample Filtration Procedure

Check with the laboratory for any special requirements prior to commencing field work. Filtration should be performed under subdued light conditions.

1. Open the database on the Tablet PC for direct entry of data.
2. Pre-label a small piece of aluminum foil with the appropriate sample information for Chla processing (lake name, sample number, date, "Chla"), and leave a space to add the volume filtered.
3. Pre-label a 250 mL bottle for ions (lake name, sample number, date, "Ions", "filtered", "frozen").
4. Pre-label a 125 mL bottle for DOC (lake name, sample number, date, "DOC/Si", "filtered").
5. Assemble the filtration apparatus (filter, filter holder, filter flask, and hand pump with tubing as shown in Hach Method 8025) and place on a clean Erlenmeyer flask.
6. Place a 0.45 μm glass fiber filter onto the filter apparatus to collect a chlorophyll sample. Use filter forceps to handle the filter. DO NOT TOUCH THE FILTER WITH YOUR FINGERS. Filtration should be performed in subdued lighting. VACUUM PRESSURE SHOULD NEVER EXCEED 25 KPA. If the pressure exceeds 25 kpa, algal cells will lyse and Chla will pass through the filter.
7. Decant 700 mL of the 1L sample into a graduated cylinder. Filter the decanted sample through the glass fiber filter into the Erlenmeyer flask. If the sample is silty or difficult to filter, aim for at least 500 mL or as much as possible without damaging the filter. Carefully monitor the total amount of water filtered throughout process. Write the volume of water filtered directly on the prepared piece of foil, and enter it into the database on the Water Samples tab.
8. Continue filtration to remove as much moisture as possible from the filter without unduly stressing the cells trapped on the filter.
9. Release the vacuum using the trigger on the pump handle, allowing the filter apparatus to de-pressurize without rapidly pushing air back up through the filter.
10. Using forceps, remove the filter and fold it in on itself twice to form a quarter circle. DO NOT TOUCH THE FILTER WITH YOUR FINGERS AT ANY POINT DURING THE ENTIRE PROCESS.
11. Transfer the folded filter to the pre-labeled aluminum foil envelope. Place the foil containing the filter into a Ziploc bag and store in a freezer or between pieces of dry ice in a cooler.
12. Disconnect the pump and filter head and attach to a clean Erlenmeyer flask.

13. Using forceps, place the 0.45 µM membrane filter on the filter head. DO NOT TOUCH THE FILTER WITH YOUR FINGERS AT ANY POINT DURING THE ENTIRE PROCESS.
14. Filter approximately 550 ml of the initial filtrate (now contained in the Erlenmeyer flask labeled Chla) through the membrane filter. Transfer 225 ml of the final filtrate into the poly bottle pre-labeled for Base cations and anions (Na, K, Ca, Mg, NO_3^-, NH_3^+, PO_4^-, SO_4^-, Cl^-), and fill a pre-labeled 125 mL poly bottle to the shoulder for DOC and Silica.
15. Place the DOC/Silica sample bottle into a refrigerator or small foam cooler kept at approximately 4°C.
16. Place the Base cations and anions sample bottle into a freezer.
17. The remaining filtrate will be used for color and total alkalinity analyses.

III. Sample Analysis Procedure

Ions, Nutrients and Organic Components

Samples will be submitted to Cooperative Chemical Analytical Laboratory (CCAL) for analysis of the following components:

Total Nitrogen
Total Phosphorus
Acid Neutralizing Capacity
Base Cations
Base Anions
Total Dissolved Phosphorus
Total Dissolved Nitrogen
DOC
Silica

Chlorophyll-a

Samples for chlorophyll-*a* will be submitted to the University of Alaska Fairbanks for analysis.

Alkalinity

Alkalinity is a measure of the capacity of water to neutralize acids and is usually expressed in terms of mg/L as calcium carbonate. Alkalinity in natural waters is primarily due to the presence of bicarbonate, carbonate, and hydroxide ions. Alkalinity for most surface water is due to bicarbonate with little or no carbonate or hydroxide alkalinity present when pH is less than 7.5. Alkalinity is expressed as phenolphthalein alkalinity or total alkalinity. Both are determined by titration with a standardized sulfuric acid solution to an endpoint pH, as evidenced by an indicator solution color change. Alternatively, a pH meter can be used to monitor the end point. The field procedure uses a Bromcresol Green-Methyl Red indicator, rather than the Methyl Orange indicator typically used, to obtain a more distinct titration end-point.

Generally 5 to 10 minutes is sufficient for an experienced analyst to complete the analysis of a sample. Additional time is required to set up, clean, and pack equipment. The steps for performing this analysis are outlined below. Refer also to Hach Alkalinity Method 8203 for additional details.

Selection of Sample Volume and Titrant Concentration

Select the sample volume to be used and the sulfuric acid (H_2SO_4) titration cartridge *corresponding to the expected alkalinity concentration* as mg/L calcium carbonate ($CaCO_3$) from Table 1 below. Most surface water is anticipated to require 100 mL of sample and the 0.1600 N H_2SO_4 titration cartridges. While results obtained using volumes or concentrations outside of the alkalinity range will still be correct, selecting the correct range allows the most efficient use of titrant and the most precise results.

Table 1. Materials and digit multiplier to be used for alkalinity analysis, based on expected alkalinity values; most likely values are in bold type.

Alkalinity Range in mg/L as $CaCO_3$	Sample Volume in mL	Titration cartridge (H_2SO_4 Concentration)	Digit Multiplier
10 - 40	**100**	**0.1600 N**	**0.1**
40 - 160	25	0.1600 N	0.4
100 - 400	100	1.600 N	1.0
200 - 800	50	1.600 N	2.0
500 - 2000	20	1.600 N	5.0
1000 - 4000	10	1.600 N	10.0

Equipment Preparation

1. Insert a clean delivery tube into the titration cartridge.
2. Attach the cartridge to the titrator body.
3. Turn the delivery knob on the titrator to eject a few drops of the sulfuric acid solution.
4. Reset the counter to zero and wipe the tip with a kimwipe.

Sample Analysis

1. Use a graduated cylinder to measure the required sample volume (as indicated in Table 1).
2. Use deionized water to bring the sample volume to 100 mL, if required, and transfer into a clean 250-mL Erlenmeyer flask.
3. Place the flask on a white flat porcelain plate or waterproof white paper.
4. Add the contents of one phenolphthalein indicator powder pillow and swirl to mix.
5. If the solution is colorless before titrating with sulfuric acid, the phenolphthalein alkalinity is zero; proceed to step 7.
6. If the solution turns pink, titrate to a colorless endpoint. Place the titrator delivery tube tip into the solution and gently swirl the flask while titrating with acid until the pink color just disappears. Record the number of digits required in the comments section of the Water Samples data entry form in the database.
7. Add the contents of one Bromcresol Green-Methyl Red indicator powder pillow and swirl to mix.

8. Continue the titration with sulfuric acid to a light greenish blue-grey (pH 5.1), a light violet-grey (pH 4.8), or a light pink (pH 4.5) color as required by the approximate alkalinity in Table 2. Record the total number of digits required in the Alkalinity field of the Water Samples data entry form in the database. Note that if there was a phenolphthalein alkalinity result, that number should also be included in this result.

9. Discard sample.

Table 2. pH endpoint associated with approximate alkalinity of sample.

Alkalinity	End Point
~ 30 mg/L	pH 5.1
~ 150 mg/L	pH 4.8
~ 500 mg/L	pH 4.5

Calculation of Results

The phenolphthalein alkalinity (P) in mg/L as $CaCO_3$ is calculated as the number of digits required for phenolphthalein titration times the digit multiplier from Table 1. The total alkalinity (T) in mg/L as CaCO3 is calculated as the total number of digits required (including those for phenolphthalein) times the digit multiplier from Table 1.

If the resulting total alkalinity is outside the range expected, the analysis may be repeated for more precise and accurate results. If this is desired, repeat the analysis using the volumes and concentrations appropriate to the alkalinity just calculated. Record results from each trial in the comments field of the Water Samples form in the database, retaining the best result in the Alkalinity field.

Carbonate, bicarbonate, and hydroxide alkalinity are expressed individually using the relationships in Table 3.

Table 3. Alkalinity components correlating to relationship between phenolphthalein alkalinity (P) result and total alkalinity (T) results.

If Titration Result is:	Hydroxide Alkalinity =	Carbonate Alkalinity =	Bicarbonate Alkalinity =
P = 0	0	0	Total alkalinity
P = T	Total alkalinity	0	0
P < 0.5 T	0	2 times P	T - 2 times P
P = 0.5 T	0	Total alkalinity	0
P > 0.5 T	2 times P minus T	2 times (T minus P)	0

Remaining Sample

Store the remaining water sample in the cooler until all results have been cross-checked. The leftover sample can be discarded once the alkalinity and color have been satisfactorily determined.

IV. Quality Control

Nitrate+Nitrite, Total Nitrogen, Total Phosphorus, Chlorophyll-*a*, DOC

1. Submit one blind duplicate sample (blind to the lab) to the laboratory with every batch of 10 or fewer samples. Agreement between original and duplicate sample results should be within 25 percent relative percent difference (RPD).

2. The laboratory must calibrate the instrument using a minimum of four calibration standards and a blank prior to analysis of each batch of samples.

3. The laboratory must perform one blank analysis using deionized water with every batch of 10 or fewer samples.

4. The laboratory must perform one duplicate measurement with every batch of 10 or fewer samples. Agreement between the original and duplicate sample results must be within 20 percent. If results are outside this range, all samples must be reanalyzed.

Alkalinity

1. Perform one blank analysis using deionized water with every batch of 10 or fewer samples. Record results on separate data form entitled "*LakeID* – analysis blank."

2. Perform one duplicate measurement with every batch of 10 or fewer samples. Agreement between the original and duplicate sample results must be within 10 percent. If results are outside this range, all samples for that analyte must be reanalyzed. Record results on separate data form entitled "*LakeID* – analysis duplicate."

V. Sample Holding Times

- Total Nitrogen, Total Phosphorous, Nitrate/Nitrite, ammonia, base cations, and base anions – Store frozen.
- Chlorophyll a – Store frozen for unlimited time.
- Dissolved Organic Carbon and Silica – Store at 40° C

VI. Equipment and Supplies

Sample Filtering

Equipment

Forceps/tweezers for handling filters.
Filter head, 47 mm (if using hand-pump)
2 Hand-operated vacuum pumps
Silicone tubing (12 inches) for pump head
Polypropylene sampling tubing (~ 20 inches)
2 Erlenmeyer Filter flasks, 1 L
Rubber stopper, No. 7, 1-hole
Thermometer

Supplies

Deionized water in squeeze bottle
Filter discs, 47 mm, 0.45 μm glass fiber
47mm membrane filters
Lab-supplied sample bottles (125 mL and 250 mL polyethylene)
Tablet PC with Shallow Lakes database, or Pond Data field forms
Sharpie pens

Chlorophyll-a Sample Preparation

Aluminum foil
Small Ziploc plastic freezer bags
Dry ice (blocks) and small foam cooler OR freezer

Alkalinity

Required Equipment

Hach digital titrator (or equivalent); Hach catalog number 16900-01.
Erlenmeyer flask, 250 mL
Graduated polypropylene cylinder, 100 mL
Graduated polypropylene cylinder, 25 mL
Waterproof white paper to visualize color changes more easily.
Titrator delivery tubes (spare) with 180° bend (Hach 17205-00 or equivalent)

Required Supplies

Bromcresol Green-Methyl Red powder pillows (Hach 943-99 or equivalent).
Phenolphthalein powder pillows (Hach 942-99 or equivalent).
Deionized water
Sulfuric acid titration cartridges, 0.16 N (Hach 14388-01 or equivalent)
Sulfuric acid titration cartridges, 1.6 N (Hach 14389-01 or equivalent)
Kimwipes (or equivalent) tissues

Optional Supplies

Alkalinity standard solution ampules, 0.5N Na_2CO_3, 10 mL (Hach 14278-10 or equivalent).
(Note that standards may also be pre-prepared in lab prior to trip if desired.)
Buffer powder pillows, pH 3.7 (Hach 14551-68 or equivalent)
Buffer powder pillows, pH 4.5 (Hach 895-68 or equivalent)
Buffer powder pillows, pH 4.8 (Hach 896-68 or equivalent)
Buffer powder pillows, pH 5.1 (Hach 897-68 or equivalent)
Buffer powder pillows, pH 8.3 (Hach 898-68 or equivalent)

VII. References

EPA Method 415.1. Methods for Chemical Analysis of Water and Wastes.

OASIS, 2004. OASIS Environmental, Inc. 2004. Big Lake and Lake Lucille Water Quality Monitoring, Final Report, QAPP. AK DEC.
http://www.state.ak.us/dec/water/wnpspc/pdfs/fy04_finalreport_big_lucille_lakes_oasis.pdf

Standard Methods for the Examination of Water and Wastewater (APHA), Method 4500-N.

Standard Methods for the Examination of Water and Wastewater (APHA), Method 10200-H Chlorophyll.

Standard Methods for the Examination of Water and Wastewater (APHA), Method 2120 Color.

Standard Methods for the Examination of Water and Wastewater (APHA), Method 2320 Alkalinity.

VIII. Supplemental Material

Hach Filtration Procedure, Method 8025.
Hach Alkalinity Procedure, Digital Titrator Method 8203

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #22: Field Trip Demobilization

Version 2.0 22 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/22/2010	H. Kristenson	Minor edits to procedures. Document format change	New database design and sample tracking methods precipitated some edits to the procedures. Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides step-by-step instructions for closing out each sampling trip after the crew returns from the field.

I. General

1 Clean and inventory all gear and restock non-perishable supplies, including forms, for next field trip. Set batteries and power equipment to recharge. Store all equipment and gear appropriately.

2 Assemble, photocopy, and file all field data sheets and log books.

3 Tablet PC and Trimble GPS units should be given to the Data Manager for the downloading of all field data as described in SOP 24: Data Management.

4 Download and label all photos from the digital camera, as described in SOP 15: Documenting a Lake Using Digital Photography.

II. Water Chemistry

Laboratory Samples

CCAL samples

1. Store all samples appropriately:
    a. Total nitrogen, total phosphorus, nitrate/nitrite, ammonia, base cations, and base anions should be stored frozen.

b. Dissolved organic carbon and silica should be stored at 4°C (refrigerated).

2. Ensure that all water samples have been logged into the database in the table tblWaterSamples (this is best done in the frmMain form, under the Water Samples tab for each sampling event).
3. Create an inventory list of the samples, using the query vwSampleListWaterChem. Print a copy to use to inventory the samples to be shipped, and email an electronic copy of the list to the lab.
4. Inventory the samples, verifying that all samples listed are present, all samples present are listed, and that all samples are labeled correctly.
5. Package the samples in coolers and ship to the laboratory using Priority Overnight.
6. Specify the following laboratory analytical methods:

Water Quality Variable	Method
Alkalinity	APHA 2320 with modification (CCAL)
Ammonia	APHA 4500-nh3 G; EPA 350.1
Calcium	APHA 3111 with modifications (CCAL)
DOC	APHA 5310 B
Chloride	APHA 4110; EPA 9056A
Specific conductivity	APHA 2510
Magnesium	APHA 3111 B
Nitrate	APHA 4500-NO3
pH	APHA 4500 H
Orthophosphate	APHA 4500-P E; EPA 365.2
Total phosphorus	APHA 4500-PB; APHA 4500-P E; EPA 365.2
Potassium	APHA 3111 B
Silica	APHA 4500-SiO2
Sodium	APHA 3111 B
Sulfate	APHA 4110 B

Chlorophyll samples

1. Samples should be stored frozen, and can be stored for a maximum of 6 months. As such, it is possible to simply freeze the chlorophyll samples upon return from the field, and wait until all chlorophyll samples have been collected for the season. At that point, all of the samples can be delivered to the lab together. If necessary, however, the samples may be sent to the lab in smaller batches following each field excursion.
2. Ensure that all water samples have been logged into the database in the table tblWaterSamples (this is best done in the frmMain form, under the Water Samples tab for each sampling event); the table with the Chlorophyll lab data (tblChlorophyll) is linked to the Water Sample data based on the sample names, dates, and replicate numbers recorded in tblWaterSamples.
3. Create an inventory list of the samples, using the query vwSampleListChlorophyll. Print a copy to use to inventory the samples to be shipped, and email an electronic copy of the list to the lab.
4. Inventory the samples, verifying that all samples listed are present, all samples present are listed, and that all samples are labeled correctly.
5. Deliver the samples to the lab for analysis, minimizing the time the samples are in temperatures above freezing.

6. Specify the following laboratory analytical method: EPA Method 445.0 Modified for Biotek Synergy HT plate reader (Kielland).

Conventional Water Quality Parameters

1. Ensure that all Water Profile data has been transferred from the YSI MDS field computer to the network drive, and saved in a folder named YSIProfiles, under the Field_Data folder under the appropriate year. Note that the data is generally downloaded from the MDS to a field laptop during field trips, and this data must be moved to the network drive location. Check that no profile data remains on the MDS.
2. Ensure that YSI Sondes are stored appropriately, with the probes in a moisture-saturated environment.

III. Vegetation

Follow the procedures detailed in SOP 20: Preserving Vegetation Samples to press and store the samples. If time allows, and the specimens have been fully dried, plant samples may be mounted following a field excursion, and stored appropriately. Otherwise, the processing of plant samples should be completed at the end of the season.

1. Check all vegetation samples in as "received at station" on sample tracking form.
2. Prepare samples to be identified by outside specialists for mailing and store until end of season.
3. Prepare all other samples for storage and record date and storage location on sample tracking form.
4. Scan maps of vegetation beds and file the originals and the scans for reference over time. If needed, polygons of each vegetation type or at least vegetation bed locations can be attributed for analysis. This may also be performed at the end of the field season.

IV. Aquatic Macroinvertebrates

1. Ensure that all of the invertebrate samples have been logged into the database in the table tblInvertebrateSamples (this is best done in the frmMain form, under the Invertebrates tab for each sampling event).
2. Check that all samples are labeled correctly.
3. Check that all macroinvertebrate sample bottles contain an adequate preservation volume of ethanol, and re-preserve with 80% ethanol if necessary. For samples that require additional alcohol, tighten or replace lid in order to prevent further evaporation.
4. Store the samples until the end of the season.
5. Before shipping, create an inventory list of the samples, using the query vwSampleListInvertebrates. Print a copy to use to inventory the samples to be shipped, and send a copy with the sample shipment.

6. At the end of the season, a database will be generated to send to the lab for data entry (see Instruction Sheet "Generating Invertebrate Lab Data Entry Database" for details), and samples will be shipped via ground (truck/barge) transportation to the lab for analysis. Because the samples contain ethanol, they must be packaged appropriately for shipment, with the appropriate Hazardous Materials documentation. As such, it is easiest to wait until the end of the season and ship all of the samples together at one time.

V. Quality Control

1. It is very important that all samples have been labeled correctly and logged into the database. The database is designed so that it will not accept laboratory data unless there is sample data entered with matching LakeName and SampleDate fields; if laboratory data does not match these fields in the sample data, there will be an error during import due to non-matching primary keys. If samples have been diligently entered, these errors should not occur unless the laboratory has misidentified sample data.
2. If procedural problems occurred during the field sampling trip, adjust procedures and/or crew training to alleviate future problems when possible. These issues should be addressed immediately, before the next sampling trip.
3. If any deviations in SOPs are deemed necessary, or additional sampling conventions practiced, document these in a memo to the program manager for discussion and dissemination to other field crews. Any such field modifications or extensions of SOPs, with the concurrence of program management, must be instituted immediately and consistently by all field crews. Any such modifications must be documented in revisions to the appropriate SOPs as described in SOP 27: Revising the Protocol.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #23: Macroinvertebrate Processing and Identification

Version 2.0 30 September 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.1	11/09/2009	H. Kristenson	Added Data Entry section	New database design required instructions for creating a database for the lab to populate.	1.2
1.2	09/30/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides instructions for the laboratory analysis of macroinvertebrates collected for the shallow lake monitoring in the three National Park units in the Central Alaska Network (CAKN). These methods have been modified from ABR, Inc. (Cole 2002, 2003).

I. Sample Preparation and Identification

Sample Log-In

1. When samples arrive in the lab, immediately assign a sample number and enter number into the Sample Log (Figure 1). Log information to be entered at this time includes site name, sample point, collection date, and sample number. The sample number (1, 2, 3, 4,…) is assigned to each sample of a given project in the order in which the samples are entered in the log (they may be different from site numbers or codes).
2. Use a sharpie to write the sample number on the outside of the bottle. If the sample is stored in more than one bottle, use the same sample number, but write "(1 of 2)" or "(2 of 2)", etc.
3. When duplicate samples from the same field site are taken, they should receive different sample numbers, with the notation "(DUP 1)" or "(DUP 2)", etc. following the sample number. This information, together with the site number or code, will provide the needed information to accurately identify each sample.
4. Samples should be stored on the shelves in the lab until they are sorted.
5. Before being stored, they should be checked to ensure that the proper volume and dilution of alcohol has been added. Sample bottles should not be more than 2/3 full of sample material, and should be well covered by alcohol that smells strong. A weak or lack of alcohol smell

indicates that the alcohol is likely too diluted and that it should be replaced. To replace the alcohol, pour the sample into a sieve over the sink, and refill with 70% ethanol.

Macroinvertebrate Sample Log

ABR, Inc., Environmental Research and Services
P.O. Box 249 Forest Grove, Oregon 97116

Project:_____ Date:_____

Sorter Name:_____ Sort Date:_____

Sample ID	SUB	Fraction	Sort Time	Number Sorted	Residue Volume	Matrix Type	Comments

(Sub)sampling method: GT = gridded tray, SS = sample splitter, NO = not subsampled
Fraction = Number of squares sorted (to nearest quarter square)
Number Sorted = Number of organisms sorted Residue
Volume = Rough estimate (cc) of settled residue volume
Matrix = primary material sorted through (algae, fine/coarse organic particulate matter, inorganic – pebbles, gravel)

Figure 1. ABR macroinvertebrate sample log

Sample Preparation

Samples from the field are often laden with fine materials that cloud the sample and very coarse materials that add a lot of volume to the amount of material to be sorted through. It is the aim of sample washing to rid the sample of these materials at the extreme ends of the size spectrum without losing any macroinvertebrates. Importantly, some samples require a lot of washing, others require

none. Most require some; only experience will help determine in advance how much washing will be necessary.

If the sample contains lots of silt and sand (which can be seen through the bottle once it's settled), much of this can be washed out through a 500-μ sieve:

1. Pour the sample contents onto a 500-μ sieve, rinsing the sample container to ensure that all materials have been transferred onto the sieve.
2. Run tap water through the sieve and retained material for about one minute; use water stream to concentrate sample in one corner of the screen.
3. Dump the sample into an examination tray, rinsing all material retained on the screen into the tray.
4. Fill the tray half way with water; allow the water to stir up the contents of the sample.
5. Swirl the tray gently and pour again into the sieve, this time allowing the water to run into the sink, while catching the sample in the sieve.
6. Repeat this process until the water from the sample is clear.

At this point, the sample may have large material that can be hand picked, rinsed into the screen and discarded.

1. Pour sample again into the tray and fill halfway with water.
2. Hand pick large leaves, sticks, etc. from the sample and discard in a detritus pail.
3. Closely examine, and wash (if necessary) items that have invertebrates adhered to them.

Finally, if the sample has a large amount of gravel and coarse sand, this material can also be separated from that to be sorted:

1. Again fill the examination tray halfway with water and slowly pour the water and the sample into the sieve with a gentle swirling action (Figure 2). The idea is to pour water from the tray at a rate that carries the invertebrates and other lighter organic material into the sieve, while heavier pebbles and sand are retained in the tray.
2. Repeat this process a number of times, leaving the sample in the sieve, until the water isn't carrying any smaller inorganic materials out of the tray when you are pouring.
3. This process may sometimes require pouring out and refilling the tray with water 5 to 10 times.

Once the sample has been washed, the pebbles and coarse sand should be thoroughly inspected for caddisfly cases and mollusk shells that are also retained in the tray (Figure 3). If these are seen, then the same proportion of this material will have to be searched as will be searched of the washed sample. Save this material and put whatever wasn't searched with a dissecting scope back into the "unsorted fraction" bottle.



Figure 2. Separating pebbles and sand from lighter material



Figure 3. Example of pebbles and sand removed from sample to be sorted, but saved for later search for caddisfly cases and mollusk shells

Sorting Procedures

1. All samples are subsampled to remove 525-550 organisms. Subsampling is performed using either a 30-square gridded tray, on which the sample can be divided into quarters or eighths.
2. Pour the washed sample into a gridded tray and then float the sample in the tray to evenly distribute the sample contents across the tray (Figure 4).
3. Randomly select one square and transfer into a Petri dish. Add water to the sample, just enough to facilitate sorting through the material, but not enough to spill easily. Usually, about half full is enough (Figure 5).
4. Place the Petri dish under a dissecting microscope. 7X power is the preferred magnification for sorting.
5. As a rule, if the entire depth of the material is not in focus, then there is too much material and/or liquid on the Petri dish. In this case, carefully place half of the sample on another Petri dish and sort after the first half is sorted. This is important in ensuring that the sample can be well searched and that organisms aren't being missed because they are out of focus or because too much material is impeding visibility.
6. Use a gridded Petri dish or a Petri dish with four dividing ridges to provide reference points while the sample is being searched. Beginning on one side of the dish, begin systematically working through the material within each grid piece or section, until the dish has been entirely searched. This systematic approach ensures that the entire sample is searched, and searched with equal effort.
7. Once the entire Petri dish has been searched, scan the dish for another 30 seconds or so to ensure that organisms were not being missed. Look for small organisms, including nematodes, microcrustaceans, and midge larvae that are more easily overlooked.
8. Once finished, the sorted residue should be placed in a graduated container to estimate volume sorted when the sorting is complete. Depending on the project, you might also be asked to save the sorted fraction for later quality control work.
9. Continue sorting additional squares until 525-550 organisms are counted. Do whatever necessary to maintain an accurate count. Making a tally mark for every ten organisms seems to work well, but whatever works for you. Just make sure you're accurate to within 10-20 organisms. Also, make sure you write down the number you've sorted whenever you're interrupted.
10. Carefully count and record the number of squares searched, as this information will be used to calculate macroinvertebrate densities.
11. DESIRED REMOVAL RATE: 95% (i.e. only 1 out of every 20 invertebrates should be missed, preferably fewer)



Figure 4. Evenly distributing sample material across gridded tray (tray is filled with water)



Figure 5. Example of Petri dish with proper volume of sample material. Much more than this will impede ability to detect invertebrates and impede search rates. Note the unfolded paperclip running through the middle of the sample.

Sorting Rules

The objective of sample processing is to remove a representative subsample of aquatic macroinvertebrates from the sample. Samples will primarily contain aquatic macroinvertebrates, but will also contain:

- terrestrial invertebrates (spiders, commonly)
- airborne adult stages of aquatic invertebrates

Some of these invertebrates are *sorted, but not counted*; others are *rejected* altogether. As a rule, if you're not sure about a particular type of organism, sort it, but don't count it, and place it in a separate vial.

Always Reject

Do not sort or count these organisms – i.e., leave them in the sorted residue.

Larval Molt Skins: Look for the split down the ecdysial line on the mid-dorsum of the specimen. Skin casts are usually transparent/translucent and do not have any internal materials.

Invertebrates Obviously Dead before being preserved.

Eggs of invertebrates or vertebrates (Oligochaeta worm egg cases are not counted)

Miscellaneous body parts: legs, antennae, gills, tips of abdomens, etc. **Counts are based on heads and thoraxes.**

Small fragments of Oligochaeta: When worms are fragmented (more often than not), worm counts are based on tips. Count only large pieces with a tip (an anterior or posterior end), and count each tip as one-half. Ignore smaller fragmented sections that do not include a tip.

Sort, But Don't Count

Put these specimens in a separate vial for a taxonomist to see.

If large numbers of any of these are encountered, put a number of them (6-12) in a vial and make a note estimating the total number you encountered.

Empty caddisfly cases

Empty mollusk shells

Vertebrates: Fish and amphibians (including tadpoles) should be saved, and counted separately from invertebrates.

Headless specimens should be sorted, but not counted.

Taxa Expected to be Regularly Encountered in the CAKN Network

Sci Name	Common Name	Notes
Oligochaeta	aquatic worms	count large portions of bodies as 1, tips as 1/2
Chironomidae	Midges	look for pupae, as well
Nematoda	Nematodes	look out - these are easy to miss!
Copepoda	copopods	can be very small
Daphnia	water fleas	Can be very small
Ostracoda	seed shrimp	Can be very small - look like tiny white jelly beans
Odonata	dragon/damselflies	
Trichoptera	Caddisflies	sort, but don't count empty cases
Mollusca	snails/clams	sort, but don't count empty shells
Hemiptera	true bugs	see sorting notes for water striders, sort and count Corixidae
Coleoptera	Beetles	sort and count all beetles and their larvae

This list is almost certainly incomplete - look out for other organisms, as well

Remember: Counts are based on heads – sort otherwise intact bodies, but don't count them.

Use of Sorting Vials

Invertebrates should be sorted into 1-dram snap cap vials. Use a separate snap cap vial for each distinct group of organisms. Sometimes, larger containers will have to be used for mollusks and other larger organisms. Generally, 6-7 vials are used per sample, sorted into the following groups: mayflies, stoneflies, caddisflies, dipterans, beetles, mollusks, other.

Depending on the relative abundance of other organisms, additional vials may be used, or other groups substituted for one or more of those listed above. **Importantly, place a small strip label with the LAB SAMPLE NUMBER inside of each vial.** This way, if the vials ever become separated, they can still be identified.

Large/Rare Search

Once the 525-550 organism subsample is complete, the remaining unsorted squares are searched with the naked eye for large/rare (LG/RR) invertebrates. These are invertebrates that are larger than ~1 cm and are represented by only a few specimens in the sample (i.e., they weren't encountered while you were sampling the squares under the scope). Use the following procedure to perform the search, and place these specimens in a separate vial with a large/rare search label included:

1. Refloat the sample with water in the gridded tray.
2. Gently redistribute the remaining material across the tray screen.
3. Search the sample with forceps and place a few of each LG/RR organism into the vial.

Products

The UNSORTED FRACTION is returned to the original sample bottle and refilled with alcohol. Use a spatula to return the unsorted material to the bottle. An UNSORTED FRACTION LABEL should be filled out and placed INSIDE the sample jar with the remaining fraction. Wash the gridded tray thoroughly between samples to ensure that no cross-contamination of samples occurs.

The SORTED RESIDUE is also saved, unless otherwise specified by the project manager. Be sure to record the approximate volume of material (in ml) sorted in the sample log, and be sure to include a SORTED RESIDUE label in the cup with the material. Some of the alcohol from the original sample should be used to preserve this material, as well. This material is saved to check sorting efficiency.

The SORTED INVERTEBRATE VIALS should be bound with a rubber band (include the LG/RR vial; affix a SORTED SAMPLE label to the sample vials (Figure 6).

To recap, these products are expected from each sample, unless otherwise instructed:

- Vials with sorted invertebrates (include label)
- Vial with large/rare organisms (include label)
- Unsorted fraction (label as such inside and out)
- Sorted residues (may sometimes discard, check with project manager)
- COMPLETED INFORMATION IN SAMPLE LOG



Figure 6. Completed sample with large-rare vial and series of sorted specimen vials. Note sample label and labels inside of each vial.

Quality Control

As a rule, 10% of the SORTED RESIDUE samples will be rechecked by a senior scientist to determine whether 95% sorting efficacy has been achieved. Keep in mind that this means that from a 500 organism subsample, only 25 organisms can remain in the unsorted fraction. With large amounts of detritus and inorganic material, sorting can become very slow and tedious; be patient and thorough and do not get too hasty. Also, check yourself. After you've completed a sample, check some of the residue to ensure that you're sorting thoroughly. If any of the selected samples are not adequately sorted, as ascertained by the QC checks, then all samples will be checked, and those failing will have to be resorted by that person performing the work.

Miscellaneous Notes and Guidelines

Because of their small size and/or rarity, some organisms are easily overlooked. Examples of organisms that may sometimes be common, but are so small that they may be missed are: nematodes, microcrustaceans (ostracods and copepods), midge larvae, and early instars of many aquatic invertebrates. It is VERY IMPORTANT that you familiarize yourself with these particular invertebrates so that you know what to look for and how to recognize them.

Other organisms are going to be very rare, and sorting too quickly may lead to omission of these rare, yet important invertebrates. First and foremost, work methodically and thoroughly. You will be asked to be efficient, but NEVER AT THE EXPENSE OF COMPROMISING THE DATA. If you ever feel that your sample processing is compromised by time constraints please inform the project manager. If you rush, it will likely be evident to the trained eye that the samples were inadequately processed and that the data were compromised. Please do all that you can to avoid such errors.

PLEASE PAY VERY CLOSE ATTENTION TO PROPER LABELING AND RECORDING, FAILURE TO DO SO CAN SERIOUSLY COMPROMISE DATA.

II. Macroinvertebrate Sample Identification

This section provides guidance on how to perform identifications of macroinvertebrates from sorted benthic samples, usually pre-sorted to order, class, or phylum (as discussed above). This guide does not include a treatment of all difficulties and issues that may arise during identification procedures; consultation with a senior biologist is required to work through any difficult circumstances encountered that are not covered here.

Before Starting

Consult the Processing Specifications Sheet in the project file folder to determine what taxa are to be included in the data and at what levels of taxonomic resolution.

Sample Preparation and Microscope Use

To start, carefully pour the sample vial contents onto a Petri dish, or remove with a pipette. Please label the bench sheet before proceeding with identifications. Identifications are normally performed under a zoom stereoscope. These scopes have magnification capabilities ranging from 7X to 67.5X,

depending on zoom magnification and whether 10X or 15X oculars are being used. Positive identification, particularly of organisms that you haven't yet seen, sometimes requires looking at body parts under higher magnification to see microscopic diagnostic characters (on legs, gills, mouthparts, etc.). Such characters will require use of the compound slide microscope. If, for example, villipores on a Baetidae need to be searched for, it would be appropriate to pull off a couple of legs, place them on a slide with a drop of alcohol, cover them with a cover slip and place under the compound microscope.

If diversity is high in the sample, then morphologically-distinct organisms should be sorted into sections on the dish for easier identification and more certain counts. Once a particular taxon has been identified and counted, you can remove it from the dish with a pipette. Place identified organisms back into the vial with appropriate labeling. Invertebrates not belonging to that taxa group from that vial should be set aside during ID work, and then placed into the appropriate vial. Do not ID and count organisms belonging to groups that have not yet been IDed. Just add them to the correct vial and wait until the contents of that vial are identified to include those organisms in counts.

Count and ID all aquatic and semi-aquatic organisms in the sample, as taxa not to be included in the data set were likely ignored during sorting. Before beginning a given project, ask the project manager WHAT TAXA SHOULD BE IGNORED IF ENCOUNTERED. This list often, but not always, includes Cladocera and Hemiptera. Again, also consult the Processing Specifications Sheet to ensure the proper organisms are included in the final enumerations and at the correct level of resolution.

Use of Bench Sheets

Bench sheets are provided for each project. Data should be entered on these as the samples are being identified. The column to the left of the taxon name should be used as a tally area. Tally-whackers may be used as an alternative, but should be appropriately labeled to ensure accurate tallies. The column to the right of the bench sheet should be used for both abbreviated notes, and for total counts for that particular taxon. Notes should follow the format of standardized USGS notes (See Lab Document 1, L1) often used to explain why the desired taxonomic level is not achieved or to convey additional information about that taxon in the sample.

Importantly, please note all specimens from the large/rare vial as such on the identification bench sheet. Please use the shorthand notation: "LG/RR".

Level of Taxonomic Resolution

The Northwest Biological Assessment Workgroup (NBAW) is currently developing a standard level of taxonomic resolution for Pacific Northwest biomonitoring and assessment studies. Level of taxonomic resolution varies among taxa and taxonomic groups. Most insects will be identified to genus or species, many mollusks are taken to genus, and some other groups are identified only to class, order, or family. Chironomids are identified to genus when required for the project, but sometimes left at subfamily or tribe levels. Oligochaetes are generally left at "Oligochaeta", as standards have yet to be developed for this class. We do sometimes identify Oligochaeta to family or genus, if required by the project.

- *As a rule, strive to obtain the levels of resolution listed in the Draft Taxonomic Standard List for the Northwest.* This list should be checked for updating at http://www.xerces.org/aquatic/current_activties.htm. Click on "Program Activities".

- Information regarding distribution, habitat, and abundance of many taxa is provided on *Common Pacific Northwest Benthic Invertebrate Taxa-Draft, March 1996* (L2). This document may help resolve some taxonomic uncertainties by examination of the notes provided.
- The lab bench sheets (L3) with pre-typed taxa names are intended to help maintain high levels of resolution, but are not complete and should be updated, as needed.

Of course, not all taxa encountered will be on these lists; when such taxa are encountered, a senior biologist should be consulted to confirm ID. For further guidance on taxonomic resolution, refer to the document "ABA Comments" (Lab Document 4). If the standard levels cannot be achieved, it should be determined whether the cause is a lack of experience of the taxonomist performing the work, or if it's a real lack of characters used to make the determination. In either case, a senior biologist should be consulted before counting/identifying these organisms.

Resources

A number of general keys are available for much identification work. Those most often used include:

Merritt and Cummins (1996) for many aquatic insects
Stewart and Stark (1988) for stoneflies (especially difficult taxa, figures are very helpful)
Wiggins (1996) for caddisflies (figures again very helpful)
Smith (2001) and Thorp and Covich (2001) for non-insects
Weiderholm (1989) for Chironomidae to genus

In addition, a large number of regional keys and keys are specific to certain families and genera. Washington DOE Taxonomic Laboratory Protocols (L5) is a (somewhat outdated) source for determining what specific key is required to take a specimen to a desired level of resolution. Do not use the DOE taxa list as the reference list for desired level of resolution. Please get familiar with the set of keys in the laboratory. Additionally, lab document 5 (L6), "Taxonomic References for Macroinvertebrates," provides a partial list of keys published to date.

Mindy Allen's Glossary of Aquatic Insect Morphology (1999) is a good document for learning morphologic characters necessary for identification work.

Special Circumstances: Incomplete/Damaged Specimens, Difficult Taxa

Many specimens are damaged beyond recognition to less-experienced taxonomists. As a first attempt to identify such specimens, if several exist in a single sample, group them in one area of the Petri dish, and use the combined parts from various organisms to obtain the set of characters needed to make a positive ID. IT IS VERY IMPORTANT THAT YOUR CONFIDENCE IS VERY HIGH THAT ALL OF THESE ORGANISMS ARE THE SAME TAXON. If a determination still cannot be made, a senior biologist should be consulted before leaving at a higher (Family or Order for most insects, for example) level of resolution. In many cases these damaged specimens will be readily identifiable to more experienced taxonomists.

Some specimens will not seemingly fit neatly into any particular combination of couplets. In such cases, a Difficult Taxon Worksheet (L3) should be used to assist in the identification. Importantly, this worksheet traces the steps through a dichotomous key, and the taxonomist assigns a certainly rating to the decision made at each couplet. When the ID is obtained the taxonomist then assigns an overall

certainty rating to the determination. This both allows the taxonomist to better understand how he/she arrived at the decision they made and with what confidence, and will allow senior biologists to not only verify such IDs, but to determine precisely where errors where made, if they occur. This will ultimately help better train the taxonomist, as specific weaknesses in classifying/recognizing/identifying invertebrate morphology can be recognized and discussed.

Taxa that cannot be identified should be assigned a voucher number (see below for voucher collection SOPs) and then "Unk." followed by the lowest taxonomic name that can be assigned to the organism. For example, an unknown dipteran larva might be assigned voucher number 952 and be named "952 Unk. Diptera". This name should then be used for this taxon on all data sheets until a definitive identification is made. An unknown taxa list should accompany ID data sheets for each project. This list should include all unknown taxa voucher numbers, names, and descriptions of important characters so other individuals of the same taxon can be recognized as such in samples and assigned the same name and number.

In the event that multiple taxonomists are working on a batch of samples, it is important that they communicate with each other regarding assigned unknown species voucher numbers so that all specimens of a given unknown taxon are consistently identified.

Voucher Collection Assembly

A common voucher collection will be assembled for each park in the CAKN. This voucher collection will be assembled as new taxa are encountered, and should include every taxon encountered, even those that are very common and/or easy to identify, and regardless of whether that taxon already occurs in the laboratory's voucher collection. Importantly, every morphologically unique specimen should be catalogued and counted as a separate taxon. For example, if morphologically distinct *Baetis* species are encountered, even if they cannot be identified to species, they should be catalogued as two separate taxa (sp. 1 and sp. 2) and counted as such. Every new voucher specimen should be entered into the laboratory's voucher database. Enter the specimen into the database when the specimen is physically placed into the collection; this eliminates the possibility that it won't get entered. A "voucher specimen" label should placed into the vial with the specimen that includes the voucher number. This voucher number should also be written on the top of the vial cap with a permanent marker.

If a voucher specimen was IDed using diagnostic characters under a compound microscope, those body parts should be permanently mounted on a slide and included in the voucher collection in addition to the whole organism in a separate vial. The slide should receive the same voucher number as the vial, and a note should be made in the database that slides are also included.

Use of Existing Voucher Collection

The existing voucher collection should be used to confirm the identity any organisms that you're not completely sure have been correctly identified. Use the "Voucher Collection" file and sort by taxon name. Locate the taxon of interest to retrieve the vial and box numbers, which can then be used to locate the needed voucher specimens. IF THE LABORATORY VOUCHER SPECIMENS DO NOT MATCH UP WITH THOSE FROM THE SAMPLE, AND YOU'RE RELATIVELY CONFIDENT THAT YOUR ID IS CORRECT, PLEASE CONSULT WITH A SENIOR BIOLOGIST. It is always possible that laboratory collection specimens are incorrectly identified. This use of the collection is the best way to identify and correct these errors.

Identifying and Counting Organisms in Large/Rare Vials

Organisms in the large/rare vial also need to be counted and identified. Count and ID all organisms in the vial and mark them as LG/RR on the bench sheet. If the same taxon was encountered in the subsample, then those organisms of the same taxon in the large/rare vial should not be included on the data sheet.

Quality Control

The voucher collection provides a good starting point for evaluating the accuracy of identifications made for a given project. From this starting point, one or more of the following procedures will be performed to ensure high-quality data are produced:

- A senior biologist will identify every organism placed in the voucher collection for a given project.
- 10% of the samples identified by a junior biologist will be reidentified by a senior biologist to ensure that counts are accurate and taxa are not being missed.
- A further 10% of the samples may be resorted (from unsorted fractions) and reidentified to determine the quality of work from sorting through identification.
- Organisms that can't be identified by senior biologists will be sent to taxonomic experts for further examination.
- Voucher collections that have been inspected by a senior biologist may be sent to an independent laboratory for cross-confirmation.

General Laboratory Operations Guidelines

1. Cover microscopes when not in use.
2. Turn off all power sources (surge protectors and strips, included) when leaving the lab for longer than a short break.
3. Keep the lab clean and dry.
4. Notify senior biologists of supply shortages before they run out.

III. Data Entry

As each sample is identified, the taxonomist enters data into a macroinvertebrate data entry program. At the end of each sample, it is up to the taxonomist to examine data entry and to make any necessary corrections before moving on to another sample. Human errors can still occur, but this process generally reduces the error frequency.

The database used for data entry is created from the Shallow Lakes database, and needs to be populated with the sample collection data for the samples being analyzed by the lab. See Figure 7 for a screen shot of the database. A new data entry database must be generated each year for the samples to be analyzed for that season. For detailed instructions on generating this database, refer to Instruction Sheet "Generating Invertebrate Lab Data Entry Database".

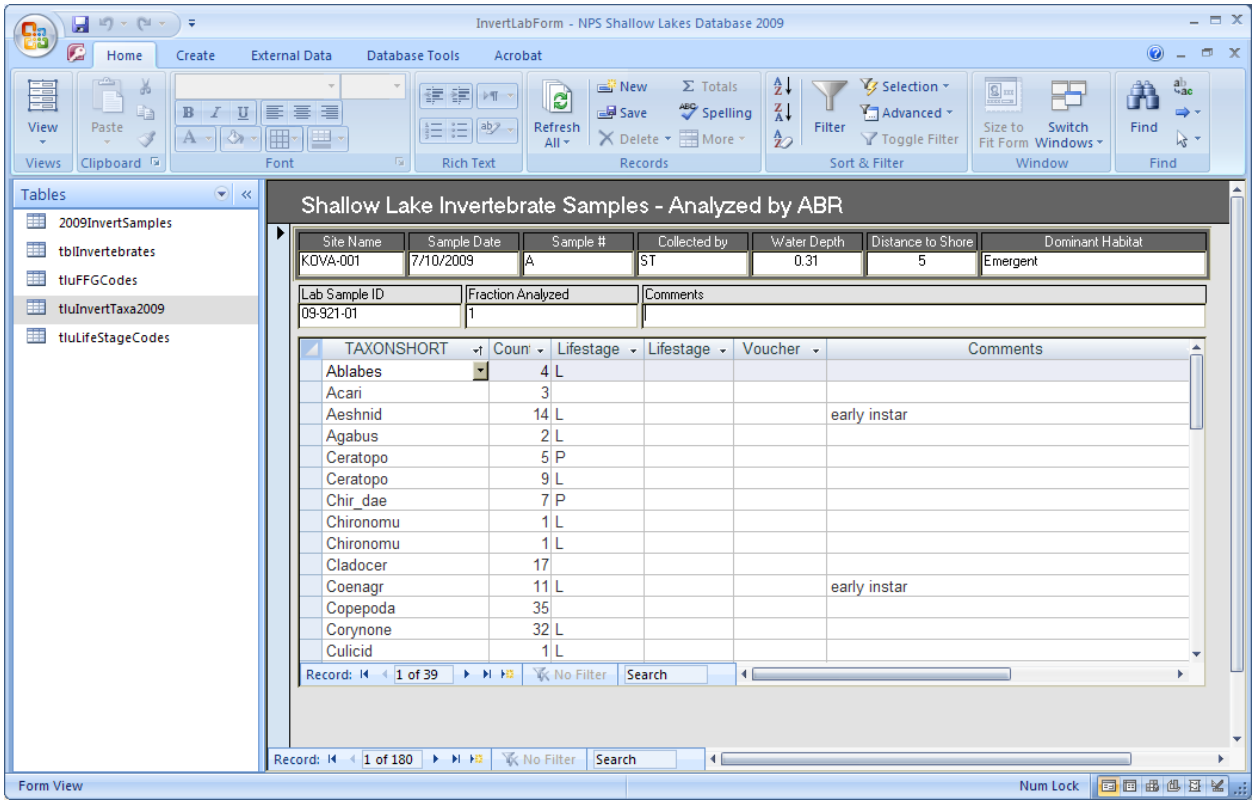


Figure 7. Screen-shot of database used for laboratory data entry

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Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #24: Data Management

Version 2.0 29 September 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	09/29/2010	H. Kristenson	Extensive overhaul and document format change	We have a new SQL Server database, a new Access front end, new protocols for handling imports of external data, and new electronic devices and software for handling various data types. Format was changed to produce a more streamlined reference document, which is more easily served to the public.	2.0

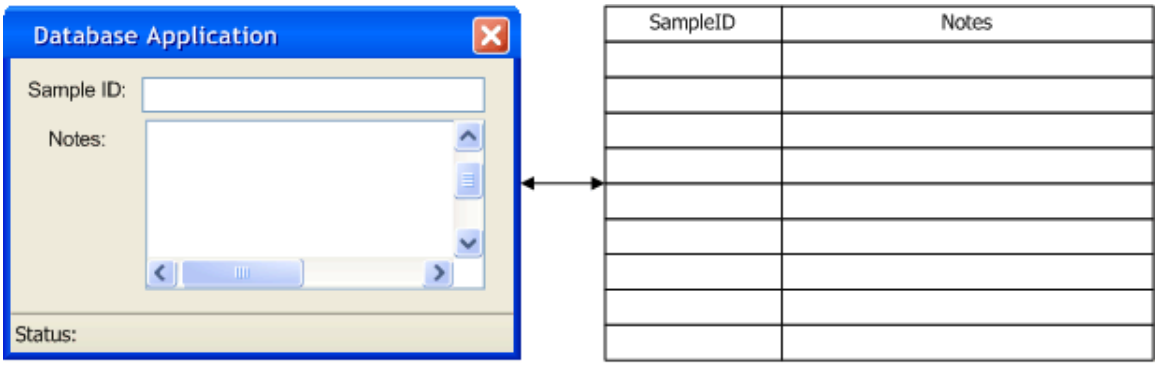
This SOP summarizes data management of the shallow lake monitoring protocol for the Central Alaska and Arctic Networks. Here we document the two-tiered Microsoft SQL Server/Access database used to house project data, provide instructions for data entry, import, validation and management, and outline the administration of the database. This SOP has been developed following strategies and guidance for data handling and quality assurance/quality control in the CAKN Data Management Plan.

I. Shallow Lakes Monitoring Database

Most of the data associated with this project is housed in a single database. This database has a two-tier architecture, in which the application's presentation (forms, queries and reports) is in Microsoft Access, while the underlying data model and business logic is contained in a Microsoft SQL Server database. The Access file is commonly referred to as the "front end", while the SQL server database is commonly referred to as the "back end".

The SQL Server is located in the server room at the Fairbanks Administrative Center office building. SQL Server databases exist as files (.mdf and .ldf) in a directory, and the process of attaching a database to a SQL Server essentially shows the SQL Server where the database files reside. The details of the SQL database used for this project are listed below:

Server Name: INPYUGAMS08\SQLExpress
Database: AK_ShallowLakes
Security: Integrated



Front End. The presentation layer (Microsoft Access)

Back End Database (Microsoft SQL Server Express)

The Microsoft Access front-end file is named ShallowLakes-X.X.adp, with the X.X being the numeric indicating the version. This front-end file is stored on the CAKN network drive: J:\Monitoring\Water_Quality_Macroinvert\Database. In order to use this two-tiered database, the two layers must be connected. See Instruction Sheet "Connecting SQL Server to Access Database" for details.

SQL Server Database Structure

The database is fairly large and complex, with many tables and relationships. The database model is regularly mapped, and can be viewed either as a diagram showing a visual representation of the tables and their relationships, or as a text data model, listing each table with all of its properties and fields. Select the appropriate link below to view either the diagram or the full text data model report.

Data Model – Diagram | Data Model – Full Text

Preparing Tablet PC for use in the Field

The AK_ShallowLakes database is loaded onto a Tablet PC, allowing data to be entered directly into the database in the field and reducing the need for paper forms. With the introduction of the SQL database with an Access front end, the procedures for loading the database onto the Tablet PC became more complex than simply copying an .mbd file to the hard drive. The SQL Server database must be loaded onto the Tablet PC, along with the Access front end, and then a connection must be established between the two. See Instruction Sheet "Loading Database onto Field Computer" for details on how to load the database onto the Tablet PC and set the connection to SQL Server before the field season.

II. Field Data Backups

A number of different methods are used for collection of field data, including several different electronic formats. Most of the field data is entered directly into a Tablet PC, while other data is collected using a Trimble GPS unit, a Garmin eTrex unit, or the YSI MDS 650 field computer. It is very important to back up this electronic data regularly while in the field. The following instructions are also included in Instruction Sheet "Field Data Backups" for easy reference.

Backing up data in the Field

Refer to Instruction Sheet "Field Data Backups" for more details.

1. Use the SQL Server Backer-Upper to back up Tablet data to a thumb drive
2. Download YSI files to field PC and clear data from the MDS 650 unit (see Instruction Sheet "Downloading Data from YSI MDS" for details). Clear the site list in the 650 and add the sites for the following sampling day.
3. Download Trimble files to field PC, leave the originals on the Trimble unit
4. Download Garmin eTrex using MapSource, saving as a .gdb file with the unit number and date as the file name
5. Download photos from Camera if necessary or desired, as described in SOP 15: Documenting a Lake Using Digital Photography.
6. Save a copy of data backups to a thumb drive. The most important data to include on the thumb drive is the YSI files, as the data is not saved anywhere other than on the computer. The Trimble and Garmin units retain their data, so are of a lower priority for thumb drive backup. The rule of thumb is to have all data in at least 2 places at the end of the field day:
    a. Tablet: on Tablet and thumb drive
    b. YSI files: on field PC and thumb drive
    c. Trimble: on Trimble and PC
    d. Garmin: on Garmin and PC
    e. Camera: on memory card and/or thumb drive and/or field PC as appropriate

Backing up data upon return from Field

1. Move the following backup files from the field PC to J:\Monitoring\Water_Quality_Macroinvert\Field_Data\YYYY
    a. Tablet: to TabletBackups folder
    b. YSI files: to YSIProfiles folder
    c. Garmin: to GarminTrackLogs folder (if more than one park is being visited during the season, it may be helpful to add a subfolder with the park name in order to keep the files more organized).
2. Download Trimble files directly from the unit to J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY
3. Download cameras directly (or move the photos already downloaded to the field PC) to J:\Monitoring\Water_Quality_Macroinvert\Photos\YYYY
4. Do not retain duplicate copies of the data on the field PC. Delete (or clearly mark for deletion) the folders once the data has been transferred to the J drive, in order to reduce potential for confusion about which file is the most recent.

III. Lab Sample Tracking

Because many of the samples collected in this program require extensive laboratory processing before the data are available, it is essential that the samples be inventoried and tracked. When the data

is received back from the laboratories, the project manager must notify the data manager who will then import the data into the database (see the Import and Validation of Laboratory Data section).

To assist the labs in analysis and minimize errors in sample identification, an inventory of the samples shipped to the lab for analysis should be generated and forwarded to the lab. These lists can all be generated from the database. See Instruction Sheet "Generating Sample Lists" for detailed instructions.

IV. Spatial Data

Data with a spatial component is collected using Trimble GPS units, and must be properly transferred, post-processed, and archived to ensure a high quality dataset. Some of the information collected with Trimble GPS units is imported into the AK_ShallowLakes database, while most is maintained in a geodatabase and file management system external to the database. Refer to SOP 12: Using the GPS and the instruction sheets referenced therein for more information about the collection, organization, and processing of spatial data using Trimble GPS units and software.

Shallow Lakes Geodatabase

A geodatabase is currently being developed to be used for the Shallow Lakes project. This will allow all of the data collected with the Trimbles to be loaded into Feature Class files, facilitating long-term management and analysis of spatial data. More details will be added once the geodatabase design is complete.

Trimble Data Management

All data collected using the Trimbles are stored in the following location, filed appropriately by year and then by Park: J:\Monitoring\Water_Quality_Macroinvert\TrimbleData

There is a project created through Pathfinder Office for each park for each year that data is collected. By creating these projects in Pathfinder Office, and using the appropriate project when processing any Trimble data, it ensures that all the data will be organized in a standard arrangement of folders, and that the raw data will always be preserved in the event that data sets need to be re-processed. Any time Trimble data is transferred from the unit, post-processed, or exported for use in ArcGIS, these processes should be performed within the appropriate project to ensure that the dataset is entire and uncorrupted.

Because the Trimble software is frequently updated, and the procedures for processing data tend to change regularly, the most recent protocols developed for GPS: Trimble Pathfinder Systems (Course No. 1730-56) should be used. Contact the GIS program in the Alaska Regional Office of the National Park Service for course information and materials. See the Instruction Sheet "Trimble Data Processing" for detailed instructions on processing data collected with Trimble GPS units and preparing it for use.

V. Data Entry and Validation of Field Data

Data Sources

Most of the data is entered in electronic format directly in the field. Paper datasheets are carried in the field as backup, in case of equipment malfunction, but the only paper forms filled out regularly in the field are Sketch Maps. At the end of the field season, the following tasks should be completed in order to ensure that all of the data is imported into the proper location and/or archived for long-term storage.

1. **Enter any data collected on paper datasheets into the database**. As soon as possible upon returning from the field, go through all of the sketch maps and any paper datasheets used, and make sure that all of the information contained on the paper datasheets (including notes on the sketch maps) is entered into the database. This can either be done on the Tablet PC before concatenation, or after concatenation on a desktop computer. Mark each datasheet with initials and date to indicate that the data was entered.

2. **Mark corrections on data sheets with red pen.** Any corrected errors, or changes that are entered differently into the database than they appear on the paper data sheet, should be circled and corrected using a red fine-point Sharpie marker. Notes, in red ink, should be written on the margins or in the comments section whenever necessary to document the reason for the corrections.

3. **Archive the original data sheets**. Organize the original field data sheets by lake and store in the designated fireproof safe or cabinet used by the Shallow Lake Monitoring protocol.

4. **Prepare database for concatenation.** Ensure that all site names and sample dates are correct in the database before the concatenation process. Check in particular for improper cases and extra spaces in site names. Check each entry in the Ponds table and the Events table to make sure that all of the fields have been filled out as completely as possible, and correct any typos or unusual spellings that result from field entry into the Tablet PC.

5. **Transfer, Post-process, and Import Trimble files**. Transfer the data files from the Trimble GPS unit, post-process the files, import the data into the database, and archive the spatial data as outlined in the Trimble Data Management section of this document. In addition, some of the Trimble files have notes fields that may contain data that needs to be added to various fields within the database, including Secchi depths, notes from the Depths files, and the measured pond depths for each Water Chemistry sample location. See the Instruction Sheet "Data Import: Trimble Files" for details.

6. **Import YSI profile data**. The data collected using a YSI Sonde is stored on the YSI MDS 650 field computer (see SOP 17: Water Chemistry Field Data and Sample Collection), and transferred to a field computer at the end of every day during a long field excursion. These files must be imported into the AK_ShallowLakes database following the directions in the Instruction Sheet "Data Import: YSI Files"

Data Processing Checklist

Because there are so many different instruments and tools used to collect data, often each requiring specific protocols for downloading, processing, and importing or archiving data, a checklist has been developed to keep track of all of the steps necessary for managing the data for this project. Print a copy of the Data Processing Checklist for each park where data is collected in any given year, and use it to track the completion of each step in data management.

VI. Import and Validation of Laboratory Data

Several different samples are sent out for laboratory analysis, and it may take several months to a year to receive the results. Once the results have been received, they must be imported into the database. These tasks should also be logged on the Data Processing Checklist.

1. **Water Chemistry Data**. The water samples collected and filtered for water chemistry analysis are sent to the Cooperative Chemical Analytical Laboratory (CCAL) for analysis. The data is returned with the results in spreadsheets, and the comments in textfile format. The tabular data is imported in the database by creating a SQL Insert Into query, while the comments in the textfiles must be manually entered. See Instruction Sheet "Data Import: Water Chemistry" for detailed instructions.

2. **Chlorophyll Data**. Water samples are filtered in the field, and the filters are sent to the Kielland Lab at the University of Alaska Fairbanks (UAF) for analysis for chlorophyll a. The data is returned with the results in a spreadsheet, and is imported into the database using a SQL query. See Instruction Sheet "Data Import: Chlorophyll" for detailed instructions.

3. **Invertebrate Data**. The invertebrate data is the most complicated dataset sent out for analysis. A small database is sent to the lab to be populated with the data, then returned for integration into the AK_ShallowLakes database. See Instruction Sheet "Generating Invertebrate Lab Data Entry Database".

VII. Database Concatenation

The Shallow Lakes Monitoring data management system consists of a Microsoft Access front-end application that is connected to a Microsoft SQL Server Expresss back-end database. The back end database is designed to be split into multiple (child) copies running on field computers and the copies reintegrated with the master (parent) database. At the end of the field season, any data entry performed on any field computers needs to be integrated into the main SQL Server database back-end housed at the NPS Fairbanks Administrative Center. The Instruction Sheet "Database Concatenation" explains how to reintegrate a child database with the parent database.

VIII. Communication with Project Leader

Once all of the data has been entered and checked, and all of the data from external sources has been imported into the database, inform the Project Leader that data entry for the current year is complete. Check the Data Processing Checklist to make sure that all tasks have been documented as being complete.

IX. Data Administration

The data management procedures that are common to all monitoring protocols implemented by the CAKN monitoring program are outlined in the CAKN Data Management Plan (*http://science.nature.nps.gov/im/units/cakn/datamgmt.cfm*).

1. **Data Maintenance.** Any editing of archived data is accomplished jointly by the Project Leader and Data Manager. Every change is to be documented in the edit log and accompanied by an explanation that includes pre- and post-edit data descriptions. To be in compliance with the National Park Service Inventory and Monitoring Program's Natural Resource Database Template, there must be a table in the database to track any of these edits. This table is currently under development; more details will be added as they become available. All data collected using this protocol is subject to the following two caveats:
   - Only make changes that improve or update the data while maintaining data integrity.
   - Once archived, document any changes made to the data set.
2. **Computer File Organization.** Files for this project are maintained on the CAKN network drive (the "J" drive) at the Fairbanks Administrative Center office in the folder:
   J:\Monitoring\Water_Quality_Macroinvert
   The files are organized according to the diagram illustrated in Figure 1.
3. **Access Front End Version Control.** Prior to any major changes in the ShallowLakes.adp front end, a copy of the .adp file is created, and assigned a sequential version number. This file is then edited, while the previous file is stored in the Database folder under the appropriate year with the appropriate version number to allow for tracking of changes over time. The most recent copy of the database front end is always stored in the root

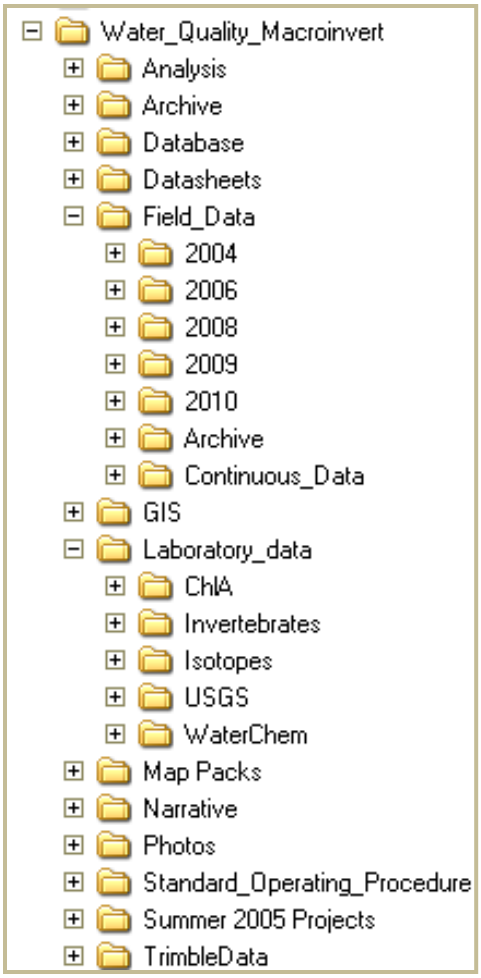


Figure 1. Diagram of file organization structure for the Shallow Lakes monitoring program

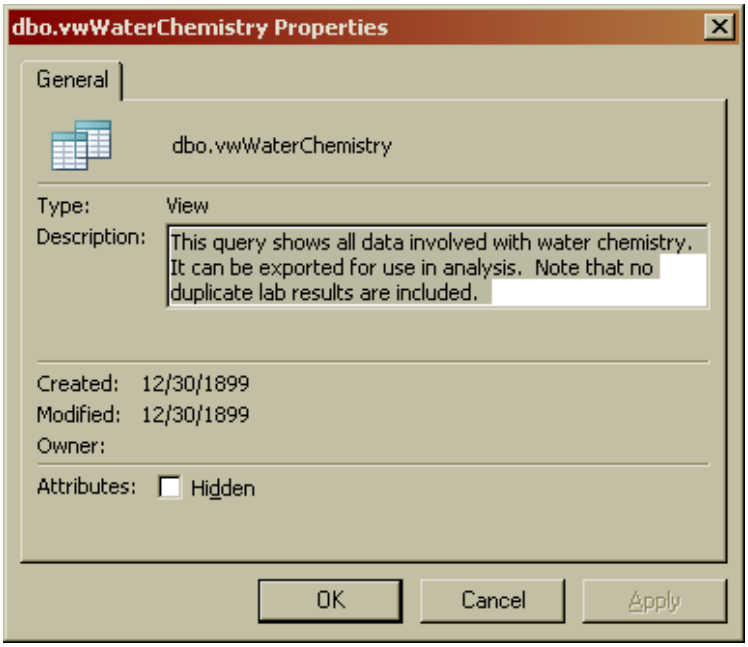
Database folder with the filename ShallowLakes-X.X.adp, where the X.X indicates the version. *Only* the most recent version should be kept in the root Database folder, to avoid confusion.

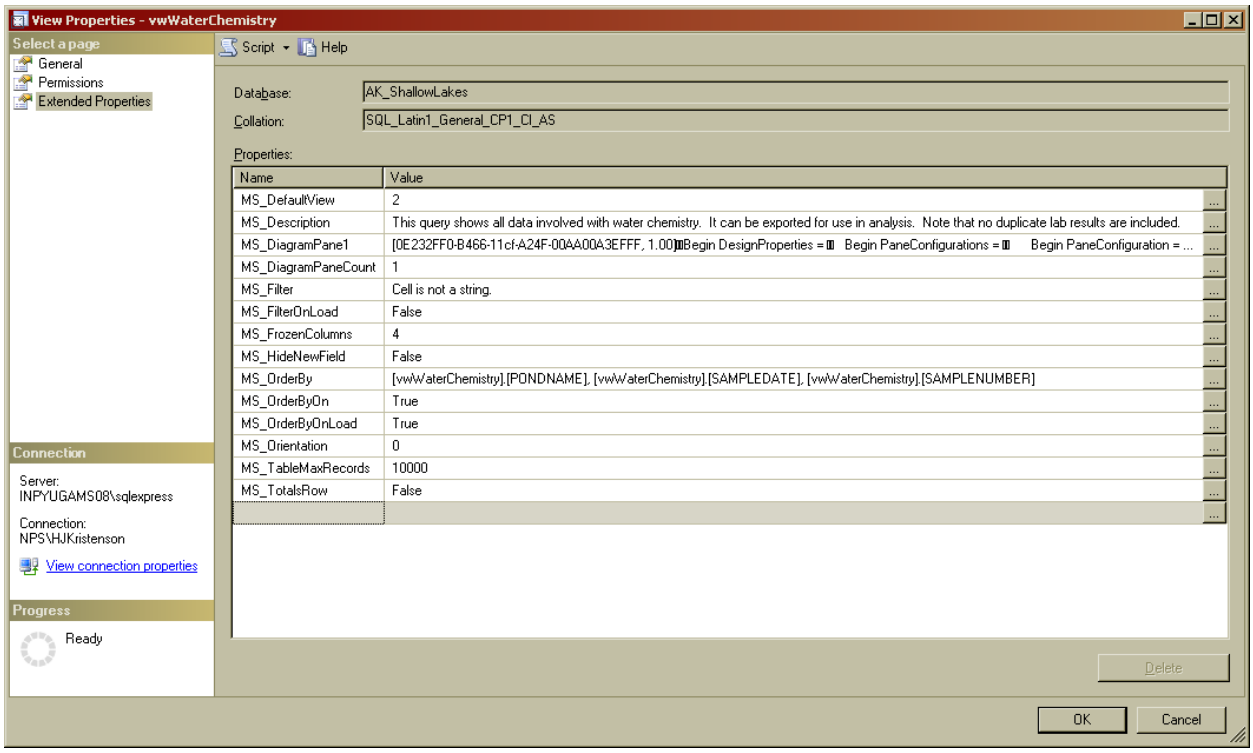
4. **SQL Database Backups.** It is important to understand that the Access front end (.adp) file does not actually contain any data, but serves as a conduit to access the data tables of the SQL Server database. In order to view the data in the Access file, it must be connected to the SQL Server database. When editing data or tables in Microsoft Access, the changes are actually taking place in the SQL Server database, and any version of ShallowLakes.adp that is attached to that same SQL Server database will reflect these changes. As such, making a backup of the Access file does NOT back up the actual data. To save the data and tables in the database at any given time, the backup must take place in SQL Server. Changes to the appearance of the front end are saved in Access, as described above.

   The SQL Server database is backed up every Monday. This involves the entire database being written to a separate file on the same server. In addition, the server is backed up regularly by IT staff at the Fairbanks Administrative Center. This replicates the data on the server and stores it on an off-site server (FAPLIC). Contact one of the IT staff to access archived versions of the database. Note that both the .mdf and .ldf files will need to be obtained to reconstruct the database.

   At the end of each season, when all data has been entered, imported and checked, the database should be backed up and saved in the database backup folder. Both the .mdf and .ldf files must be included. (J:\Monitoring\Water_Quality_Macroinvert\Database\Database Backups)

5. **Database Metadata.** All of the fields in all of the tables in the Access front end have descriptions of the field. Any new fields that are added must have a description added that clearly explains what type of data is to be entered in that field, and any pertinent information required for future users of the database to understand the data presented. In addition, all tables and views should have a description entered in the Object Properties window, which can be viewed and edited by right clicking the name of the table or view in the Access table of contents pane. The descriptions entered in the Object Properties window are also added to the record of the table/view in SQL Server, and can be viewed by right-clicking the table/view and selecting Properties. The information can be found under Extended Properties, in the MS_Description field.





X. STORET Database

The primary mechanisms that will be employed to enter water quality data into the EPA's STORET database are a series of input screens (forms/templates), developed as part of the Natural Resource Database Templates (http://www.nature.nps.gov/im/apps/template), and the STORET Interface Module (SIM Ver. 2). The input screens (called NPSTORET), developed by the NPS WRD, will allow Vital Signs Monitoring Networks to enter data about their projects, stations, metadata, and results.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #25: Data Analysis and Reporting

Version 2.0 26 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	10/25/2010	A. Larsen, J. Schmidt	Addition of analysis procedures and software information	Analysis procedures have been developed for the program, and software has been chosen for use.	1.1
1.1	10/26/2010	H. Kristenson	Document format change	Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP outlines the requirements and guidelines for analysis and reporting of data collected for the Shallow Lakes monitoring project, including annual summaries, and analysis of decadal-scale trends in lake status.

I. Introduction

Data analysis and reporting plans have been developed for each of the major objectives for Shallow Lake monitoring within both the Central Alaska (CAKN) and Arctic (ARCN) Networks. The following measureable objectives have been identified:

1. **Water Quantity and Distribution**: Detect decadal-scale trends in the water surface area, distribution, and number of shallow lakes and ponds in CAKN and ARCN parks.
2. **Water Chemistry**: Detect decadal-scale trends in the water chemistry of shallow lakes and ponds in CAKN and ARCN parks.
3. **Vegetation**: Detect decadal-scale trends in the structure and composition of vegetation in shallow lakes and ponds in CAKN and ARCN parks.
4. **Macroinvertebrates**: Detect decadal-scale trends in macroinvertebrate taxa richness and relative abundance in shallow lakes and ponds in CAKN and ARCN parks.

For each objective, we plan to quantify change on the four following scales:

1. Individual lake level
2. Regional level
3. Park level
4. Network level (all lakes sampled within both CAKN and ARCN)

II. Datasets Specific to Each Objective

Objective 1: Water Quantity and Distribution

Data to address this objective will be collected using satellite imagery. We will use GIS measurements to quantify surface area, distribution, and abundance. This will occur as imagery becomes available, probably at 5-10 year intervals. We will integrate the quantity and spatial distribution of water on the landscape across many vital signs to help explain Network-level changes (e.g. wetland passerine bird abundance, permafrost extent, vegetation, large mammal abundance).

Objective 2: Water Chemistry

We will collect data related to this objective at multiple temporal scales and intensities. At a small number of lakes we will monitor ($n \leq 3$), pH, temperature, specific conductivity, and dissolved oxygen continuously using sondes to provide estimates of daily and seasonal variation in these parameters. At ~3-10 lakes per park, we will collect complete water chemistry samples ~6 times annually to provide estimates of seasonal variation for all chemical parameters of interest. Water chemistry samples will be collected from 200 lakes to provide broad spatial inference. We will conduct sampling on a rotating basis with individual lakes revisited every 10 years. Water chemistry is an important driver for multiple vital signs, possibly influencing fish and macroinvertebrate communities, passerine bird abundance, amphibians, and mammals dependent on wetlands.

Objective 3: Vegetation

To assess trends in the structure and composition of vegetation, we will sample 3 replicate transects within an index site at ~80 lakes (a subset of the 200 from objective 2) to record species composition and abundance. These will also be revisited every 10 years. Changes in wetland vegetation communities are expected to help explain changes in bird, mammal, and macroinvertebrate vital signs.

Objective 4: Macroinvertebrates

At lakes chosen for macroinvertebrate sampling, we will collect 5 replicate samples and analyzed for composition and abundance. At this time, samples are not being collected for this objective.

III. Annual Summaries

Annual summaries of data collection efforts are useful for providing regular information on vital signs at shorter intervals than the more comprehensive analyses that are conducted every 5-10 years. Although these reports are not intended to provide statistically robust estimates of change, large differences between years and/or among regions may be apparent and provide interim indications of a changing system. Dramatic apparent differences found in the annual summary may also prompt a more formal analysis. Also, these reports document annual sampling efforts and locations to provide visual summaries of monitoring efforts for this vital sign. This allows a quick comparison of spatial coverage for further integration across multiple vital signs.

Objective 1: Water Quantity and Distribution

Data for this objective are not collected annually, so no summary is necessary for annual reporting. This objective is addressed in the discussion of the analysis of decadal-scale trends.

Objective 2: Water Chemistry

Continuous Data/Repeated Measures

We will summarize data annually from the subset of lakes visited multiple times within a year, or continuously monitored using sondes. We will present plots for each measured parameter at each lake over the course of the season, along with tables containing summary statistics (e.g. mean, median, standard deviation) for each lake (Table 1). We will present daily, weekly, monthly and annual summaries for each sonde. We will also prepare correlation matrices of continuously monitored data and climate proxies annually to track trends in lake variation relative to climate.

Table 1. Example table of monthly summary statistics for continuous data collected in Wrangell-St. Elias National Park and Preserve in 2009

June, 2009 (215 samples)							
WRST	Mean	Minimum	Maximum	Avg Deviation	Std Deviation	Valid Samples	%
Temperature (°C)	11.80	9.19	15.41	1.32	1.58	215	100.00
Specific Cond (mS/cm)	0.060	0.058	0.064	0.001	0.001	215	100.00
Conductivity (mS/cm)	0.045	0.041	0.050	0.002	0.002	215	100.00
DO (mg/L)	9.57	9.22	9.96	0.11	0.14	215	100.00
pH (pH)	7.32	7.14	7.43	0.06	0.06	215	100.00

July, 2009 (744 samples)							
WRST	Mean	Minimum	Maximum	Avg Deviation	Std Deviation	Valid Samples	%
Temperature (°C)	17.06	11.16	21.92	1.45	1.80	744	100.00
Specific Cond (mS/cm)	0.062	0.058	0.068	0.001	0.002	744	100.00
Conductivity (mS/cm)	0.053	0.043	0.060	0.002	0.003	744	100.00
DO (mg/L)	6.75	3.68	9.59	1.40	1.63	744	100.00
pH (pH)	7.40	7.13	7.62	0.07	0.09	744	100.00

August, 2009 (744 samples)							
WRST	Mean	Minimum	Maximum	Avg Deviation	Std Deviation	Valid Samples	%
Temperature (°C)	13.39	10.61	19.39	1.72	2.06	744	100.00
Specific Cond (mS/cm)	0.065	0.063	0.076	0.000	0.001	744	100.00
Conductivity (mS/cm)	0.050	0.047	0.059	0.002	0.003	744	100.00
DO (mg/L)	1.15	0.02	3.65	0.89	1.06	744	100.00
pH (pH)	7.39	7.25	7.59	0.06	0.07	744	100.00

September, 2009 (338 samples)							
WRST	Mean	Minimum	Maximum	Avg Deviation	Std Deviation	Valid Samples	%
Temperature (°C)	10.33	8.96	12.07	0.58	0.73	338	100.00
Specific Cond (mS/cm)	0.066	0.065	0.072	0.001	0.001	338	100.00
Conductivity (mS/cm)	0.048	0.046	0.052	0.001	0.001	338	100.00
DO (mg/L)	-0.02	-0.07	0.07	0.03	0.03	338	100.00
pH (pH)	7.40	7.28	7.50	0.03	0.04	338	100.00

Single-visit Lakes (~200/year)

The annual summary for this objective will include a table containing park-level summary statistics (e.g. mean, median, standard deviation) for each water quality parameter. A comprehensive list of water chemistry factors is listed in Table 2. The program will provide a list of sites showing where water chemistry, vegetation and macroinvertebrate samples were collected during that year (Table 3). A figure showing the locations of the lakes sampled for water chemistry will be included (Figure 1) to show the distribution of lakes sampled.

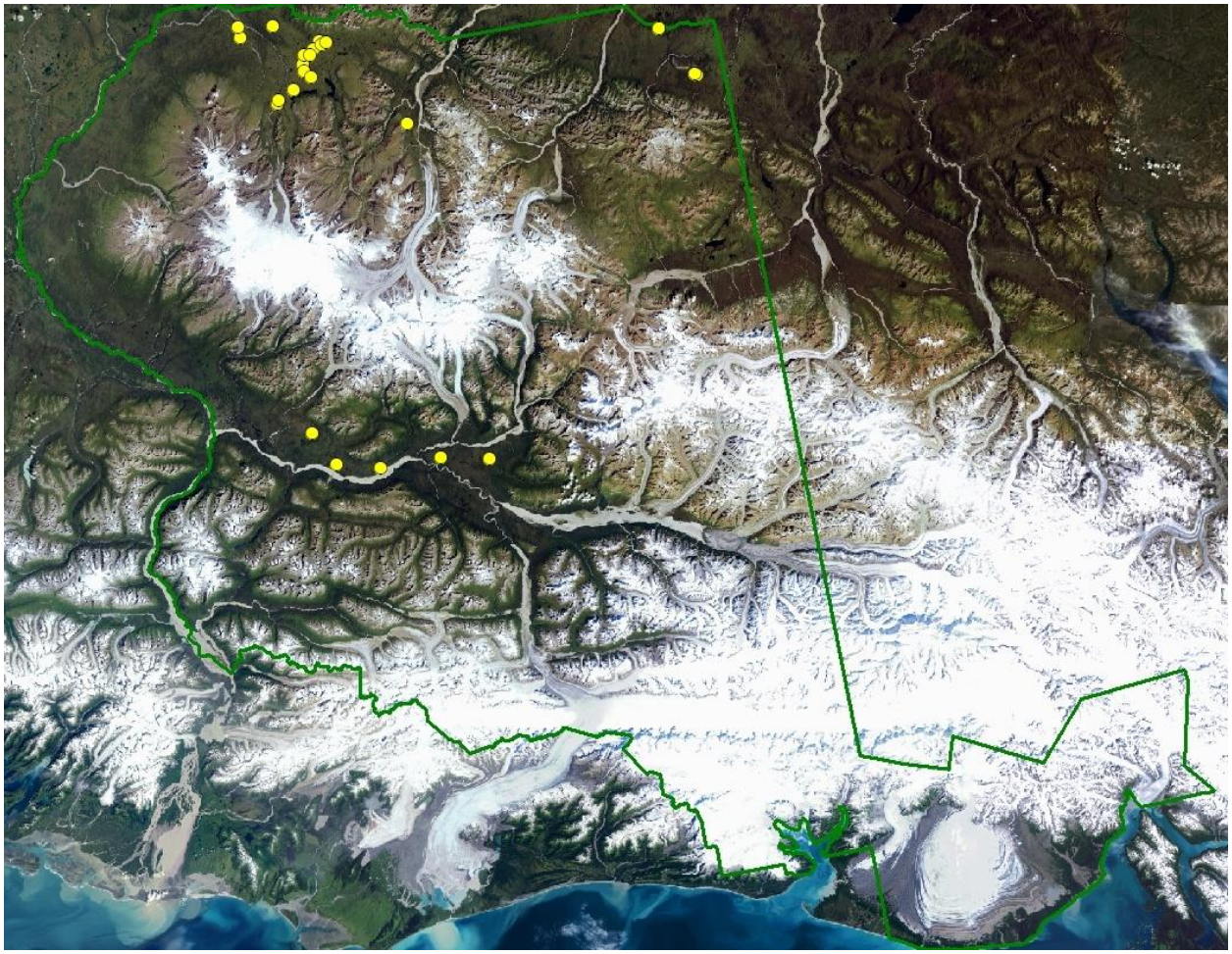


Figure 1. Example figure showing sites where water chemistry data were collected in Wrangell-St. Elias National Park and Preserve in 2009

Table 2. List of factors that will be summarized each year by park, subsection, or other pertinent categories

Core Parameters	Nutrients	Cations/Anions	USGS Provided
Epilimnetic temperature (T)	Total nitrogen (TN)	Calcium (Ca)	Dissolved inorganic carbon (DIC)
pH	Total phosphorus (TP)	Magnesium (Mg)	Carbon dioxide (CO_2)
Specific conductivity (KSP)	Nitrate (NO_3)	Potassium (K)	Oxygen isotope (delta ^{18}O)
Epilimnetic Dissolved Oxygen (DO)	Ammonia (NH_3)	Sodium (Na)	Hydrogen isotope (delta ^{2}H)
Secchi depth (SD)	Orthophosphate (PO_4)	Chloride (Cl)	UV
Alkalinity (HCO_3^-)	Dissolved organic carbón (DOC)	Silica (SiO_2)	SUVA
Acid neutralizing capacity (ANC)			

Table 3. Example table illustrating which variables were sampled at each lake

Lake	Water Chemistry	Vegetation	Macroinvertebrates
WRST-001	X	X	X
WRST-002	X		
KOVA-001	X	X	X
KOVA-002	X		

Objective 3: Vegetation

Each year, 40-50% of the lakes visited are sampled for vegetation. A summary of vegetation characteristics from this subset of the lakes will be presented annually. This table will include a summary of the basic vegetation characteristics by lake. The following characteristics should be included: mean width of emergent zone, average percent cover by species, species composition and frequency by species. A figure showing the locations of the lakes sampled for vegetation will be included (Figure 2) to show the distribution of lakes sampled.

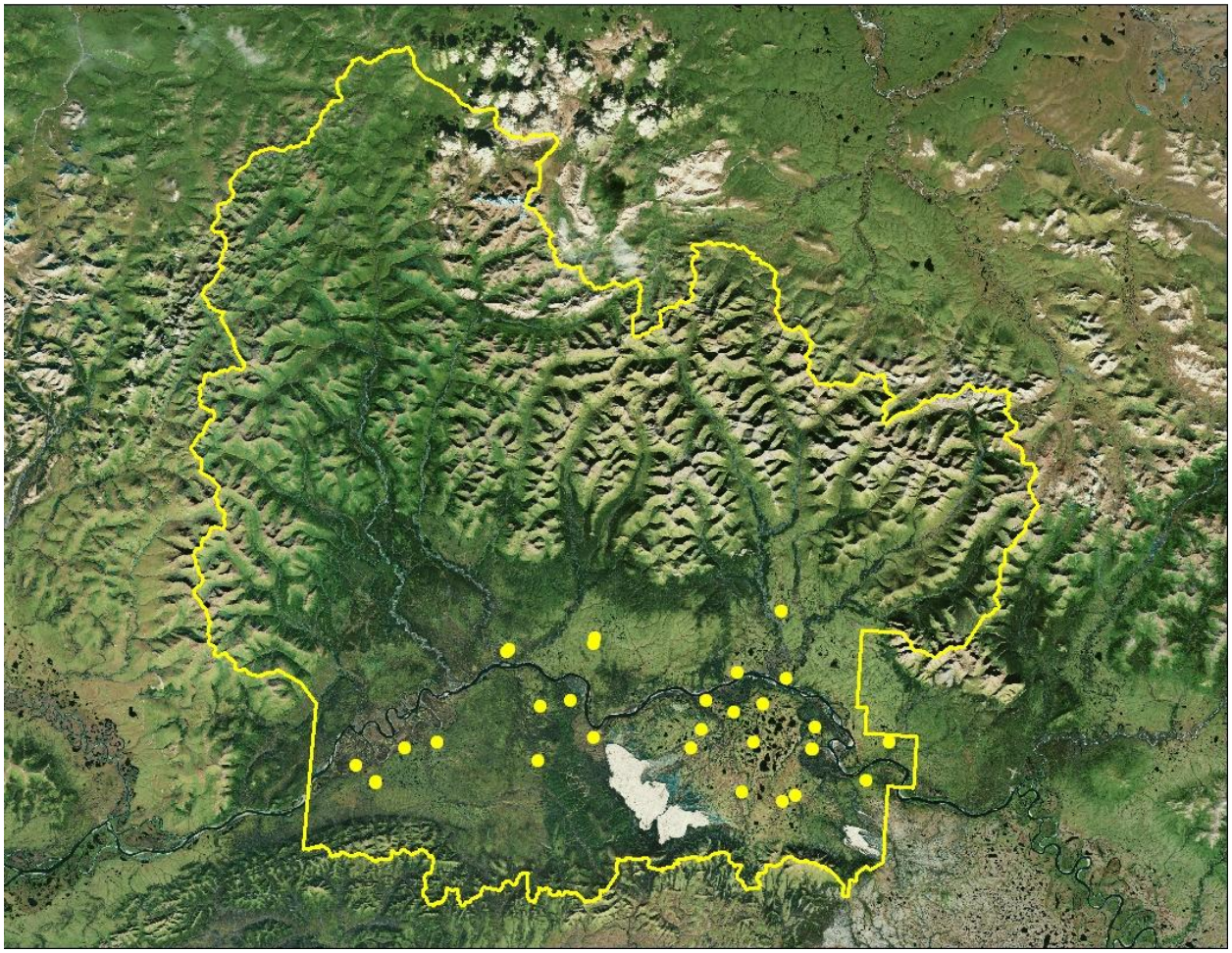


Figure 2. Example figure showing lakes sampled in 2009 for vegetation in Kobuk Valley National Park

Objective 4: Macroinvertebrates

Summary tables containing species composition and abundance information for each lake where invertebrates are sampled should be presented in the annual report. A figure showing the locations of the lakes sampled for macroinvertebrates will be included.

IV. Analysis of Decadal-Scale Trends in Lake Status

At 5-10 year intervals, we will complete comprehensive statistical analyses of monitoring data to identify any trends in lake status at multiple scales. This will provide a formal assessment of trends that is not possible using annual data summaries. These periodic analyses also provide an opportunity to assess the statistical power of the current sampling design and provide recommendations for modifications to future sampling efforts if necessary. This can be important for improving inference and the ability to detect trends across the Networks.

Objective 1: Water Quantity and Distribution

Every 10 years, or as additional imagery becomes available, we will assess changes in the quantity and distribution of water on the landscape. If possible, all lakes within each park will be identified on the series of images, and the surface area of each lake calculated. If this is not feasible due to time/budget constraints, a subset of lakes will be assessed (e.g. by region within a park) for trends in the number of individual lakes and/or the total lake surface area on the landscape. This analysis will be done at the individual lake level.

Lake Numbers

Lake presence/absence data will be analyzed using a version of occupancy models developed for metapopulations, allowing the estimation of 'extinction' and 'colonization' rates for lakes in the sample. As lakes dried they would become extinct, but this approach would also allow basins to be 'colonized' by water if conditions changed in the future. Trends in the rates of these processes across the landscape would indicate large scale changes in lake numbers.

This analysis will be done in a Bayesian framework, following the approach described by Royle and Dorazio (2008), which can be expanded to include spatial autocorrelation. This approach will help identify differences in extinction rates/trends by region or lake type that might be obscured if autocorrelation is ignored, and much variation in extinction/colonization probabilities between individual lakes at different spatial scales is expected. This will also provide a quantitative assessment of trends in the spatial distribution of lakes across the parks.

Covariates should also be included to help explain variation in lake extinction/colonization probabilities. This will improve understanding of the mechanisms associated with lake dynamics. These could include: lithology, soil type, subsection, lake origin, and hydrologic regime, to name a few. Model selection criteria should be used to select among models and estimates for all model parameters should be presented. The spatial distribution of extinction/colonization probabilities will also be presented graphically.

Lake Surface Area

Lake surface area should be calculated in conjunction with the presence/absence data. This information will then be combined and analyzed using Bayesian occupancy/abundance models (Royle and Dorazio 2008), providing estimates of the probability of a lake being present, and if present, the size of the surface area. Model construction should follow an approach similar to the analysis of lake numbers. Covariates affecting lake extinction/colonization (e.g. subsection, permafrost distribution and ice content, precipitation, temperature, flow patterns) would be expected to be similar to those affecting area, and spatial autocorrelation is expected to be important.

Results would include estimates of factors associated with changes in lake size and spatial distribution of trends in lake size through time. Future analyses could also include some climate change covariates as they become available. For example, if estimates of permafrost degradation were available at the same scale as the lakes data, this could be included as an explanatory covariate to help explain why certain lakes change in certain patterns.

Objective 2: Water Chemistry

Every ten years, after one full rotation through the sampling design, we will conduct an analysis to assess trends in water chemistry parameters across both Networks. This analysis will simultaneously include the continuous monitoring data collected using sondes, as well as the data from lakes visited repeatedly throughout the season each year. These more frequently-collected data will help to address seasonal and annual fluctuations in chemical paramaters not captured during single visit sampling events. This data will augment the broad spatial sample and help assess some of the seasonal and annual variation not captured during single-visit sampling events. This will increase the power to detect any landscape-scale trends.

We will use generalized linear mixed models, fit in a Bayesian framework, for estimation. This approach explicitly accounts for unbalanced sampling (e.g. different coverage extents in different years, continuous/repeated sampling) and rotating panel designs. Individual lakes will be treated as sampling units and trends at the lake, region, park, and network levels will be estimated. Spatially-explicit models will help to account for variation across the landscape and will help identify trends and spatial patterns in any trends that may otherwise be obscured. Covariates such as ecoregion, subsection, lithology, soil-type, and lake origin will be included to help explain variation in the chemical properties of individual lakes and may reveal differences in trends among lakes/lake types.

The Deviance Information Criterion (DIC) will be used to select among competing models. Results will include estimates of factors associated with trends in chemical properties of lakes and a description of any spatial patterns in them. This will be done graphically by showing aggregations of lakes with similar chemical properties and/or trends across the landscape. This will provide a better understanding of the physical characteristics associated with any detected trends, and the spatial distribution of lake change throughout both Networks. A combined analysis across all parks and Networks will also increase the power to detect trends at all spatial scales.

Objective 3: Vegetation

The replicated vegetation transects collected at a subset of lakes within each park will be analyzed using hierarchical occupancy-abundance models (Royle and Dorazio 2008). Detection histories for each

species from each transect will be used to estimate detection probability, occupancy, and species richness for each index site sampled. Covariates thought to influence composition or abundance (e.g. substrate, lake origin, subsection) can also be included to help account for differences among lakes.

The DIC will be used to select the most parsimonious model. Analyses will include data from all parks when possible to increase the precision of estimates and enhance the ability to detect long-term trends at multiple spatial scales. Results will include estimates of factors affecting occupancy, abundance, and composition at multiple scales. Trends in species richness and similarity will also be assessed over time. Estimates of these measures can be directly incorporated into the proposed modeling framework.

Objective 4: Macroinvertebrates

The replicate samples collected during sampling will be analyzed using hierarchical occupancy models, very similar to the vegetation analysis described above. Results will include estimates of occupancy and composition at multiple scales. Estimates of species richness and similarity will also be produced from these models.

V. Statistical Software Packages

R

R is a language and environment for statistical computing and graphics. R can be regarded as an implementation of the S language and also forms the basis of the S-PLUS systems. R is a GNU project which is similar to the S language and environment which was developed at Bell Laboratories (formerly AT&T, now Lucent Technologies) by John Chambers and colleagues. R can be considered as a different implementation of S. There are some important differences, but much code written for S runs unaltered under R. R provides a wide variety of statistical (linear and nonlinear modeling, classical statistical tests, time-series analysis, classification, clustering, ...) and graphical techniques, and is highly extensible. The S language is often the vehicle of choice for research in statistical methodology, and R provides an Open Source route to participation in that activity.

The use of R facilitates diagnostics and interpretation of the data. One of R's strengths is the ease with which well-designed publication-quality plots can be produced, including mathematical symbols and formulae where needed. Great care has been taken over the defaults for the minor design choices in graphics, but the user retains full control.

R is available as Free Software under the terms of the Free Software Foundation's GNU General Public License in source code form. It compiles and runs on a wide variety of UNIX platforms and similar systems (including FreeBSD and Linux), Windows and MacOS.

R is an integrated suite of software facilities for data manipulation, calculation and graphical display. It includes:

- an effective data handling and storage facility
- a suite of operators for calculations on arrays, in particular matrices
- a large, coherent, integrated collection of intermediate tools for data analysis

- graphical facilities for data analysis and display either on-screen or on hardcopy
- a well-developed, simple and effective programming language which includes conditionals, loops, user-defined recursive functions and input and output facilities

The term "environment" is intended to characterize it as a fully planned and coherent system, rather than an incremental accretion of very specific and inflexible tools, as is frequently the case with other data analysis software.

R, like S, is designed around a true computer language, and it allows users to add additional functionality by defining new functions. Much of the system is itself written in the R dialect of S, which makes it easy for users to follow the algorithmic choices made. For computationally-intensive tasks, C, C++ and Fortran code can be linked and called at run time. Advanced users can write C code to manipulate R objects directly.

WinBUGS

WinBUGS is available for free online, is one of the most commonly used programs for Bayesian model fitting, and is the preferred software for the analyses described in this SOP. A version known as OpenBUGS is now currently available within R and future support and updates are expected to be confined to OpenBUGS. Future iteration of the analysis will likely be done completely within R using OpenBUGS. Coding is very similar to the WinBUGS format, so migration to this platform at a future date should be relatively easy. It is expected that the inclusion of BUGS within R will ensure that the software is updated and freely available for the foreseeable future.

VI. References

Royle, J.A. and R.M. Dorazio. 2008. Hierarchical Modeling and Inference in Ecology. Academic Press, San Diego

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #26: After the Field Season

Version 2.0 14 October 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	03/18/2010	H. Kristenson	Minor additions	Changes in equipment, electronics and data storage.	1.1
1.1	10/13/2010	H. Kristenson	SOP number changed from 27 to 26 Document format change	SOPs 25 and 26 were merged into a single SOP. Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP describes procedures that all field observers for shallow lake monitoring should complete following the field season. These tasks help bring the field season to a close by tying up loose ends, making sure data and equipment are properly stored and maintained. Effectively accomplishing these tasks can dramatically reduce efforts to initiate sampling in the following spring and reduce the likelihood of an aborted field excursion to lack of preparation.

I. Procedures

Equipment and Reference Materials

1. Properly clean, maintain, or replace, all equipment prior to storage in the appropriate park resources storage area.
2. Log missing or broken equipment in the equipment log, as appropriate. Store all calibration standards with MSDS sheets in the laboratory.
3. Prepare Sondes for long-term storage (see Instruction Sheet "Preparing Sonde for Longterm Storage" for detailed instructions).
4. Prepare the Trimble GPS for long-term storage (See SOP 12: Using the GPS).
5. Re-shelve all reference materials in the appropriate location in the project manager's office.
6. File other reference materials and extra data sheets in the appropriate locations.

Data

1. Review all data sheets and check again for completeness. Data sheets should have been checked for completeness in the field and again, once the sheets have been amassed following the end of each field trip (SOP 22: Field Trip Demobilization).
2. Identify any missing information and, if possible, fill in data from field notes or from the Tablet PC. If this is not possible, annotate the missing data with a brief explanation.
3. Be sure that all trip reports have been completed and turned in to the project manager.
4. Review trip reports and interview field crew members on suggested changes to procedures, what could be improved, etc.
5. Perform end-of-season electronic data management tasks. See SOP 24: Data Management for specific instructions and checklists for the following:
    a. Concatenation of the data in the version of AK_ShallowLakes database on the Tablet PC to the main SQL Server database.
    b. Trimble file management: transfer, post-processing, import and archiving.
    c. Import of YSI water chemistry profiles into the database.
    d. Adding notes and ancillary data collected using the Trimble GPS to the database.
    e. Importing laboratory data from water chemistry and chlorophyll samples into the database.
    f. Importing laboratory data from invertebrate samples into the database.
6. Organize and process photographs from the field season. See SOP 15: Documenting a Lake Using Digital Photography for details on taking and processing photographs.
    a. Organize photos into folders by lake and update images and metadata in the Portfolio 8.5 catalog.
    b. Use GPS-Photo Link to geotag aerial photos.
    c. Stitch any panoramic images.
7. Enter and process Continuous Monitoring data, using StreamlineENV and the AK_ShallowLakes database. See SOP 8: Continuous Monitoring for details.
8. Obtain data for season from the nearest park weather station.

Samples

Refer to SOP 22: Field Trip Demobilization for details on storing, inventorying, and shipping samples.

1. Deliver vegetation voucher specimens to the University of Alaska Fairbanks Herbarium for verification and determination (see SOP 20: Preserving Vegetation Samples).
2. Ship macroinvertebrate samples to ABR, Inc. (or other contracted laboratory) for identification and analysis.
3. Deliver chlorophyll samples to UAF (or other contracted laboratory) for analysis.

4. Ship any remaining water samples to CCAL (or other contracted laboratory) for analysis.
5. Ensure that results from samples sent out for analysis are returned and complete.

Protocols

1. Revise protocol and SOPs to reflect changes in methods or conventions that were established during field season.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #27: Revising the Protocol

Version 2.0 30 September 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	09/30/2010	A. Larsen, H. Kristenson	SOP number changed from 28 to 27 Addition of Revision History Document format change	SOPs 25 and 26 were merged into a single SOP. Protocol was reviewed extensively from 2005 to 2007. Producing a more streamlined reference document, which is more easily served to the public.	2.0

This Standard Operating Procedure explains how to make changes to the Shallow Lake Monitoring Protocol Narrative for the Central Alaska and Arctic Networks and accompanying SOPs, and tracking these changes. Observers asked to edit the Protocol Narrative or any one of the SOPs need to follow this outlined procedure in order to eliminate confusion in how data is collected and analyzed. All observers should be familiar with this SOP in order to identify and use the most current methodologies.

I. Procedures

The Shallow Lake Monitoring Protocol Narrative for the Central Alaska and Arctic Networks and accompanying SOPs have attempted to incorporate the most sound methodologies for collecting and analyzing shallow lake limnologic data, including macroinvertebrates and vascular vegetation. However, all protocols require editing as new and different information becomes available. Required edits should be made in a timely manner and appropriate reviews undertaken.

1. All edits require review for clarity and technical soundness. Small changes or additions to existing methods will be reviewed in-house by CAKN or ARCN staff, as appropriate. However, if a complete change in methods is sought, then an outside review is required. Regional and National staff of the National Park Service with familiarity in aquatic ecology and water quality research and data analysis will be utilized as reviewers. Also, experts in aquatic ecology research and statistical methodologies outside of the Park Service will be utilized in the review process.

2. Document edits and protocol versioning in the Revision History Log that accompanies the Protocol Narrative and each SOP. Log changes in the Protocol Narrative or SOP being edited only. Version

numbers increase incrementally by tenths (e.g. version 1.1, version 1.2, …etc) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0 …). Record the previous version number, date of revision, author of the revision, identify paragraphs and pages where changes are made, and the reason for making the changes along with the new version number.

3. File names of the SOPs and Instruction Sheets should be tagged with the revision date (added to the end of the filename) in YY-MM-DD format.

4. Obsolete versions of the SOPs and Instruction Sheets will be moved to the appropriate Archive folder, and stored appropriately. Only the current versions of the SOPs should be in the root Standard_Operating_Proecedures folder.

5. The most recent versions of the Instruction Sheets will be available as individual documents on the NPS Natural Resource Information Portal and/or the network website(s) for this project. The published protocol will not necessarily be updated for changes at the Instruction Sheet level, but the individual Instruction Sheet documents available for download should be kept up-to-date.

6. Inform the Data Manager about changes to the Protocol Narrative or SOP so the new version number can be incorporated in the Metadata of the project database. The database may have to be edited by the Data Manager to accompany changes in the Protocol Narrative and SOPs.

7. Convert all final documents to PDF format, and create or update the PDF version of the full protocol with the new documents or changes. Refer to the Instruction Sheet "Creating and Updating PDF Protocols" for details.

8. Post new versions on the internet and forward copies to all individuals known to have a previous version of the affected Protocol Narrative or SOP. Upload the updated version into the NPS Protocol Database and NRInfo portal as required.

II. Review History

The Shallow Lake Monitoring Program (SLMP) was initiated in 2004 when the protocol was submitted with the Central Alaska Network Phase 3 report. At this time the protocol and standard operating procedures were submitted for review by three reviewers: Nancy Deschu, NPS Alaska Regional Hydrologist; Carl Markon, USGS Deputy Regional Director; and Kirk Lohman, NPS Alaska Region Science Advisor. Reviews were received from two of the reviewers late in 2005. The SLMP narrative and SOPs were modified slightly based on these reviews. The review manager, Sara Wesser, and project principal investigator, Amy Larsen, were not convinced that reviews were rigorous enough and submitted the narrative and SOPs for additional review in 2007. Additional reviews were solicited from Chistopher Arp, USGS Research Scientist and Patricia Heglund, USFWS Supervisory Fish and Wildlife Biologist. In 2008, reviews were received, a response to reviewers was completed and the SLMP protocol was approved by NPS Inventory and Monitoring Regional Coordinator, Sara Wesser.

In 2005, the Arctic Network (ARCN) Inventory and Monitoring program was initiated and lake ecosystems were included as a vital sign. In 2008, ARCN decided to implement the recently approved Central Alaska Network Shallow Lake Monitoring Protocols. Lakes were sampled in Bering Land Bridge National Preserve in 2008, and in Kobuk Valley National Park in 2009.

In 2010, the SLMP underwent preliminary analysis of data. This data analysis identified several weaknesses in the sampling design. Joshua Schmidt, CAKN biometrician, suggested that the program modify the sampling design to eliminate macroinvertebrate sampling due to the high variation in species composition throughout the year and the high cost of sampling. He suspected it would be difficult to detect trends in macroinvertebrate composition with the limited numbers of samples the program was capable of analyzing. He also suggested that the program increase sample sizes from 90 lakes per park to 200 lakes per park. His final request was to increase the information we collect on seasonal variation so that we can account for the variation in chemistry across the open water season. To do this we developed a third tier of sampling to include repeat visits to a small number of sites per year. This will require the program to visit 3-6 lakes per park at least six times per summer. These three suggestions were also included in the remarks by Patricia Heglund in the 2007 review. To accommodate these changes and to integrate the ARCN Inventory and Monitoring Program into the narrative and the data management sections included in the SLMP protocol, the project PI revised the narrative and SOPs to reflect these changes. Although this rewrite might appear to constitute a major revision to the protocol, only minor adjustments were made to sampling design. These changes largely represent a continued response to the 2007 review process that ultimately resulted in the approval of the SLMP protocol.

Also contributing to the different appearance of the SOPs in Version 2 of the SLMP protocol is the introduction of Instruction Sheets. As explained in the protocol narrative, this adds a third level to the protocol documentation. The Protocol Narrative refers to individual SOPs for detailed methods, and in turn the SOPs refer to Instruction Sheets, which provide step-by-step technical instructions for working with specific equipment and software. The addition of this extra tier of documents in 2010 has changed the appearance of the SOPs, but while the organization of the information has changed, the informational content is the same.

Shallow Lake Limnology Monitoring Protocol
Central Alaska Network (CAKN) and Arctic Network (ARCN)

Standard Operating Procedure (SOP) #28: Quality Assurance and Quality Control

Version 2.0 08 November 2010

Revision History Log

Prev. Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	11/08/2010	H. Kristenson	Changed SOP number from 29 Document format change	Analysis and Reporting SOPs were combined, so subsequent SOPs were renumbered. Producing a more streamlined reference document, which is more easily served to the public.	2.0

This SOP provides the procedures for quality assurance and quality control for Shallow Lake Monitoring in the Central Alaska and Arctic Networks. Many aspects of this QA/QC program are discussed in the Shallow Lake Limnology Monitoring Narrative. Detailed information regarding the target population, representativeness, and completeness as well as information regarding data comparability can be found in the narrative. Because it is essential that QA/QC be implemented at every phase of the program, additional QA/QC information regarding particular methods can be found in individual SOPs.

SOPs specifically related to water quality include SOP 8: Continuous Lake Monitoring, SOP 17: Water Chemistry Field Data, Bathymetry and Sample Collection, and SOP 21: Processing of Water Chemistry Samples. These three SOPs explain in detail several aspects of QA/QC including measurement sensitivity, measurement precision, systematic error and blank controls. We also have outlined QA/QC procedures for vegetation (SOP 18: Vegetation Sampling) and macroinvertebrate (SOP 19: Aquatic Invertebrate Field Sampling) sampling, and SOP 23: Macroinvertebrate Processing and Identification includes extensive QA/QC procedures to be followed for lab analysis and data entry.

Data management has an inherent need for extensive QA/QC procedures, and these are detailed in SOP 24: Data Management. These procedures can be expected to change as new software programs, technologies, NPS-wide mandates, and data requirements are introduced over time.

I. Approach

An extensive literature review revealed that little work has been conducted on shallow lakes in the boreal forest, and surprisingly little is known about shallow lake ecosystems in Alaska. The work that has

been done typically reported incomplete methodology or used methods that are inappropriate to the broad-scale and remote nature of the CAKN vital signs monitoring project. Because of these factors, we were required to combine elements of multiple study designs into a model we felt best suited the logistic and budgetary restraints of the program, yet maintained scientific integrity. As a result, we were unable to simply adopt a previously-developed QA/QC program**.**

To compensate for this, we have been using a variety of established QA/QC programs to build a sound monitoring program. One vital resource has been Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Site Selection, Field Operation, calibration, Record Computation, and Reporting; Water-Resources Investigations Report 00-4252 by Richard J. Wagner, Harold C. Mattraw, George F. Ritz, and Brett A. Smith; U.S. Department of the Interior U.S. Geological Survey. This document has since been superseded by Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting; Techniques and Methods 1-D3 by Richard J. Wagner, Robert W. Boulger, Jr., Carolyn J. Oblinger, and Brett A. Smith; U.S. Department of the Interior U.S. Geological Survey.

We have also examined water quality monitoring projects undertaken by the Alaska Department of Environmental Conservation (DEC) and the Alaska Department of Fish and Game; while the projects are quite different from the Shallow Lake Monitoring program in scope and sampling setting, we were able to glean some helpful ideas to integrate into our QA/QC practices. Lastly, we have relied heavily on Part B of the Vital Signs Long-term Aquatic Monitoring Projects document generated by Roy Irwin with the Water Resources Division (WRD) of the Natural Resource Program Center (NRPC) of the National Park Service.

II. Representativeness, Target Population, and Completeness

There are three target populations for monitoring water quality in shallow lakes in the Central Alaska and Arctic Networks. The first population of lakes is comprised of the sites that will be continuously monitored throughout the summer season using multi-parameter water quality loggers. The monitoring procedures used for tracking change in these lakes are detailed in SOP 8: Continuous Lake Monitoring. Data collected from this small number of lakes will be used to track seasonal changes in water quality and to compare patterns of variation in water quality among years. These data will also be used to assess the validity of monitoring lakes at the landscape scale, synoptic sampling, and the suitability of using an index time period. The automated aspect of this data collection, using sensitive instruments to collect continuous water quality measurements, requires a high degree of attention to QA/QC procedures before data is used for analysis. These procedures are outlined in SOP 8, and will be expanded as new software (including Aquarius) is incorporated into our protocols.

The second population of lakes is the randomly selected set of lakes that will be monitored to detect landscape-scale changes in water quality. Lakes included in this population are a subset of all shallow lakes within the Central Alaska and Arctic Network park units that are larger than > 1 Ha < 50 Ha. The process by which we identify these lakes is detailed in SOP 5: Delineation of Shallow Lakes and the method by which the sample of lakes is drawn is discussed in SOP 7: Sampling Frame and Lake Selection. These lakes will be visited only once per sampling season, and revisited every 10 years.

Lastly, a new set of measurements have been incorporated into the sampling design as of 2011, wherein a small number of lakes in each park will be visited repeatedly over the course of the summer for the collection of water chemistry samples. This will be similar in purpose to the continuous monitoring sampling, as it will give a sense of variability and trends in water chemistry over the course of a summer season.

The sampling frame was constructed in this way to provide knowledge of temporal lake dynamics through the season of open water (through continuous monitoring and repeated water chemistry sampling), while the large-scale single-visit sampling of many lakes will provide information on the spatial variability of water chemistry, and inter-annual variation not only of water quality, but also other important factors such as vegetation, macroinvertebrate composition, and water level. It is important to understand that we do not expect to detect small amounts of change, but rather major shifts in water quality and the other biological components being monitored.

III. Data Comparability

To maintain the quality of data collected within this program, we intend to minimize changes and/or alterations to the sampling methodologies once they are fully implemented. Given the long-term nature of this program, there is no question that methodologies will change over time. These changes may be due to changes in manufacture of instruments, laboratory methods that are beyond our control, funding of this program, or access to sites. In the event that changes occur in methodologies, we will collect data using the older method alongside the new method for a season to ensure that the new methods result in comparable data. If the data are not found to be equivalent, a method will be developed to correlate the measurements, to the extent possible.

Water Chemistry methods are similar to those used by the state of Alaska Department of Environmental Conservation (DEC) and Department of Fish and Game on studies reported from the Matanuska-Susitna Borough area (OASIS 2004; Edmundson 2002). Methods could not be replicated exactly, due to issues of accessibility and sampling extent, along with differences in monitoring objectives. However, much of our data should be largely compatible with that collected by those state agencies. The methods adopted here are compatible with pilot study data collected by CAKN personnel.

We are working with several local agencies and institutions to ensure that our data are comparable. We have been consulting with USFWS (Kanuti and Yukon Flats National Wildlife Refuges) for the past three years to share our methods and data to better understand shallow lake dynamics in interior Alaska. We will also be working with the Cold Regions Research and Engineering Laboratory to ensure that our data will be comparable with their water quality program. We have a cooperative agreement with the University of Alaska Fairbanks to maintain data comparability in regards to remote sensing and evaluation of lake surface area a critical component to our water quality monitoring program. We share data and assist in data collection for the USGS, ensuring that our data sets are compatible.

IV. References

Edmundson, J.A. 2002. Limnological Information Supporting the Development of Nutrient Criteria for Alaskan Lakes: water quality monitoring and trophic assessment of seven lakes in the Matanuska-Susitna Borough.. Alaska Dept. of Fish and Game, Division of Commercial Fisheries, Anchorage Alaska. Regional Information Report No. 2A02-24:72p.

OASIS Environmental, Inc. 2004. Big Lake and Lake Lucille Water Quality Monitoring, Final Report, QAPP. AK DEC. http://www.state.ak.us/dec/water/wnpspc/pdfs/fy04_finalreport_big_lucille_lakes_oasis.pdf

Wagner, R. J., Boulger R. W., Jr., Oblinger, C. J., and Smith, B. A. 2006. Guidelines and standard procedures for continuous water-quality monitors: Station operation, record computation, and data reporting. U.S. Geological Survey Techniques and Methods 1-D3, 51 p. http://pubs.water.usgs.gov/tm1d3 or http://pubs.usgs.gov/tm/2006/tm1D3/pdf/TM1D3.pdf

Wagner, R. J., Mattraw, H. C., Ritz, G. F., Smith, B. A. 2000. Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Site Selection, Field Operation, calibration, Record Computation, and Reporting. U.S. Geological Survey Water-Resources Investigations Report 00-4252. https://www.wou.edu/las/physci/taylor/luck/water_qual_sensor.pdf

Calibrating Sondes

The multi-meter sensors for pH, conductivity and dissolved oxygen (DO) should be calibrated before leaving for the field, and the pH and conductivity sensors should be calibrated every few days while out in the field. Turbidity should only be calibrated in the lab, and is generally only done in the spring, before deployment. Refer to Instruction Sheet "Calibrating Turbidity Probes" for details. If there are fluctuating or otherwise unexpected readings occurring, additional calibration can be performed as necessary. On sampling trips where there are large changes in the barometric pressure, more frequent calibration may be required, particularly for the DO sensors.

Calibration procedures are detailed in the YSI Environmental Operations Manual, copies of which are kept in the lab, which is the primary reference for the following instructions for calibration. Another excellent resource is YSI's Calibration, Maintenance & Troubleshooting Tips. The basic calibration steps are outlined below. Be sure to rinse the calibration cup, bulkhead and probes with the appropriate solution before each calibration step. Used or expired standards can be used for the first 2 rinses, but use fresh solution for the final rinse.

Sondes can be calibrated using the YSI MDS 650 handheld computer, or the StreamlineENV software program can be used to calibrate and archive calibration records using a laptop. Procedures for the MDS method are detailed in this Instruction Sheet. For detailed instructions on calibrating Sondes using StreamlineENV, refer to the Instruction Sheet "Using StreamlineENV".

For tracking calibration results, a Sonde Calibration Form has been developed. A form should be fileed out every time a calibration is performed using the MDS 650. Completed forms should be added to the Sonde Log Book and noted in the log for each instrument calibrated.

Calibrating Sondes using MDS 650

1. Connect a MDS 650 field computer to the Sonde, and turn on the power.
2. Calibrate the Conductivity probe:
    a. Fill the calibration cup with 1500 µS/cm standard solution, making sure that there is enough fluid to cover the entire conductivity probe. Standards lower than 1000 µS/cm should not be used for calibration, even if expected field values will be lower, as the potential for contamination during calibration is too high. The calibration curve is very stable, so it's not a problem to calibrate at a much higher level than is measured in the field.
    b. From the MDS Main menu, select Sonde menu, select Calibrate
    c. Select Conductivity from the Calibrate menu, and select SpCond
    d. Enter the standard value (i.e. 1.5 mS/cm) and press enter
    e. Watch for the values to stabilize, and enter the value in the calibration form as the start value, then press enter to calibrate.
    f. Verify the new post-calibration value, record it in the calibration form, and press enter to continue.
    g. If a message screen appears with the message "Out of range Accept Anyway?", press no and check to make sure that the probe is entirely submerged in calibration solution. Repeat steps d-h. If problems persist, contact YSI.
3. Calibrate the pH probe:
    a. Make sure that the pH mV reading is displayed on the report screen. If it is not, add it by selecting Sonde menu, selecting Report setup, and selecting pH mV.
    b. Fill the calibration cup with pH 7 buffer solution, so that the tip of the probe (with the glass bulb) is completely submerged.

c. From the Sonde menu, select Calibrate
d. Select ISE1 pH from the Calibration menu, and select 2-point
e. Enter the first value as 7 (or whatever the appropriate value would be depending on the specific buffer and its temperature (appropriate pH values can be found on the standard bottle)).
f. Watch for the values to stabilize and enter the value in the calibration form as the start value, then press enter to calibrate
g. Verify the new post-calibration value and record it in the calibration form, along with the pH mV reading
h. Fill the calibration cup with pH 10 buffer solution, so that the tip of the probe (with the glass bulb) is completely submerged.
i. Enter the second pH value as 10 (or whatever the appropriate value would be depending on the specific buffer and its temperature).
j. Watch for the values to stabilize and enter the value in the calibration form as the start value, then press enter to calibrate
k. Write down the pH mV in the calibration form
l. Check the slope of the pH mV (the difference between the mV readings for the pH 7 and the pH 10 solutions); it should be 165-180. Record it in the calibration form.

4. Calibrate the DO probe:
   a. Add a small amount (1/8") of water to the bottom of the calibration cup, and insert the sonde. Do not fully tighten the cup, so that it vents to the atmosphere. Make sure that the DO membrane is NOT submersed in water, but is just in air that's saturated with water. If using the Optic DO probe, make sure that there are no water droplets on the membrane or the temperature probe.
   b. Allow the sonde to sit for 10 minutes (up to 15 minutes for the Optic DO probe) to allow the air in the cup to become moisture saturated and for the temperature to equilibrate.
   c. Take a reading by selecting Sonde run from the main menu and waiting for the DO measurements to stabilize. Record the DO%, DO mg/L, and DO ch values in the calibration form.
   d. Select Sonde menu on the MDS 650, select Calibrate, select Dissolved Oxy
   e. Select Dosat%, and enter the barometric pressure. This can be taken directly from the MDS if it has the barometer feature. If there is no barometer feature on the MDS, use the following tool to calculate the absolute barometric pressure (double click on the table to activate the Excel format) from corrected pressure data.

Barometer reading (http://climate.gi.alaska.edu/) in inches:	29.95
Barometer reading (http://climate.gi.alaska.edu/) in mm:	760.73
Local Altitude in feet above sea level:	450
True barometric pressure in mm of Hg:	749.48
Only the value in red needs to be entered for a new calculation.	

   f. Allow the sonde to calibrate (it may take up to a minute), and press Enter when instructed to return to the calibrate menu.
   g. Record the DO%, DO mg/L, and DO ch values in the calibration form. The DO% should be close to 100, and the DO ch values (the charge across the membrane) should be between about 35 and 50, with 40 being about optimal. If the charge is outside of this range, the membrane/electrolyte in the probe may need to be replaced, or the electrodes may need to be sanded. See the Care, Maintenance, and Storage of YSI 6-Series Probes and Sondes section of the manual for instructions, or online reference https://www.ysi.com/DocumentServer/DocumentServer?docID=YSI_T601

Calibrating Turbidity Probes

Some of the YSI Sondes have a turbidity probe installed. The calibration of turbidity probes is not as straightforward as the rest of the probes, and is not performed as frequently. Refer to the Instruction Sheet "Calibrating Sondes" for instructions on routine sonde calibration, not including turbidity.

This document contains the steps required for performing routine turbidity calibrations. Refer to the YSI 6-Series User Manual (copies are kept in the lab), and also YSI's documents "Calibration, Maintenance & Troubleshooting Tips" and the Turbidity Section of "Calibration Tips" for additional information.

Each sonde should be calibrated in the calibration cup supplied with the sonde. Alternatively, the probe guard may be installed, and the entire unit can be calibrated in a container large enough to accommodate the probe guard. The YSI 6920 V2 units should either be calibrated entirely with the probe guard installed, or be calibrated in the calibration cup, and then repeat the 0 calibration with the probe guard installed.

Turbidity calibrations are very linear across the range of standard concentrations, so there is no need for the use of very low or very high standards for calibration. YSI recommends the use of 126 NTU standard solution for calibration purposes. The calibration should be a two-point calibration, using a zero standard (such as DI water) for the first point and the 126 NTU standard solution for the second point.

For deployments in very low turbidity environments, there are ways to optimize the turbidity sensor, especially if negative values are being recorded. The most significant modification is setting a zero-offset. Refer to the Turbidity Section of "Calibration Tips" for details.

Calibration Procedures

1. Ensure that the sonde is clean before calibrating.
2. To reduce potential contaminant sources, remove any unnecessary probes. Only the Turbidity probe and the temperature probe are required for calibration.
3. Wipe the optics with a KimWipe or lint-free cloth to ensure that they are free of any debris or fingerprints. Ensure that the wiper and pad are clean.
4. Install a new pad (and wiper, if necessary), before the calibration.
    a. To replace the wiper, loosen the set screw and remove the wiper. Place a new wiper such that the setscrew seats on the flat of the wiper shaft. Gently press the wiper against the face of the probe until the foam pad is compressed to about half of the original thickness, then tighten the setscrew. There should be a gap of about 0.02" between the wiper arm body and the face of the probe (just enough of a gap for a business card to slide in).

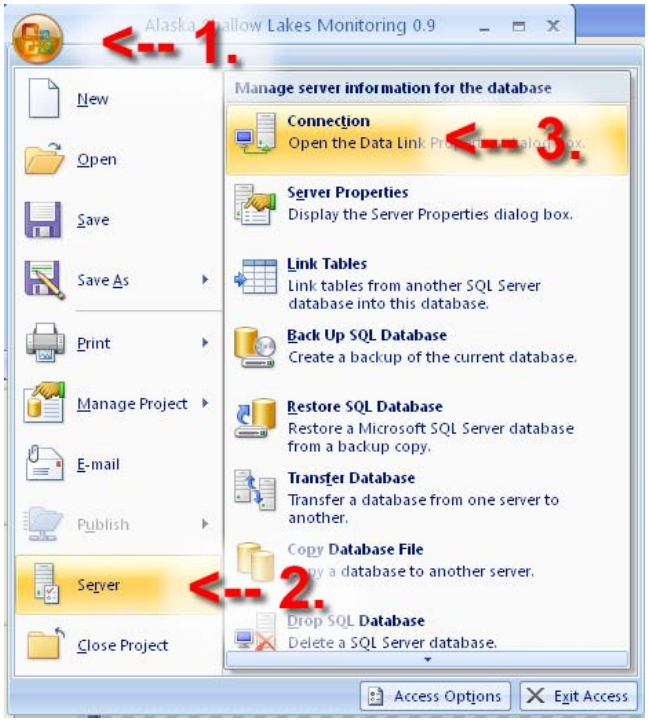
b. To replace the pad, remove the wiper, replace the pad, and reinstall the wiper.

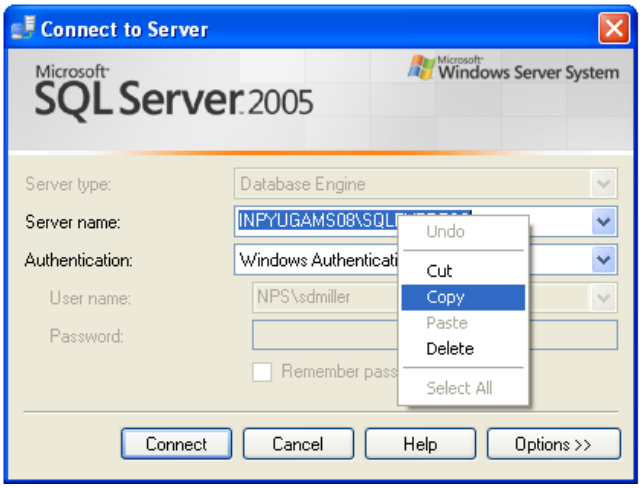
5. Test the functionality of the turbidity sensor
    a. Hold your finger over the optics while the sonde is in discrete run mode at a one-second rate. The readings should reach full scale (~1000 NTU) within about 12 seconds. Clean the optics afterwards to make sure that there are no fingerprints left behind.
    b. Verify the wiper function. It should wipe twice in one direction, then once back in the other direction. The wiper should park directly across from the optics.
6. Calibrate the probe
    a. In the Sonde Menu, choose Calibrate – Turbidity – 2 point
    b. Rinse the calibration cup and sonde 3 times with DI water (fill the cup, screw it on to the sonde, and shake)
    c. Fill the calibration cup with 0 NTU standard (DI water), pouring it down the side of the cup to avoid aeration or development of air bubbles.
    d. Put the sonde into the calibration cup, and engage one thread (do not screw it on completely)
    e. Confirm that the temperature probe is submerged in the standard (the exposed metal thermistor probe at the bottom of the C/T probe)
    f. Check for air bubbles, and run the wiper.
    g. Wait at least 12 seconds after the wiper stops running before proceeding with the calibration
    h. When a stable turbidity reading is achieved, press enter to calibrate
    i. Pour out the 0 standard, and wipe the probes clean and dry
    j. Pour an inch of 126 NTU standard into the calibration cup, attach it to the sonde, and shake to rinse. Repeat three times. Note that used standard from a previous calibration may be used for the rinsing process, and the standard from the last rinse may be saved for future rinsing use. Be sure to store used standard in a clearly-marked container, designated for rinsing purposes only.
    k. Fill the calibration cup with 126 NTU standard, pouring it down the side of the cup to avoid aeration or development of air bubbles.
    l. Place the sonde back in the calibration cup, engaging one thread
    m. Confirm that the temperature probe is submerged in the standard
    n. Run the wiper, and visually inspect for air bubbles
    o. When the turbidity readings have been stable for at least 12 seconds, press enter to calibrate
    p. Keep the used 126 NTU standard for future rinsing use.
    q. Rinse the calibration cup and sensors

Connecting SQL Server to Access Database

The Microsoft Access front-end file is named ShallowLakes-X.X.adp, with the X.X being the numeric indicating the version. This front-end file is stored on the CAKN network drive: J:\Monitoring\Water_Quality_Macroinvert\Database. In order to use this two-tiered database, the two layers must be connected as follows:

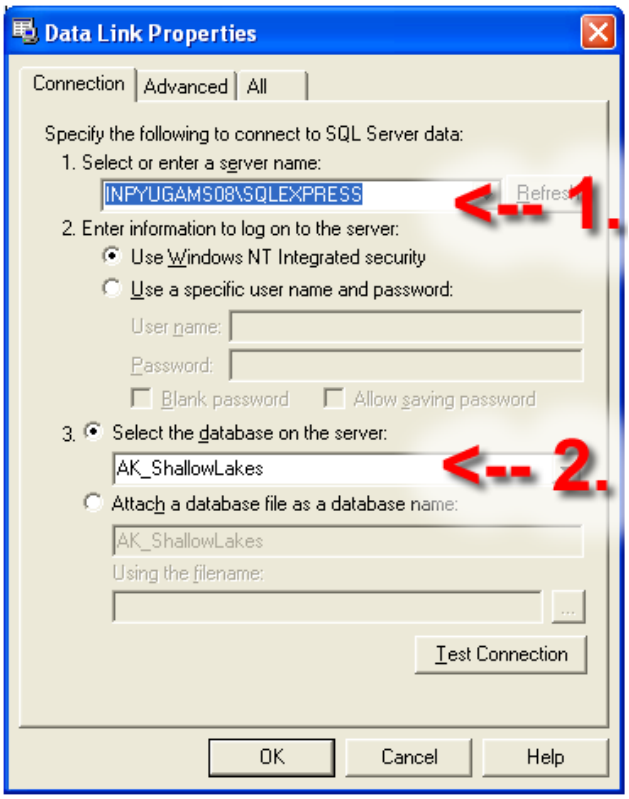
1. Ensure the Access application is an Access Data Project by examining the file extension. It should be '.adp', not '.mdb'.
2. Open the application. It may or may not show data depending on whether it is currently configured to connect to a SQL Server.
3. Click the Office Button in the upper left corner of Microsoft Access.
4. Select 'Server'
5. Select 'Connection'
6. The 'Data Link Properties' dialog comes up.
7. Enter the SQL Server name. To determine the name:
    a. Start Microsoft SQL Server Management Studio. The 'Connect to Server' dialog should appear.
    b. Copy the name of the required SQL Server. If you are using a field computer there should only be one choice.





c. Paste the SQL Server name into the server name text box in the 'Data Link Properties'dialog from above.

8. Select your database from the database combo box in the 'Data Link Properties' dialog.
9. Optionally click 'Test connection' to ensure the application will connect to the SQL Server.
10. Click 'OK' to connect the front end to the back end.



Continuous Monitoring File Storage

Naming Conventions

YSI Sondes

YSIXXXX_PARK-Lake_YYYY_serial

Note that XXXX represents the YSI model type; some are numerical, some alpha-numerical.

HOBO Dataloggers

Pressure Transducers

Water Level (in lakes)

WL_PARK-Lake_YYYY_serial

Barometric Pressure (in air)

BP_PARK-Lake_YYYY_serial

Temperature Loggers

- Note that depth is in cm, with 3 digits (i.e. 030 for 30 cm)
- Note that the year should be the year in which the instrument was retrieved if it has been out for multiple seasons.
- Note that when loggers are deployed in rivers and streams, the name of the river should be used in place of the lake name and no depth should be included.

Pendant Temperature Loggers

TLL_PARK-Lake_YYYY_depth_serial

External Temperature Loggers

TL_PARK-Lake_YYYY_depth_serial

File Storage

1. Sondes
   J:\Monitoring\Water_Quality_Macroinvert\Field_Data\Continuous_Data\ Sonde_data
2. Hobos
   a. Pressure Transducers
      J:\Monitoring\Water_Quality_Macroinvert\Field_Data\Continuous_Data\ Hobo_data\Water_level_loggers
   b. Temperature and/or Light
      J:\Monitoring\Water_Quality_Macroinvert\Field_Data\Continuous_Data\ Hobo_data\Temperature_loggers

Creating and Updating PDF Protocols

The Shallow Lake Limnology Monitoring Protocol is produced in PDF format for ease of distribution. The protocol includes the Protocol Narrative, the SOPs, and Instruction Sheets, all packaged together into a single PDF file using Adobe Acrobat.

Creating PDF Protocol Documents

The Protocol Narrative should be prepared in Microsoft Word, using the NRR Template from the Natural Resource Publications Management website: http://www.nature.nps.gov/publications/NRPM/NRRNRTR.cfm

The SOPs should be prepared individually in Microsoft Word, using a template to ensure consistency from one SOP to the next. Paginate each SOP separately; use a footer to indicate which SOP any page belongs to.

Instruction Sheets should be prepared individually in Microsoft Word, using a basic template to produce similar-looking documents. The format of the Instruction Sheets may be modified more extensively than the SOPs in order to fit information onto a reasonable number of pages, facilitating use in field or laboratory settings. The footer should include a revision date, which is automatically updated whenever changes are made.

Once all of the documents have been prepared, they can be packaged together into a single PDF, using Adobe Acrobat.

1. Place the final copy of each document into a folder containing all the files to be packaged. It is easiest if no additional files are included in this folder. The files can all be in one file format (all PDF, all Word, etc.), or can be in an assortment of file formats, as long as they are supported by Adobe. Combining files into PDF format will go most quickly with files that have already been converted to PDF.
2. Open Adobe Acrobat and select *Combine Files* from the Getting Started page. Alternatively, the *Combine Files* button can be selected from the Toolbar if Acrobat is already open.
3. In the Combine Files dialog window, click the *Add Folders* button
4. Navigate to the folder containing all of the documents to be packaged together, and select it.
5. Set the order in which the documents will appear in the final document by highlighting individual files or groups of files (using the Shift and Ctrl keys during selection) and using the *Move Up* and *Move Down* buttons. The *Remove* button can be used to remove files that should not be included in the final document. Additional files can also be added from different locations by using the Add buttons at the top of the window.

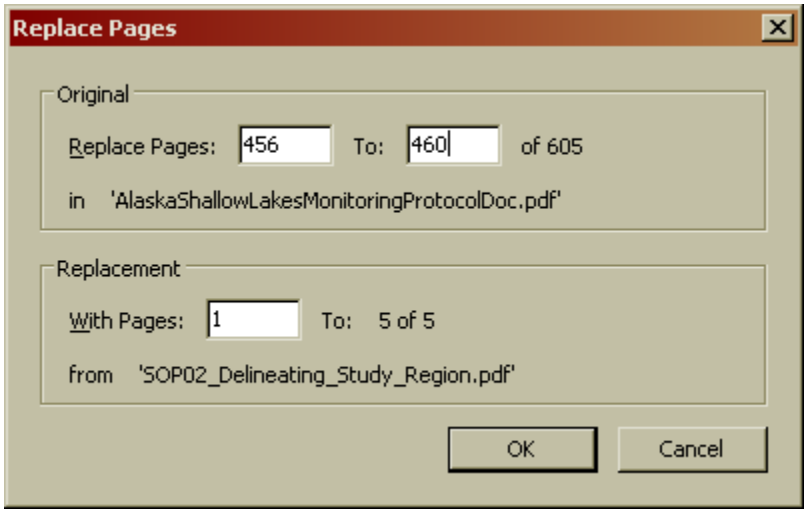
6. Click the *Next* button once all the files are present and in the correct order, using the Default File Size for the conversion settings.
7. Select the option to *Merge files into a single PDF*, do a final review that the list includes all of the required files in the appropriate order, and click the *Create* button.
8. Adobe will go through each document in the list, converting them to PDF as necessary, and combining them into one document.
9. When the process is complete, click the *Save* button to save the newly compiled PDF file. Navigate to the appropriate location, and name the file appropriately.

Updating PDF Protocol Documents

Replacing Pages in a PDF Protocol

Adobe Acrobat allows pages in a document to be replaced. Links to page numbers will be retained even through the replacement process.

1. When an SOP, Instruction Sheet, or even a page or range of pages in the Protocol Narrative have been changed, log the changes in the appropriate locations (i.e. Revision History Log), and convert the updated file to PDF format using Adobe Acrobat.
2. Open the PDF version of the protocol document to be updated, using Adobe Acrobat
3. Locate the range of pages that will be replaced by the new document, and note the page numbers of the start and end of the range to be replaced.
4. Under the *Document* menu, select *Replace Pages*
5. Navigate to the file to be used to update the protocol, and select it
6. Enter the range of pages to be replaced

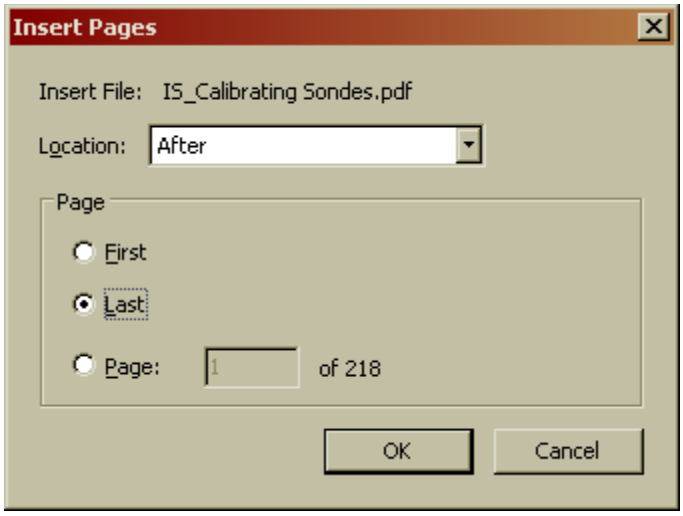


7. Click the OK button to replace the pages, and confirm the replacement

Inserting Additional Documents into a PDF Protocol

Adobe Acrobat allows additional documents to be inserted into an existing document. This makes it possible to add new Instruction Sheets or Reference Documents to a protocol document without having to repackage the entire set of documents.

1. Prepare the document to be inserted by converting it to PDF format using Adobe Acrobat
2. Open the PDF version of the protocol document in Adobe Acrobat, and determine where the new page or document will be inserted
3. Under the *Document* menu, select *Insert Pages*
4. Enter the appropriate location, either after the last page, or after the appropriate page in the document.



5. Click the OK button to insert the pages
6. Note that when a new section is inserted, the appropriate bookmark appears, but it may not be linked to the actual location of the new document. The headers within the document should be properly linked automatically, but clicking the bookmark with the name of the document will probably not result in navigating to the document location. To fix the bookmark:
    a. Navigate to the actual location of the inserted document, and place your cursor at the beginning of the document
    b. Right-click the bookmark with the title of the newly inserted document, and select *Set Destination*
    c. Confirm that the destination of the selected bookmark is correct
7. Rename the bookmark, if necessary (i.e. to remove file extensions) by right-clicking the bookmark, and selecting *Rename*.

8. Note that documents do not need to be converted to PDF format before inserting (PDF will convert Word documents in the process of insertion), but bookmarks are not automatically inserted if this option is used.

Links in PDF documents

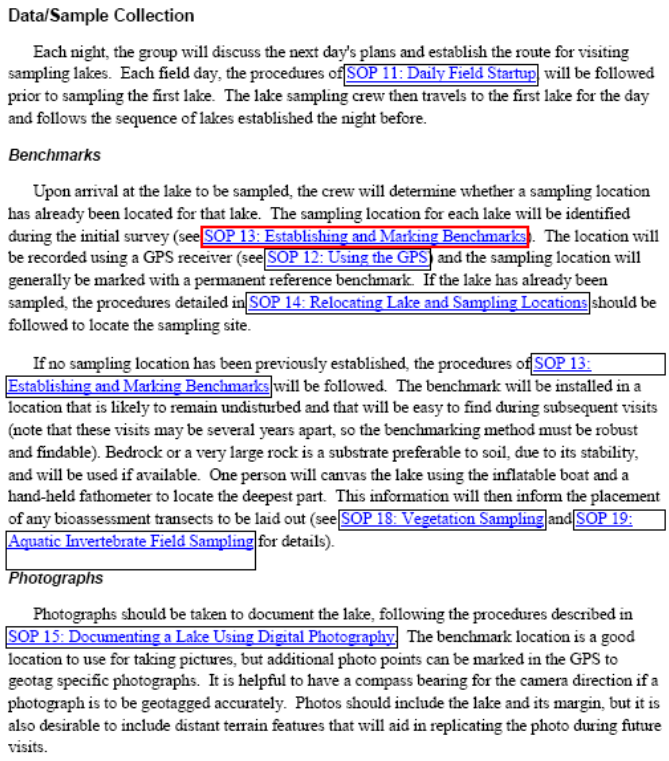
Many of the protocol documents contain hyperlinks to other documents (Narrative refers to SOP, SOP refers to Instruction Sheets, etc.). Once all of the documents are combined into PDF format, these links will all need to be reset to refer to locations within the document. This only needs to be done once after the production of the document, but edits may be required if additional materials are inserted, or within the pages of documents that replaced original content.

Editing Links

1. Add the Advanced Editing Toolbar to your Adobe Acrobat window
    a. Under the *View* menu, select *Toolbars*, and activate the *Advanced Editing* option
2. Click on the Link button in the Advanced Editing Toolbar



3. All of the links in the document will be displayed as rectangular boxes. Ideally, all text to be linked to another document will have been hyperlinked in Word to the actual documents, making it easy to spot which links need to be repaired.



Data/Sample Collection

Each night, the group will discuss the next day's plans and establish the route for visiting sampling lakes. Each field day, the procedures of SOP 11: Daily Field Startup will be followed prior to sampling the first lake. The lake sampling crew then travels to the first lake for the day and follows the sequence of lakes established the night before.

Benchmarks

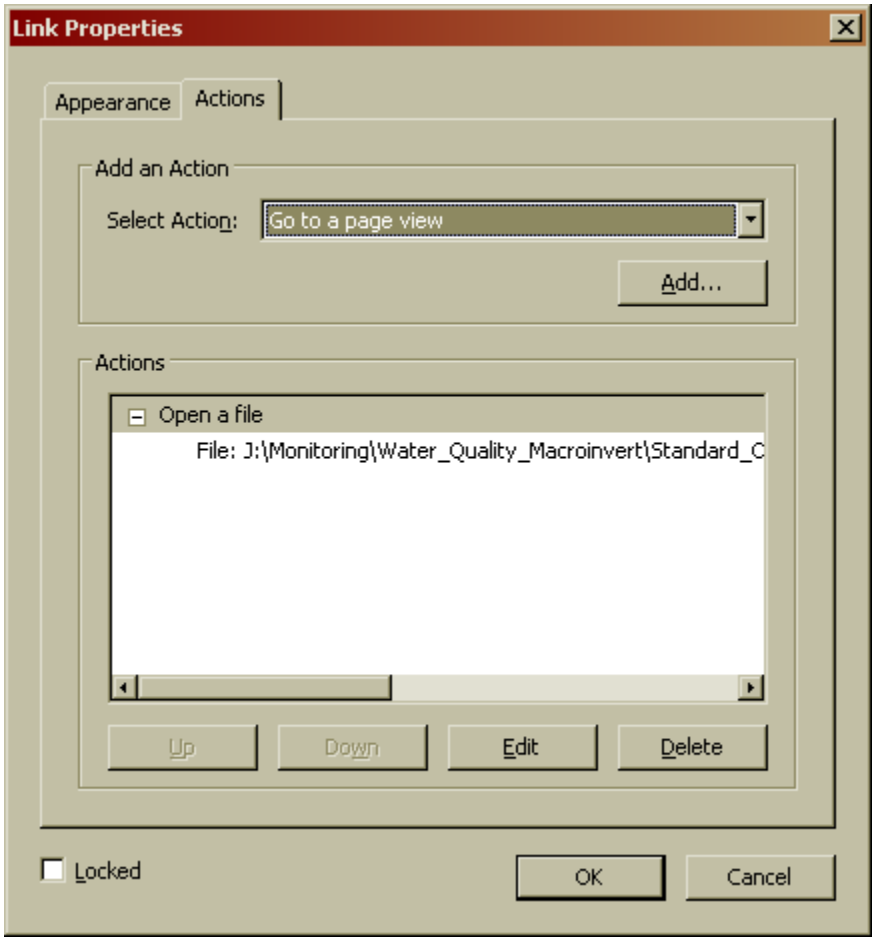
Upon arrival at the lake to be sampled, the crew will determine whether a sampling location has already been located for that lake. The sampling location for each lake will be identified during the initial survey (see SOP 13: Establishing and Marking Benchmarks). The location will be recorded using a GPS receiver (see SOP 12: Using the GPS) and the sampling location will generally be marked with a permanent reference benchmark. If the lake has already been sampled, the procedures detailed in SOP 14: Relocating Lake and Sampling Locations should be followed to locate the sampling site.

If no sampling location has been previously established, the procedures of SOP 13: Establishing and Marking Benchmarks will be followed. The benchmark will be installed in a location that is likely to remain undisturbed and that will be easy to find during subsequent visits (note that these visits may be several years apart, so the benchmarking method must be robust and findable). Bedrock or a very large rock is a substrate preferable to soil, due to its stability, and will be used if available. One person will canvas the lake using the inflatable boat and a hand-held fathometer to locate the deepest part. This information will then inform the placement of any bioassessment transects to be laid out (see SOP 18: Vegetation Sampling and SOP 19: Aquatic Invertebrate Field Sampling for details).

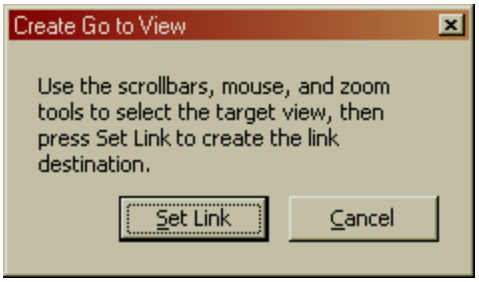
Photographs

Photographs should be taken to document the lake, following the procedures described in SOP 15: Documenting a Lake Using Digital Photography. The benchmark location is a good location to use for taking pictures, but additional photo points can be marked in the GPS to geotag specific photographs. It is helpful to have a compass bearing for the camera direction if a photograph is to be geotagged accurately. Photos should include the lake and its margin, but it is also desirable to include distant terrain features that will aid in replicating the photo during future visits.

4. Hover over one of the link boxes and right-click (the selected link will be highlighted in red); select *Properties* from the menu.
5. Click on the *Actions* tab in the *Link Properties* window, and examine the actions listed. If there is an action to Open a file, highlight it and click the Delete button.



6. To set a link within the current PDF document, select *Go to a page view* from the drop-down menu in the Add an Action section of the window, and click *Add…*
7. Navigate through the document (using the bookmarks window) to the destination for the link. Click the main bookmark for the desired SOP or Instruction Sheet, and click the *Set Link* button in the Create Go to View dialog box.



8. Ensure that the Appearance tab in the Link Properties window is for an Invisible Rectangle, and click OK to complete the Link.
9. Note that if the hyperlink spans two lines due to a line break, both segments of the link need to be reset.

Creating Map Packs

Map Packs should be created for all of the lakes on the sampling lists prepared for each park. Map Packs consist of high-quality imagery and a topographic map. Each of the lakes on the sampling list should be included in at least one Map Pack, but there may be many lakes included in one Map Pack.

1. Compile a list of the aerial photographs necessary to give coverage for all of the lakes on the sampling list using the Alaska High Altitude Aerial Photography (AHAP) dataset located in the NPS Theme Manager in ArcGIS. This shapefile will provide the frame number and flight line for each photograph as well as a unique identifier for each photograph. Create a list containing these three reference numbers.

2. Locate the aerial photographs in each park that provide imagery of all of the lakes on the sampling list. Hard copies of the photographs can be found in the natural resources office of each park or on the X drive.

3. In some cases, there may be high-resolution satellite imagery (IKONOS) of the lake area that might be more appropriate than the AHAP imagery. When this occurs, use ArcMap to generate an image of the lake and its surroundings from the IKONOS imagery.

4. Print the imagery, or have it professionally printed.

5. Using ArcMap, generate a topographic map of the region around the sampling lake(s) displayed in the AHAP or IKONOS printout. Label each sampling lake with an identifying number (either GRTS, or a sequential number based on the GRTS order) and print a copy.

6. Label the lakes in the imagery with the same identifying number as used for the topo maps. If the AHAPs are printed and laminated professionally, the lakes can be labeled using clear tape stuck onto the plastic. If the imagery is printed in the office, it can be labeled with markers before being laminated.

7. If the imagery and topo maps have been printed out on the same size paper, place them back to back and laminate them together. If the AHAP photos are printed out at their optimal size, laminate the photo, and place it in a clear zip-bag back to back with the topo map.

8. Label each of the map packs with an alphabetic identifier.

Data Import: Chlorophyll

Upon receiving the results from the chlorophyll analysis, the data must be imported from the Excel spreadsheet into the SQL Server database.

1. Save a copy of the chlorophyll data (preferably in the template format of the spreadsheet sent to the lab) in Excel 2007 (.xlsx) with the filename ChlorophyllXXXXImport.xlsx, where XXXX is replaced with the data year.
2. Add a column after the last column, with the header InsertQuery
3. Populate the column for each record using the following script, replacing the XXXX with the appropriate year in the SOURCE reference:

```
="INSERT INTO AK_ShallowLakes.dbo.tblChlorophyll(PONDNAME, SAMPLEDATE, SAMPLENUMBER,
CHLA_LAB, CHLA_METHOD, CHLA_CORRECTED_UG_L, CHLA_UNCORRECTED_UG_L,
REPEATED_CHLA_SAMPLE, COMMENTS, SOURCE) VALUES('"& A2 &"', '"&TEXT(B2, "mm/dd/yyyy") &"',
'"& C2 &"', '"& L2 &"', '"& M2 &"', "&ROUND(E2,2) &", "&ROUND(F2,2) &", '"& G2 &"', '"& N2 &"',
'ChlorophyllXXXXImport.xlsx');"
```

4. Check to make sure that the values populated correctly.
5. Copy the InsertQuery column and paste into an empty textfile using Notepad
6. Delete the InsertQuery heading at the top of the page and replace with:

   ```
   Use AK_ShallowLakes;
   Begin transaction
   ```

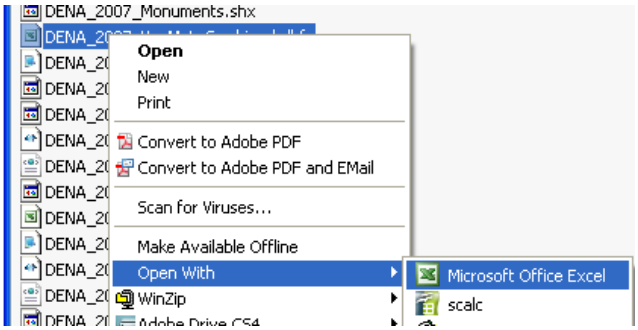
7. Save the textfile as ChlorophyllXXXXImport.sql, replacing the XXXX with the data year. Ensure that the file extension is .sql
8. Run the ChlorophyllXXXXImport.sql query file in SQL Server Management Studio Express
   a. Navigate to the .sql file edited in the previous step, and double-click to open the file in SQL Express. Connect to Database Engine in SQL as prompted.
   b. The file should open in a SQL Express window. Verify that it looks correct.
   c. Click the Execute button in the toolbar
   d. Check the log to make sure that the Query was executed successfully without errors.
      i. If there are errors in the running of the query, remove all the update query script from the query window, and type Rollback; beneath BeginTransaction; and click Execute again.
      ii. When the query completes successfully without errors, close the query window (not the entire SQL Server Management Studio Express window), which will open a warning message asking if the transactions should be committed. Click Yes to commit the transactions. Do NOT save the changes to the .sql file when asked.
   e. Close SQL Server Management Studio Express.
   f. Open the select query in Access to verify that it was updated with the appropriate data. If the query was open while the update query was performed, click the Refresh All button in the ribbon to apply the changes to the open view.

Data Import: Trimble Files

Trimble GPS units are used in this project to collect data with a spatial aspect. Much of this data is contained in a separate geodatabase, and analysis is performed outside of the AK_ShallowLakes database. However, there is some key data collected with the GPS units that needs to be imported into the SQL database from each of the three files collected at each sampling site. The protocol for importing these necessary fields is detailed below. For detailed protocols regarding data transfer and post-processing for the Trimble data, see the Instruction Sheet "Trimble Data Processing".

Importing data from Trimble VegMat files into SQL Server

Once the data has been transferred from the Trimble, post-processed, and a shapefile has been generated, the next step is to process each record in the shapefile into an SQL insert query and sequentially submit the queries to the SQL Server. The process is not hard but requires a little background knowledge. Each exported shapefile is actually a package of many files sharing the same root name, but with different extensions. Of these files the one with .dbf extension is the one that contains the data needed for this procedure. If the shapefile to be imported into the SQL Server is 'DENA_2007_VegMat_Combined.shp',for example, then you need to locate and process 'DENA_2007_VegMat_Combined.dbf'. There are many ways to import these data but the following may be simplest:



1. Open the shapefile's database file (.dbf) using Excel (Excel may not be the default editor for .dbf files in which case you can right-click the filename and select 'Open with…' and choose Excel from the options).
2. Save as an Excel file with _Import added to the filename in the folder J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY\PARK
3. Add a column to the spreadsheet containing the following script:

="INSERT INTO AK_ShallowLakes.dbo.tblVegProfiles(PONDNAME, SAMPLEDATE, TRANSECT_NUM, WATER_DEPTH, MAT_DEPTH, BOTTOM_DEPTH, MAX_PENETRATION, GPS_TIME, LONGITUDE, LATITUDE, COMMENTS, DATAFILE) VALUES('"&LEFT(O2,8)&"','"&TEXT(K2, "mm/dd/yyyy") &"', "& A2 &", "& B2 &", "& C2 &", "& D2 &", "& E2 &", '"& TEXT(L2, "hh:mm:ss") & "', "& AB2 &", "& AC2 &", '"& F2 &"', '"& O2 &"')"

   a. Ensure that the columns line up properly, as the output .dbf file will change if changes are made to the data dictionary.

b. Copy and paste the script into all of the rows of data in the spreadsheet.

4. Copy the data from the new column, and paste it into a new query in SQL Server
    a. Open Microsof SQL Server Management Studio Express and connect to INPYUGAMS08\sqlexpress
    b. Navigate to Databases – AK_ShallowLakes
    c. Click the New Query button
    d. Copy the data from the spreadsheet into the query window
    e. Press the Execute button
5. Save the query, if desired, with the same name as the .xlsx file in the following folder:

    J:\Monitoring\Water_Quality_Macroinvert\ TrimbleData\YYYY\PARK

Importing data from Trimble Monument files into SQL Server

1. Open the .dbf file for the appropriate Monument shapefile in Excel (as described for the VegMat files above).
2. Save as an Excel file with _Import added to the filename in the folder J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY\PARK
3. Add a column to the spreadsheet containing the following script:

```
="UPDATE tblponds SET LOC_TYPE='" & B2 & "',LOC_MATERIAL='" & D2 & "',LOC_NOTES='" & E2 & "',GPSDATUM='NAD83',GPSDATE='"&TEXT(K2,"mm/dd/yyyy")&"',ELEVATION=" & U2 & ",LATITUDE=" & AC2 & ",LONGITUDE=" & AB2 & ",GPSTYPE='TRM_GXT8' where pondname='" & A2 & "'"
```

    a. Ensure that the columns line up properly, as the output .dbf file will change if changes are made to the data dictionary.
    b. Copy and paste the script into all of the rows of data in the spreadsheet.
4. Copy the data from the new column, and paste it into a new query in SQL Server
    a. Open Microsof SQL Server Management Studio Express and connect to INPYUGAMS08\sqlexpress
    b. Navigate to Databases – AK_ShallowLakes
    c. Click the New Query button
    d. Copy the data from the spreadsheet into the query window
    e. Press the Execute button
5. Save the query, if desired, with the same name as the .xlsx file in the following folder:

    J:\Monitoring\Water_Quality_Macroinvert\ TrimbleData\YYYY\PARK

Importing data from Trimble Depth files into SQL Server

1. Open the .dbf file for the appropriate Depth shapefile in Excel (as described for the VegMat files above).
2. Save as an Excel file with _Import added to the filename in the folder J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY\PARK
3. Add a column to the spreadsheet containing the following script:

="INSERT INTO AK_ShallowLakes.dbo.tblPondDepths(PONDNAME, SAMPLEDATE, GPS_TIME, LATITUDE, LONGITUDE, DEPTH, DATAFILE, COMMENTS_DEPTHS) VALUES('"&LEFT(L2,8)&"','"&TEXT(H2, "mm/dd/yyyy") &"', '"& TEXT(I2, "hh:mm:ss") & "', "& Z2 &", "& Y2 &", "& A2 &", '"& L2 &"', '"& C2 &"')"

   a. Ensure that the columns line up properly, as the output .dbf file will change if changes are made to the data dictionary.
   b. Copy and paste the script into all of the rows of data in the spreadsheet.

4. Copy the data from the new column, and paste it into a new query in SQL Server
   a. Open Microsof SQL Server Management Studio Express and connect to INPYUGAMS08\sqlexpress
   b. Navigate to Databases – AK_ShallowLakes
   c. Click the New Query button
   d. Copy the data from the spreadsheet into the query window
   e. Press the Execute button
5. Save the query, if desired, with the same name as the .xlsx file in the following folder:

   J:\Monitoring\Water_Quality_Macroinvert\ TrimbleData\YYYY\PARK

Data Import: Water Chemistry

The process of importing the water chemistry laboratory data is still fairly labor-intensive. In order to accurately import the data, the individual spreadsheets received from the lab must be compiled into one spreadsheet, and then imported into an Access database. The insert query required for importing the data into the SQL database is generated in Access. This intermediate step is necessary because the script required for the insert command is too lengthy to create in Excel; it exceeds the character limit for a cell. The query syntax developed in Access is then exported in text format to be used as the script in SQL for the actual import. Once the data has been imported into the Shallow Lakes database, some additional processing is required, due to the presence of analysis values that are below detection limits.

The process of taking the lab data from its original format to its final repository in the SQL database is outlined below.

1. Prepare an Excel spreadsheet to use as the source file for the data import.
    a. Compile all of the spreadsheets from CCAL into a single Excel spreadsheet.
    b. Highlight all of the analysis columns in yellow.
    c. Add an unhighlighted column after each analysis column
    d. For each analysis column, copy the column and paste it in the unhighlighted column next to it.
    e. Rename each of the unhighlighted columns with the addition of “notes” after the analysis name.
    f. For each of the highlighted columns, convert text to numbers when appropriate, do a Find and Replace to remove any asterisks, and change the format to numeric (with the appropriate number of decimal places).
        i. Note that it’s not possible to search for *, as it is interpreted as a wildcard. One way to get around it is to find each asterisked number individually. The quicker technique is to Find *0.0 and Replace with 0.0. This will replace all the 0.00 values whether they have an asterisk or not, but it doesn’t change the value, so it doesn’t matter. This also has the convenient side effect of converting text numbers to numeric format.
    g. Add a column before the sample_id and copy the “notes” column, which contains the sample date. Fill in any missing dates.
    h. Change the filenum and labno columns to numeric fields, and convert to numbers as necessary.
    i. Change the “notes” column heading to sampledate.

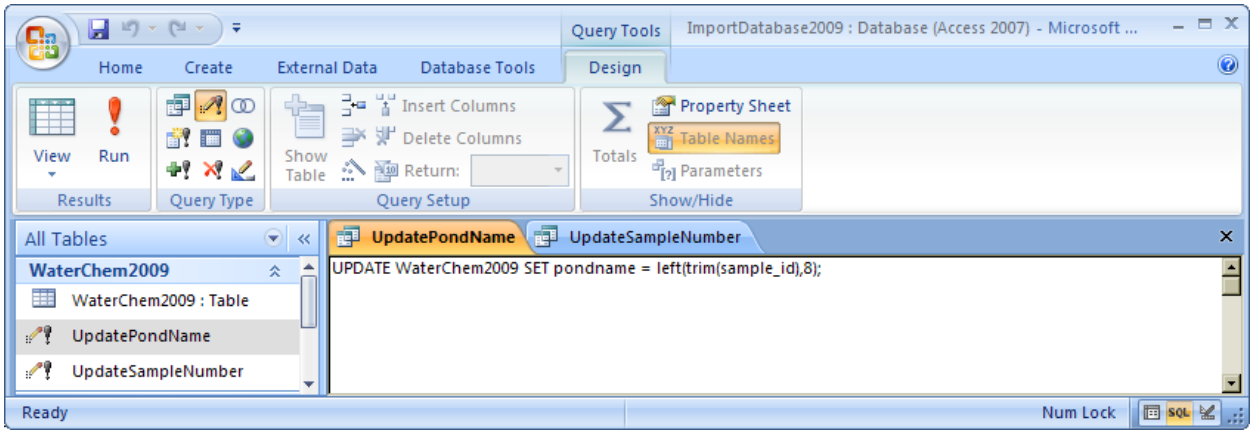
2. Prepare an Access database to serve as the conduit for importing the data from the Excel spreadsheet to the SQL database.

a. Copy the "WaterChemImportTemplate" Access project from the WaterChem folder in the Laboratory_Data folder and paste it into a folder for the data year within the WaterChem folder.
b. Change the filename of the newly pasted Access file, so that "Template" is replaced with the with the data year.
c. Open the Access project and delete the WaterChemXXXX data table.

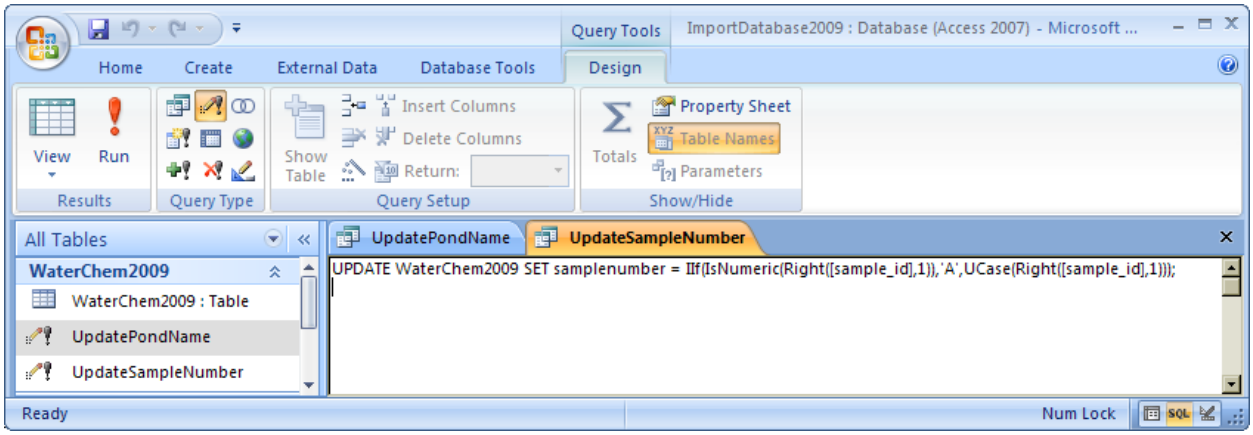
3. Import the edited spreadsheet into the Access project.
    a. Under the External Data tab in Access, Select Excel from the Import choices
    b. Browse for the file, and import the source data into a new table in the current database
    c. During the import process, select each analysis field and set the Data Type to Double. Make sure that date fields are set as date Data Type.
    d. Do not import the notes and comments field; the comments are truncated and need to be added in from the text files after the import is complete.
    e. Let Access add a primary key.
    f. Name the table WaterChemXXXX (where the XXXX is replaced with the data year)
    g. **Note that there will probably be import errors due to the null values in the analysis records for duplicate analysis. Check the ImportErrors table to verify that there aren't other problems. When there are nulls, the error is listed as a Type Conversion Failure. The row number listed matches the Excel spreadsheet row, not the newly imported table (the headers take up a row in the Excel sheet, so the row numbers in the new table will be off by one).

4. Add columns PondName (text), SampleNumber (text) and InsertQuery (memo) into the Access table.

5. The Pondname and SampleNumber come from CCAL concatenated together, as in 'BELA-001A', and need to be parsed into different columns. Update Queries have been created in the ImportDatabase to perform this function. Screen shots of the queries follow the instructions.
    a. Right click on the UpdatePondName query in the TOC and open it in Design View
    b. Change the UPDATE target so that the proper year is entered for the target table name.
    c. Save the query, and click on the Run button in the ribbon.
    d. Close the query, and open the table to verify that the PondName column was properly populated.
    e. Repeat the process for the UpdateSampleNumber query. Verify that the SampleNumber column was correctly poplulated. It's a good idea to check the filter drop-down box to make sure that the only values in the column are A, B, C.



Query text: UPDATE WaterChem2XXX SET pondname = left(trim(sample_id),8);



Query text: UPDATE WaterChem2XXX SET samplenumber = IIf(IsNumeric(Right([sample_id],1)),'A',UCase(Right([sample_id],1)));

This query examines the rightmost character of sample_id, determines if it is numeric, and if it is not then it assigns the non-numeric value (i.e. 'A' or 'B', etc.) to SampleNumber. If the value is numeric, we assume that there was no alphabetic code assigned to the sample and the value is merely the last digit of the pondname, so the sample number 'A' is assigned as a default. It is very important that the SampleNumber field is not left blank, or it causes all kinds of problems for linking the data to the Sampling Event and other associated data.

6. Populate the InsertQuery column of the WaterChem table using another Update query.
   a. Right click on the CreateInsertQueries query in the TOC and open it in Design View
   b. Change the UPDATE target so that the proper year is entered for the target table name.
   c. Change the SOURCE field reference to be the name of the spreadsheet from which the data was extracted (see Step 1). This is the last item in the VALUES list – replace the filename SourceDocument.xlsx with the appropriate filename.
   d. Save the query, and click on the Run button in the ribbon. Close the query when the updates are complete.
   e. The script of the query is as follows:

```
UPDATE WaterChemXXXX SET InsertQuery = "INSERT INTO
AK_ShallowLakes.dbo.tblWaterChemistry
(PONDNAME,SAMPLEDATE,SAMPLENUMBER,CHEM_LAB,LAB_SAMPLE_NUMBER,LAB_DATE,DU
PLICATED_CHEM_ANALYSIS,PH,PH_Notes,ALKALINITY_MG_L,ALKALINITY_MG_L_Notes,CONDU
CTIVITY_AES,CONDUCTIVITY_AES_Notes,TN_MG_L,TN_Notes,TP_MG_L,TP_Notes,PO4_P_MG_
L,PO4_P_Notes,NO3_N_MG_L,NO3_N_Notes,NH3_N_MG_L,NH3_N_Notes,SI_MG_L,SI_Notes,
NA_MG_L,NA_Notes,K_MG_L,K_Notes,CA_MG_L,CA_Notes,MG_MG_L,MG_Notes,SO4_S_MG_
L,SO4_S_Notes,CL_MG_L,CL_Notes,DOC_MG_L,DOC_Notes, SOURCE) VALUES('" & pondname
& "','" & sampledate & "','" & samplenumber & "','CCAL'," & labno & ",'"& deliv_date & "','"
& iif(trim(dup) = 'D',1,null) & "'," & ph & ",'" & trim(phnotes) & "'," & alk & ",'" &
trim(alknotes) & "'," & cond & ",'" & trim(condnotes) & "'," & utn & ",'" & trim(utnnotes)
& "'," & utp & ",'" & trim(utpnotes) & "'," & op & ",'" & trim(opnotes) & "'," & no3n & ",'"
& trim(no3nnotes) & "'," & nh3n & ",'" & trim(nh3nnotes) & "'," & si & ",'" & trim(sinotes)
& "'," & na & ",'" & trim(nanotes) & "'," & k & ",'" & trim(knotes) & "'," & ca & ",'" &
trim(canotes) & "'," & mg & ",'" & trim(mgnotes) & "'," & so4s & ",'" & trim(so4snotes) &
"'," & cl & ",'" & trim(clnotes) & "'," & doc & ",'" & trim(docnotes) &
"','SourceDocument.xlsx');";
```

7. Save the data from the InsertQuery column in text format
    a. Right click on the InsertQuery column header in the Access Table, and select Copy
    b. Open Notepad, and paste the copied column.
    c. Check the textfile to make sure that the output is correct.
        i. Check the data portion (the second part of the script, encases in parentheses) of the first entry against the data in the table to verify that all of the data fields listed in the first part of the script are matched with the data from the proper columns in the Access table.
        ii. Scroll through to make sure that all the records are included, and that there are no obvious errors.
    d. Save the file with the name WaterChemImportXXXX.sql (where the XXXX designates the data year). Ensure that the file extension is .sql
    e. Note that there is also a tool named “GetInsertQueries” that can be used to pull out just the InsertQueries field from the database table. It’s a view that contains only the one field. The data can be extracted from this view either by copying and pasting as before, or by actually exporting to a text file.

8. Make the following edits to the .sql text file:
    a. Delete the InsertQuery heading at the top of the file if necessary
        i. Note that if you copied and pasted from the GetInsertQueries view, the heading will already be correct, and you can skip the next step.

b. Add the following to the top of the file (where the InsertQuery heading used to be):

```
USE AK_ShallowLakes;
Begin Transaction
```

These lines specify the database to query and start a transaction.

c. Replace all the empty numeric fields with null values
   i. SQL cannot import empty numeric fields, and an easy way to deal with this problem is to do a simple Find and Replace
   ii. Select Replace from the Edit menu in Notepad:

```
Find:       ,,
Replace:    ,null,
```

   iii. Check that the tool is working, then click the Replace All button.

d. Save the .sql file

9. Open the Insert Query window with the data from the .sql file within SQL server, using one of the following two methods:
   a. Open SQL Server and open the file
      i. Open SQL Server Management Studio Express
      ii. Connect to the Server
      iii. Navigate to Databases – AK_ShallowLakes
      iv. Click the Open File icon in the toolbar, and navigate to the newly created .sql file
      v. When the file is selected, SQL will prompt a connection to the database. Connect.
   b. Navigate to the .sql file in Windows Explorer, and double-click the file to launch SQL.

10. Execute the Insert Query in SQL
   a. Check to make sure the USE AK_ShallowLakes; Begin Transaction is at the top of the file, and that all the data to be imported is there
   b. Click the Execute button to run the insert query.
   c. Examine the log for errors. If there are none, erase all the insert queries (leaving the USE AK_ShallowLakes ; Begin Transaction at the top of the screen) and type

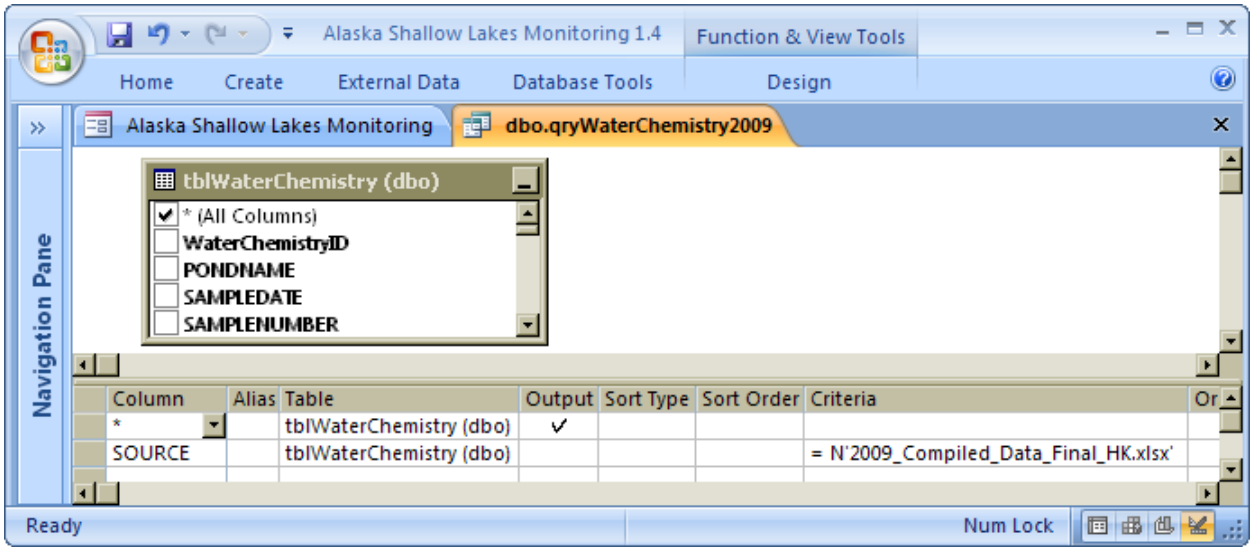
```
Commit;
```

   into the SQL window to commit all the insert queries. Do not forget to commit because the database will be left in a locked state until you do so.
   d. If there were errors, erase the insert queries (leaving the USE AK_ShallowLakes ; Begin Transaction at the top of the screen) and type

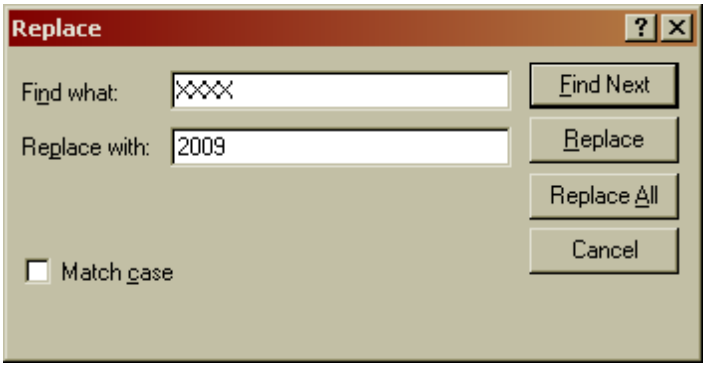
```
Rollback;
```

   The database will roll back to its state prior to the insertion attempts. Fix the errors and try again.

11. Indicate which readings are below the minimum detection limit (MDL) for each measurement
    a. Create a new select query for the newly added Water Chemistry data.
        i. Open the Shallow Lakes database and locate the query qryWaterChemistryXXXX
        ii. Copy and paste the file, replacing XXXX with the data year.
        iii. Open the query in design view, and set the Criteria of the SOURCE field to reference the newly imported data, as illustrated below.



    b. Create a SQL update query for the newly added data
        i. Locate the file WaterChemMDLupdate_Template.sql in: J:\Monitoring\Water_Quality_Macroinvert\Laboratory_data\WaterChem
        ii. Copy the template file and paste in the WaterChem folder under the appropriate year. Rename the file so that "Template" is replaced with the data year.
        iii. Open the newly renamed file in Notepad by right clicking the file and selecting Open with – Notepad
        iv. Under the Edit menu, select Replace. Use this tool to change all of the UPDATE targets from dbo.qryWaterChemistryXXXX to the appropriate query created in the previous step. If the naming has followed the guidelines, it should be possible to just find XXXX and replace with the appropriate year (as illustrated below), using the Replace All button.



v. Save and close the edited .sql file.

c. Run the SQL update query for the newly added data
   i. Navigate to the .sql file edited in the previous step, and double-click to open the file in SQL Express. Connect to Database Engine in SQL as prompted.
   ii. The file should open in a SQL Express window. Verify that it looks correct.
   iii. Click the Execute button in the toolbar
   iv. Check the log to make sure that the Query was executed successfully without errors. Generally only the PO4, NO3, NH3, Si and SO4 variables are affected by this query, and the updates for the other variables affect 0 rows.
   v. If there are errors in the running of the query, remove all the update query script from the query window, and type Rollback; beneath BeginTransaction; and click Execute again.
   vi. When the query completes successfully without errors, close the query window (not the entire SQL Server Management Studio Express window), which will open a warning message asking if the transactions should be committed. Click Yes to commit the transactions. Do NOT save the changes to the .sql file when asked.
   vii. Close SQL Server Management Studio Express.
   viii. Open the select query in Access to verify that it was updated with the appropriate data. If the query was open while the update query was performed, click the Refresh All button in the ribbon to apply the changes to the open view.

Data Import: YSI Files

The water chemistry data collected in-situ with YSI dataloggers is often saved on the MDS650 handheld computer for later input into the database. The files are exported as comma delimited files (CDF), and subsequently converted into Excel format. There are a few steps required to prepare the data in the Excel files for import into tblWaterProfiles in the AK_ShallowLakes database.

1. Edit the individual Excel files downloaded from the YSI dataloggers.
    a. Add Depth data.
        i. Add a column after Depth for entering the actual depth in meters (column H).
        ii. Manually enter the depth for each measurement, starting at 0.5 for each site, and adding 0.5 for each subsequent measurement unless otherwise noted.
            1. The formula *=[previous cell]+0.5* can be very useful.
        iii. While entering the depths, check that the site numbers match the time properly (sometimes there is one measurement in a profile that was accidentally given the wrong site number when it was saved; this can be verified by looking at the time stamp groupings).
    b. Ensure that the date and the time are in separate columns.
    c. Paste the following into column L for each measurement:

INSERT INTO AK_ShallowLakes.dbo.tblWaterProfiles (PONDNAME, SAMPLEDATE, SAMPLENUMBER, SAMPLETIME, SAMPLEDEPTH, TEMPERATURE, PH, SPECIFICCONDUCTANCE, DO_PCT, DO_Charge)

    d. Edit the PARK-XXX section in the script below to be the lake number for the YSI file, then paste the following into column M for each measurement:

="VALUES('PARK-XXX','"& TEXT(A3, "mm/dd/yyyy") &"','"& SUBSTITUTE(SUBSTITUTE(SUBSTITUTE(K3, "1", "A"), "2", "B"), "3", "C") &"', '"& TEXT(B3,"hh:mm:ss") &"', "& H3 &", "& C3 &", "& I3 &", "& D3 &", "& E3 &", "& F3 &")"

    e. Save the Excel file with the added changes.

2. Note that in future seasons this will need to be changed if other parameters are included. Also take note if different fields are present in the readouts, or if the fields are in different order. If they are, edits will need to be made to the script to reflect these differences.

This template is based on the following setup (for additional possible setups, see the end of this section):

Date	Time	Temp	SpCond	DO%	DO Charge	Depth	Depth	pH	BP	Site
M/D/Y	hh:mm:ss	C	mS/cm	%		ft	meters		psi	

3. Copy and paste the data from columns L and M into a Notepad file
    a. Open Notepad with a blank file
    b. Drag pointer to select all cells with data from columns L and M, and copy that block
    c. Paste into the Notepad file
    d. Save the Notepad file
    e. When the next Excel file has been processed, add that data to the same Notepad file
4. Create a SQL query to insert the data into the database
    a. Open Microsof SQL Server Management Studio Express and connect to INPYUGAMS08\sqlexpress
    b. Navigate to Databases – AK_ShallowLakes
    c. Click the New Query button
    d. Copy the text from the fully compiled Notepad file into the query window
    e. Press the Execute button
    f. Save the query, if desired, in the following folder: J:\Monitoring\Water_Quality_Macroinvert\Field_Data\YYYY\YSIProfiles
    g. Note that the data can also be pasted directly into the SQL query window from the Excel spreadsheets, which can eliminate the Notebook step. It is purely a matter of preference or convenience.

A few other configurations from 2009:

Date	Time	Temp	SpCond	DO%	DO Conc	DO Charge	pH	pHmV	Site
M/D/Y	hh:mm:ss	C	mS/cm	%	mg/L			mV	

INSERT INTO AK_ShallowLakes.dbo.tblWaterProfiles (PONDNAME, SAMPLEDATE, SAMPLENUMBER, SAMPLETIME, SAMPLEDEPTH, TEMPERATURE, PH, SPECIFICCONDUCTANCE, DO_PCT, DO, DO_Charge, pH_mV)

="VALUES('PARK-XXX','"& TEXT(A3, "mm/dd/yyyy") &"','"& SUBSTITUTE(SUBSTITUTE(SUBSTITUTE(K3, "1", "A"), "2", "B"), "3", "C") &"', '"& TEXT(B3,"hh:mm:ss") &"', "& H3 &", "& C3 &", "& I3 &", "& D3 &", "& E3 &", "& F3 &", "& G3 &","& J3 &")"

	A	B	C	D	E	F	G	H	I	J	K
1	Date	Time	Temp	SpCond	DO%	DO Conc	DO Charge	Depth	pH	pHmV	Site
2	M/D/Y	hh:mm:ss	C	mS/cm	%	mg/L				mV	
3	7/10/2009	10:34:22	18.17	0.085	136.5	12.88	86	0.5	7.54	-12.9	1

Database Concatenation

Overview

The Shallow Lakes Monitoring data management system consists of a Microsoft Access front-end application that is connected to a Microsoft SQL Server Expresss back-end database. The back end database is designed to be split into multiple (child) copies running on field computers and the copies reintegrated with the master (parent) database. This Instruction Sheet explains how to reintegrate a child database with the parent database.

Reintegrating a child database with the parent: Generalized work flow

Your goal is to use SQL Server Management Studio to script out the contents of the entire child database as a text file of insert queries. The script file will then be executed against the parent database, inserting all of the newly acquired records (Figure 1).

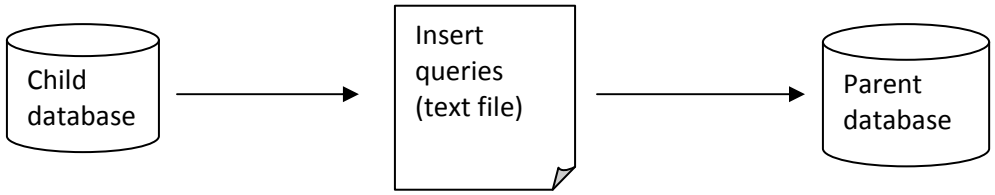


Figure 1. Generalized process of reintegrating a child database with the parent.

Generating a database script

In this work sequence you will use Microsoft SQL Server Management Studio to generate a text file of insert queries. Management Studio will cycle through each record in the child database and generate an insert query for that record in the text file. This file can then be run against the parent database where it will insert all the new records.

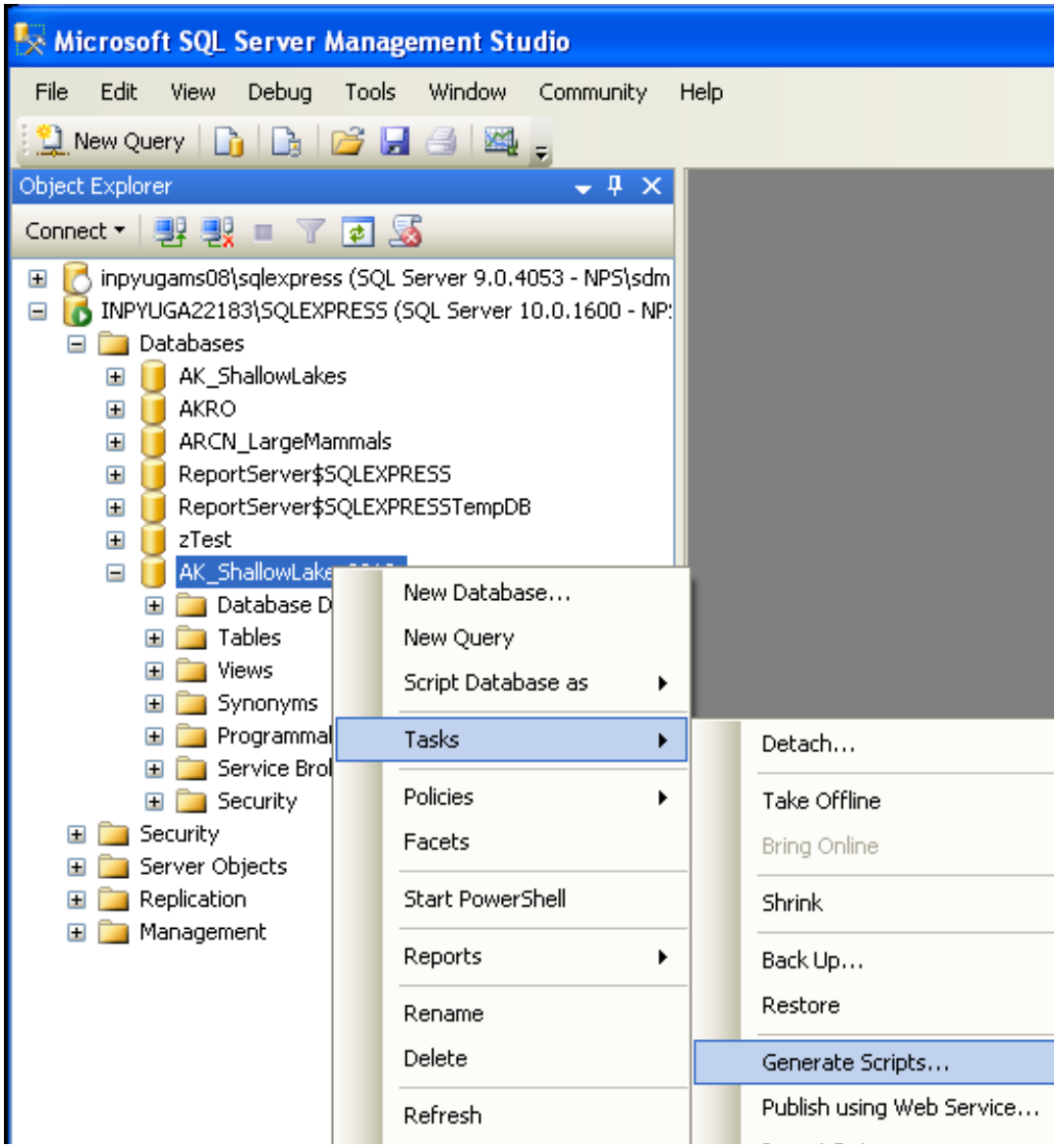
Important Note: If at the beginning of your field season you copied the entire database, including all existing records onto the field computer, then the database script you will generate below will be very lengthy. Additionally, when you execute the script against the parent database SQL Server will generate thousands of errors indicating that the record you are trying to insert already exists. This situation is harmless since the database will not allow duplicates, but things will go more smoothly if you trim out all events other than the current ones.

The best way to do this is to execute a delete query aganst the child database, similar to the following: 'DELETE FROM tblEvents WHERE YEAR(SampleDate) < 2010' where 2010 is the current year's data. This query will eliminate all data (except for lakes) prior to 2010 (you should of course copy or back up your database or at least test the WHERE clause with a SELECT query before doing this). Since the database

employs cascading deletes the unneeded events will be deleted and the deletes will cascade out to all related tables. Everything prior to 2010 will be eliminated with this one query (so it goes without saying that you should understand exactly what you're up to here before proceeding). Consider eliminating existing lakes in similar fashion. Time spent cleaning out existing data now will pay off in the future since you will have thousands fewer error messages to sift through when you run the scripts. Get help from your data manager if you need it. These tasks sound daunting but are really quite simple.

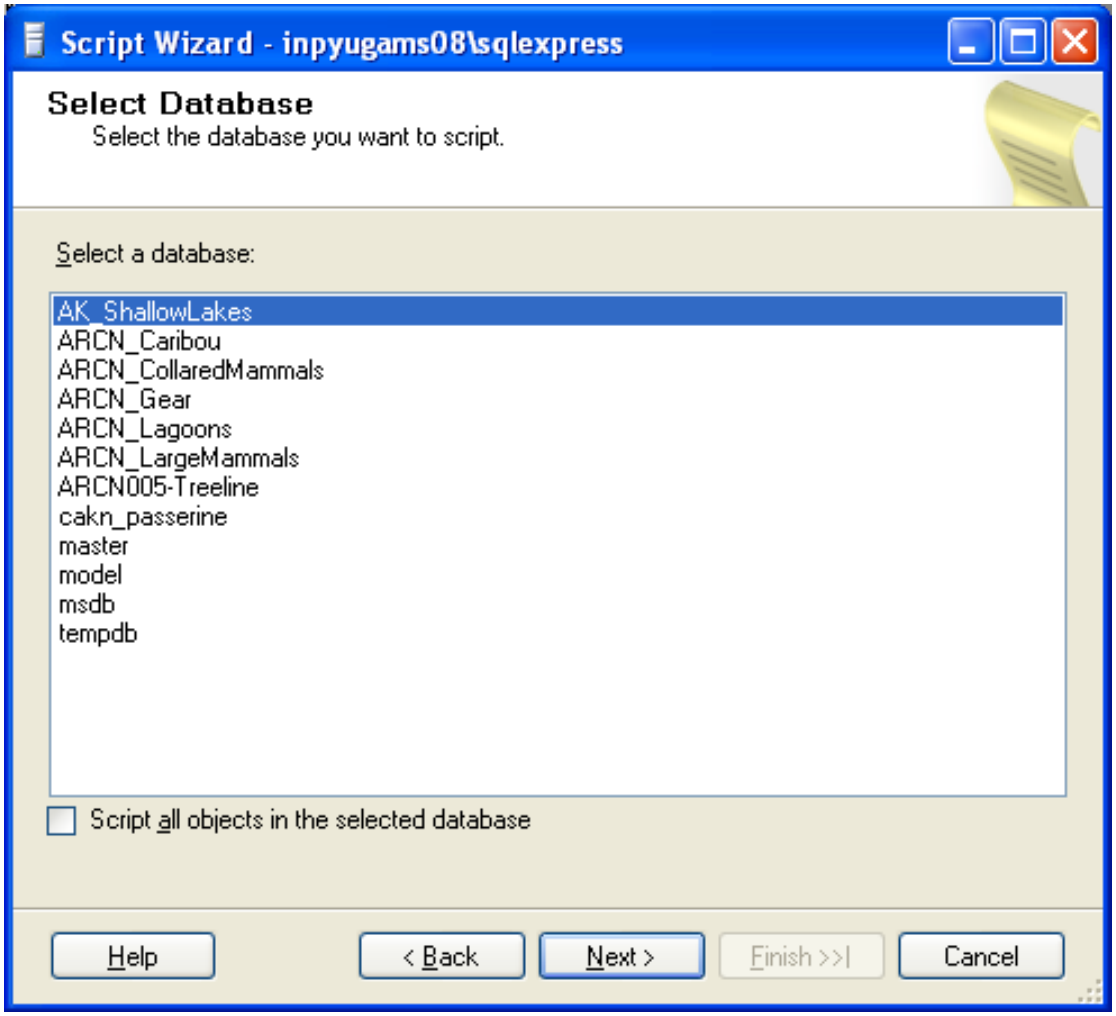
Work sequence:

1. (Optional, but recommended). Trim out all data prior to the current field season (see note above).
2. Open SQL Server Management Studio.
3. Navigate to the child database
4. Right click the database and select 'Tasks'
5. Click 'Generate Scripts…'



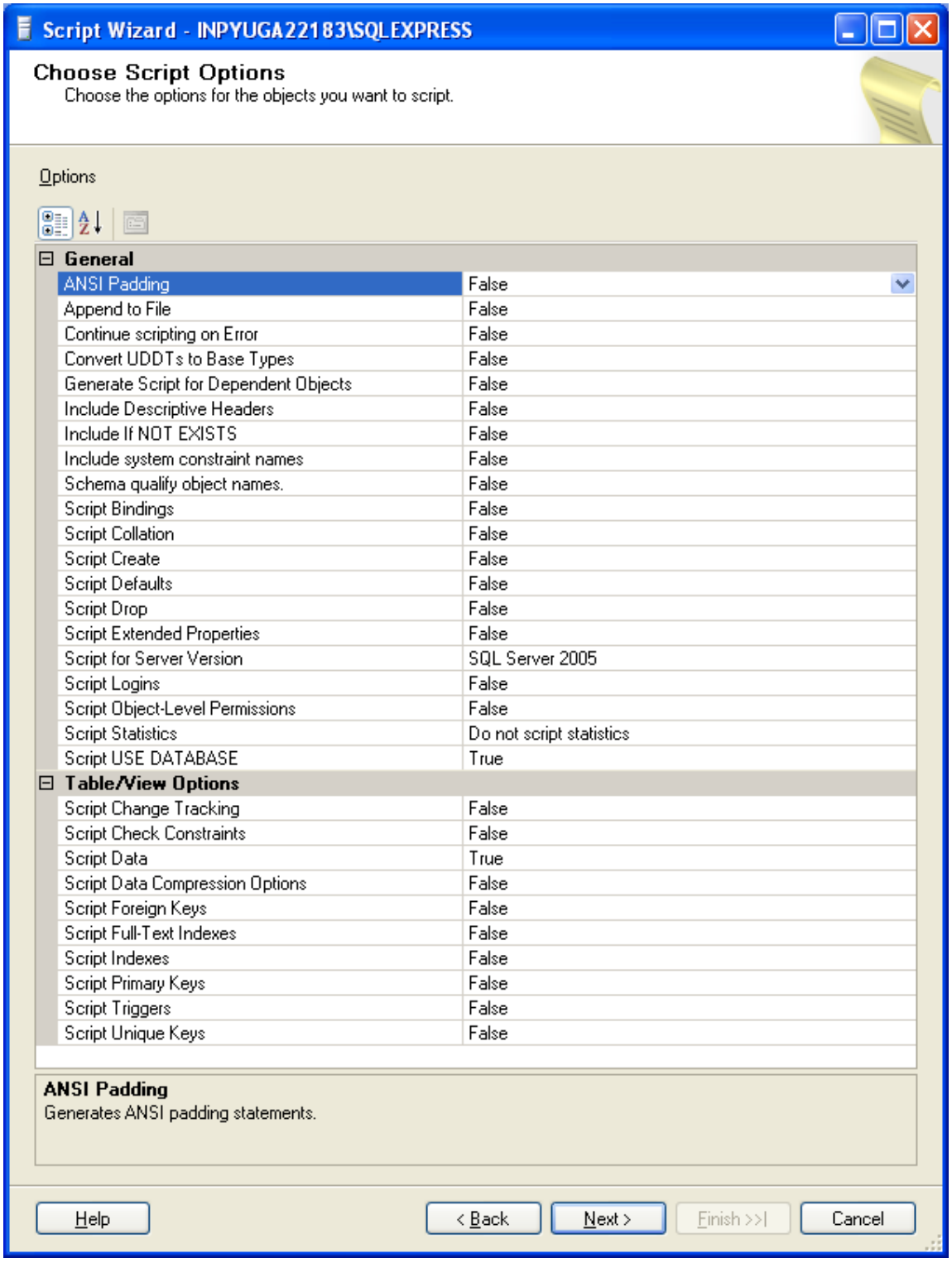
6. The Script Wizard appears.

7. Select your database

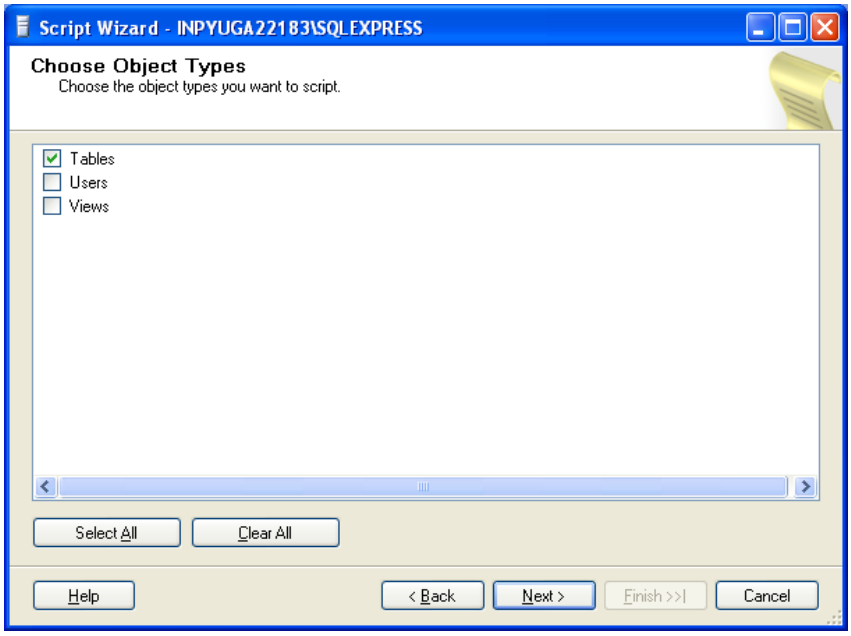


8. The Choose Script Options form appears.

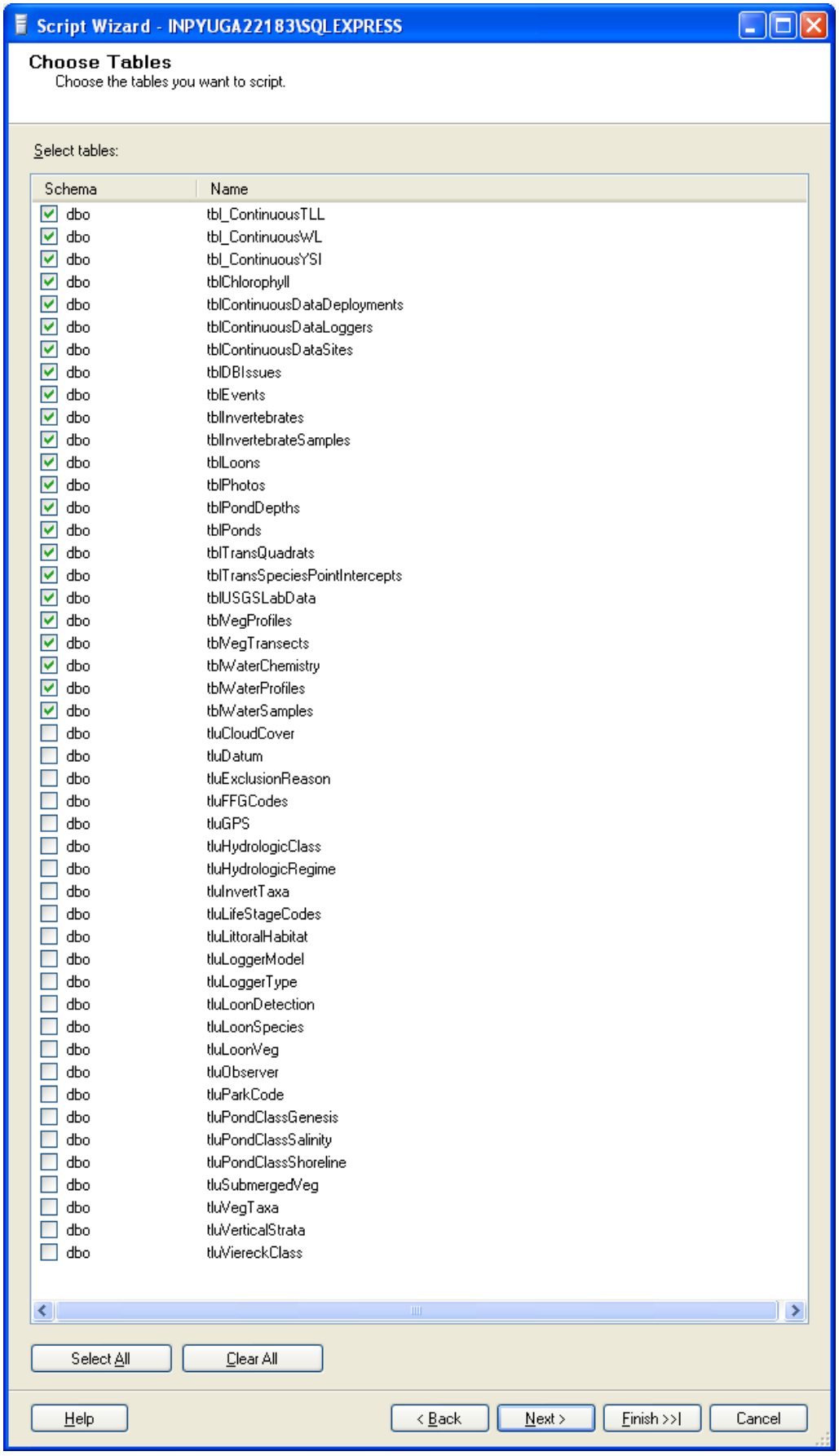
9. Make the options form appear as below. Ensure that the database version is correct and 'Script Data' is set to True.



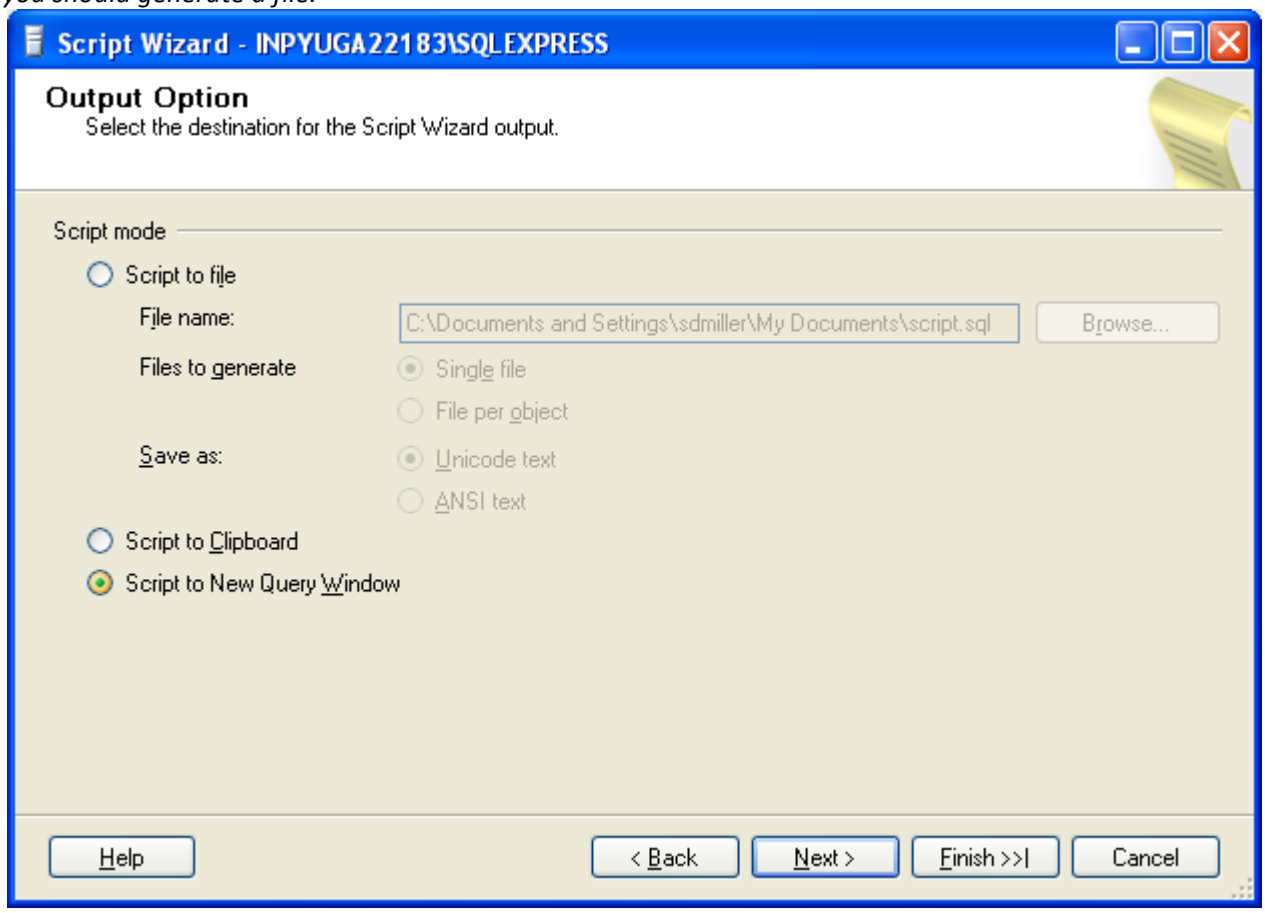
10. In the Choose Object Types form check ‘Tables’



11. Select all the tables with the ‘tbl’ prefix. (You don’t need to update the lookup tables)

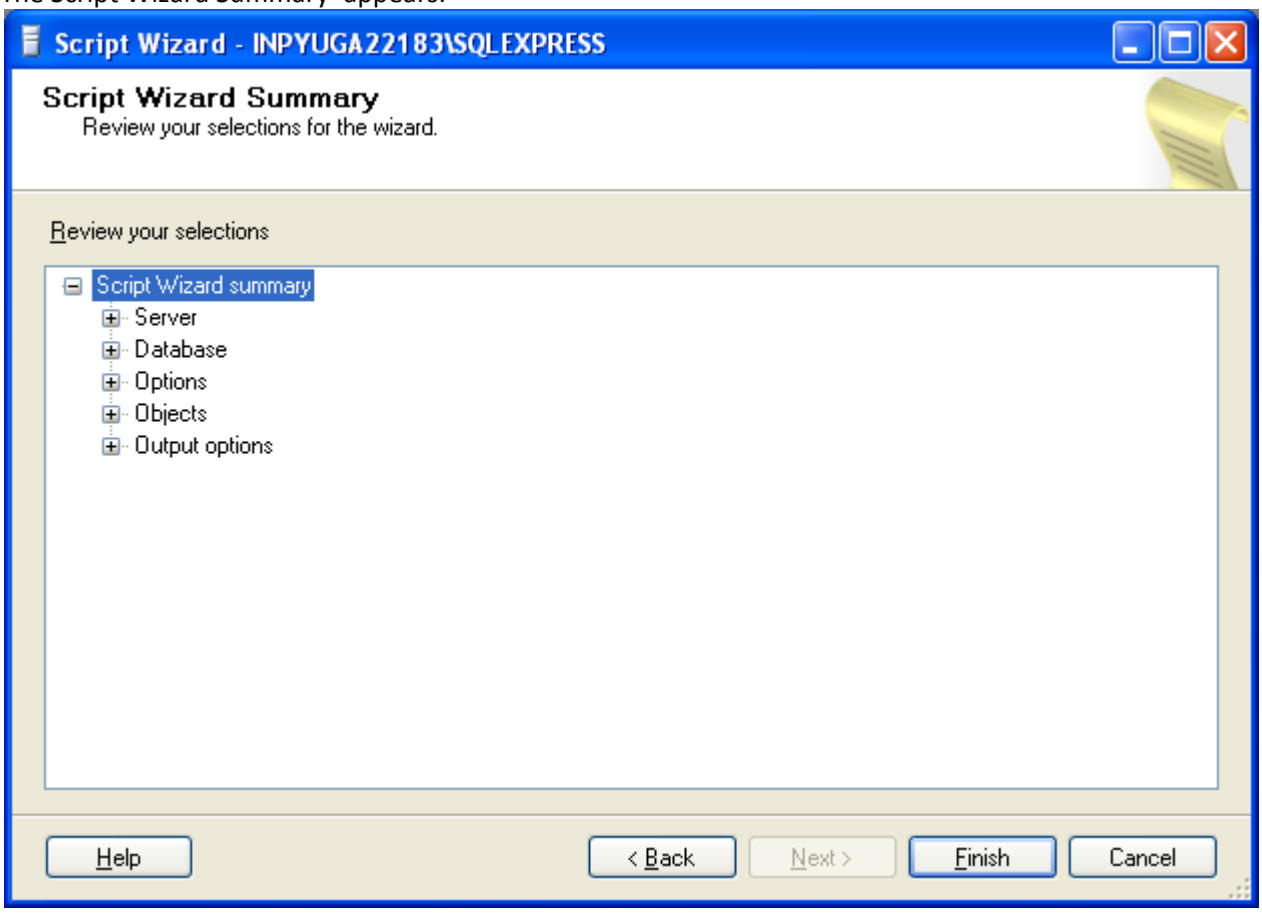


12. You may choose to have the output directed to a file, the clipboard or a new query window. *The example below directs the output to a new window so you can see the output, but, in practice you should generate a file.*

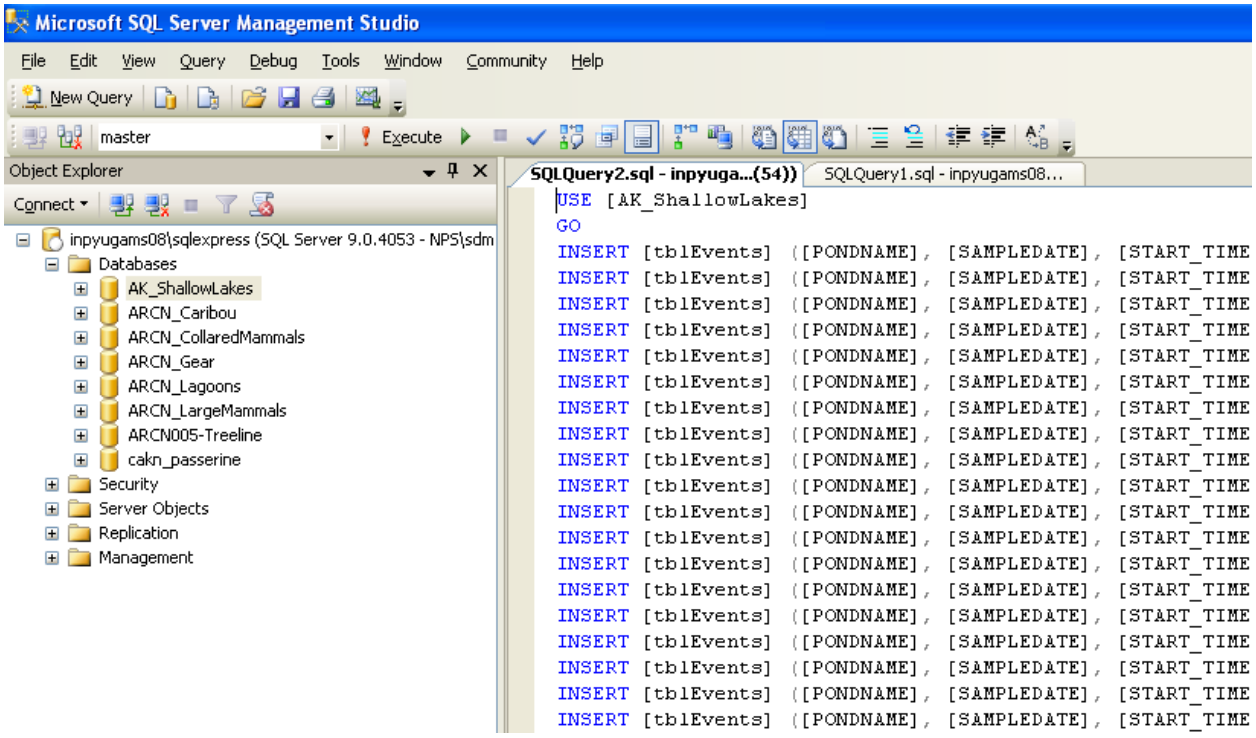


13. Select 'Next'

14. The Script Wizard Summary' appears.



15. Click 'Finish'
16. Management Studio will now generate the insert query scripts.



If you have done your work correctly you should have a text file with a .sql extension that contains a long series of insert queries. If you are going to save this file a recommended naming structure would be 'ServerName_Database_YYYY-MM-DD.sql'. If the field computer's SQL Server instance is INPYUGA22183\SQLEXPRESS then the script name should be 'INPYUGA22183_AK_ShallowLakes_2010-09-16.sql. If problems are discovered with the scripts this scheme will allow someone to quickly determine which machine the script came from and when.

Executing a database script against the parent database

Open the script you generated in the steps above and look it over. Ensure the following:

1. **The script only contains insert queries** (no create or alter table queries, delete queries or update queries.)
2. **Insert order is critically important!** Make sure the tblPonds queries precede the tblEvents queries and the tblEvents queries precede all others (i.e, the database will not allow you to insert an event related to a lake that does not exist yet and similarly, you may not insert pond depths or veg data or other related information before the related event exists in the database.
3. **Make sure you are connected to the parent database.** Make sure the USE [AK_ShallowLakes] statement is the first line. You don't want to re-insert the data into your field copy (absolutely won't work) and you don't want to accidentally try to insert lake data into a mammals or climate database (most likely won't work).

Work sequence:

1. Open Management Studio.
2. Connect to the parent shallow lakes database.
3. Open the field database SQL script generated from part one above.
4. Click the exclamation button to execute the queries.
5. Management studio will sequentially execute the queries. If any of the lakes or events or related data already exist there will be many duplicate record errors. These are harmless but may mask very important messages so study errors scrupulously.
6. Open the Shallow Lakes Database and Application, ensure you are connected to the parent database and verify the new data.
7. Repeat this SOP for any other field computers.

Deploying HOBO Dataloggers

The Shallow Lakes project currently uses HOBO dataloggers for collecting both temperature and barometric pressure data. See SOP 8: Continuous Lake Monitoring for details on how these loggers are used in the sampling regime.

Prior to field deployment, all of the loggers (both temperature and pressure) should be tested to make sure that they're working properly. Set all of the loggers to log for at least 12 hours, store them all together, then download and view all of the test files to determine if there are any unusual readings.

This document details the instructions for deploying HOBO loggers. There are currently two types of Hobo temperature loggers in use, although the External Temp loggers are being phased out and replaced with the Pendant loggers. HOBO water level loggers are used for collecting the barometric pressure at the bottom of the lake as well as in the air near the deployment sites.

Temperature Loggers

1. Set the loggers to launch using a delayed start. Set the start date/time to the earliest possible time of deployment. Any data logged before deployment will be clipped during processing after the logger is downloaded. Note that once the loggers are set to launch, a little red light will flash periodically to confirm that they are active.
2. Temperature loggers should all be set to take measurements every two hours. Temperature was formerly logged hourly, but the pendant loggers do not have sufficient memory for hourly measurements.

HOBO Pendant Temperature Loggers (UA-002-08)

1. These loggers require HOBOware Pro software and a USB pendant coupler or Waterproof Shuttle for communication, launching, and data retrieval. To launch:
    a. Open HOBOware Pro
    b. Plug the Pendant Coupler into the USB port of the PC and insert a pendant into the coupler
    c. Click the launch icon and select the device
    d. Verify that the Logging Interval is set for 2 hours
    e. Set the Launch Option to Delayed, and enter the desired date and time for the logger to launch
    f. Click the Launch button to complete the process
2. Both temperature and light level are collected by this logger.
3. These loggers are fully waterproof, and can be placed directly in the water.

HOBO External Temperature Loggers (H08-001/2-02)

1. These loggers require BoxCar Pro software and a serial port connector cable for communication, launching, and data retrieval. To launch:
    a. Open BoxCar Pro
    b. Plug the serial port cable into the PC and plug it in to a logger
    c. Click the lauch icon
    d. Verify that the inteval is set to 2 hours
    e. Select the Delayed Start option, and enter the desired date and time for the logger to launch
    f. Click the Start button to complete the process
2. Only temperature is collected by these loggers.
3. These loggers are not waterproof, and need to be deployed inside waterproof canisters. Before deployment, clean the O-rings and threads of the canisters, and lightly lubricate the O-rings. Insert the launched logger into the storage slot, add a small packet of moisture-absorbing material, and use a disc of foam to hold the logger secure.

Water Level Loggers

1. Set the loggers to launch using a delayed start. Set the start date to the earliest possible day of deployment, and set the time to noon. Any data logged before deployment will be clipped during processing after the logger is downloaded.
2. Water level loggers should all be set to take 2 measurements per day, one at midnight and the other at noon.
3. Some of the water level loggers are deployed at the bottom of the lake, while others are left on shore to gather barometric pressure data to be used as a reference for calculating changes in depth from the changes in barometric pressure at the bottom of the lake. All of the loggers are launched in the same manner, however, and collect the same data.

HOBO 30' Water Level Loggers (U20-001-01)

1. These loggers require HOBOware Pro software and an Optic USB Base Station or Waterproof Shuttle for communication, launching, and data retrieval. To launch:
    a. Open HOBOware Pro
    b. Plug the Base Station into the USB port of the PC
    c. Remove the black cap from the water level logger and insert the logger into the base station, matching the flat portions for proper alignment
    d. Click the launch icon and select the device
    e. Verify that the Logging Interval is set for 12 hours
    f. Set the Launch Option to Delayed, and enter the desired date and time for the logger to launch
    g. Click the Launch button to complete the process

Deploying YSI Sondes

There are two methods that can be used to deploy Sondes for unattended measurements. The first is using a YSI MDS 650 unit to connect to the Sondes and program the deployment details, and the other is using StreamlineENV software to program the Sondes. The method using the YSI MDS field computer is outlined here; for details on using StreamlineENV to program Sondes, refer to the Instruction Sheet "Using StreamlineENV".

MDS 650

The MDS 650 is a field computer produced by YSI to interface with Sondes both in the lab and in the field. The MDS should be set up properly before being used with any of the Sondes. *It is particularly important to verify that the date and time are correct*.

1. Set latitude and altitude
    a. In the MDS650, select Sonde menu – Advanced – Sensor
    b. Latitude: 65 degrees
    c. Altitude: 439 feet
2. Check the date and time of the MDS650
    a. Select System setup from 650 Main menu, select Date & time
    b. Navigate to http://www.time.gov/timezone.cgi?Alaska/d/-9/java for the date and time
    c. Enter the correct date and time, and press Enter
3. Calibrate the barometer if necessary

- This should not generally be required, as the MDS units arrive from YSI fully calibrated. Only calibrate the barometer if there are irregularities in the readings.
    a. Select Calibrate barometer from the System setup menu
    b. Follow the prompts to calibrate

YSI Sondes (6920, 6920V2, 600XLM)

1. Install batteries (8 AA for 6920 and 6920 V2, 4 AA for 600 XLM)
    a. **6920 and 6920 V2**
        i. Twist off the cap to the battery chamber, using the bail for leverage
        ii. Put 4 batteries in each tube, taking care to follow the directions engraved on the Sonde just above the tube openings
        iii. Close cap firmly
    b. **600XLM**
        i. Twist off the cap to the battery chamber

ii. Insert 4 AA batteries into the individual slots, using the directions engraved behind each slot

iii. Close cap firmly

2. Connect Sonde to MDS
3. Check the date and time of the Sonde
    a. Select System from Sonde menu, select Date & time
    b. Set the Sonde to match the date and time displayed on the MDS650
    c. Press the Esc key to return to Sonde menu
4. For sondes with Turbidity sensors, install the Turbidity sensor and temperature sensor, and remove all other probes. Calibrate the turbidity sensor as detailed in Instruction Sheet "Calibrating Turbidity Probes"
5. Install all probes.
6. Calibrate the sensors (see Instruction Sheet "Calibrating Sondes"). When the sondes are deployed, the Auto sleep function is activated, but for calibration it can be helpful to turn Auto sleep off so that measurements can be viewed on the display screen right away (Auto sleep settings are in the Sonde menu – Advanced – Setup).
7. Verify that the VT100 Automation, Auto sleep RS232, and Auto sleep SLI12 are all on
    a. Select Sonde menu , select Advanced, select Setup
    b. Activate VT100 and Auto sleep settings if they are not already active
    c. Press the Esc key to return to the Advanced menu
8. Verify that the DO temp co % and warm-up time is set correctly
    a. Select Sensor from the Advanced menu
    b. Set the DO temp co % value to the correct value for the sensor type:
        i. Rapid Pulse: 1.1%
        ii. ROX Optical DO with black bottom: 1.27%
        iii. ROX Optical DO with brass bottom: 1.5%
    c. Verify that the DO Warm Up time is set to 40 seconds
    d. Press the Esc key to return to the Advanced menu
9. Enable the Data Filters for the optical probes
    a. Select Data Filter from the Advanced menu, and verify that the Data Filter is enabled.
    b. Press Esc, and select the Time Constants Menu
    c. Select the turbidity sensor and change the time constant to 30 seconds, press Enter
    d. Select the DO sensor and change the time constant to 30 seconds, press Enter
    e. Press the Esc key to return to Sonde menu

10. Enable sensors
    a. Select Sensor from Sonde menu
    b. For the **6920**, enable Time, Temperature, Conductivity, Dissolved Oxy, Pressure-Abs, ISE1 pH, ISE1 Orp, Optic-T Turbidity-6136, Battery
    c. For the **6920 V2**, enable Time, Temperature, Conductivity, ISE1 pH, ISE2 Orp, Optic-T Turbidity-6136, Optic-C Dissolved Oxy, Battery
    d. For the **600XLM**, enable Time, Temperature, Conductivity, Dissolved Oxy, ISE1 pH, ISE2 Orp, Battery
    e. Press the Esc key to return to Sonde menu
11. Set report view
    a. Select Report from the Sonde menu.
    b. Include the following measurements in the report setup:

6920

i. Date
ii. Time hh:mm:ss
iii. Temp C
iv. SpCond uS/cm
v. DOsat %
vi. DO mg/L
vii. DOchrg
viii. pH
ix. pH mV
x. Orp mV
xi. Turbid+ NTU
xii. Battery volts

6920 V2

i. Date
ii. Time hh:mm:ss
iii. Temp C
iv. SpCond uS/cm
v. pH
vi. pH mV
vii. Orp mV
viii. Turbid+ NTU
ix. ODOsat%
x. ODO mg/L
xi. Battery volts

600XLM

i. Date
ii. Time hh:mm:ss
iii. Temp C
iv. SpCond uS/cm
v. DOsat%
vi. DO mg/L
vii. DOchrg
viii. pH
ix. pH mV
x. Orp mV
xi. Battery volts

    c. Note that the SpCond should be in uS/cm. If it is listed as mS/cm, select the variable to change the units.
    d. Press the Esc key to return to Sonde menu
12. Set the Sonde to log
    a. Select Run from Sonde menu, select Unattended sample
    b. Set the Interval to 01:00:00
    c. Set the start date and time
    d. Leave the duration at the default of 365 days
    e. For the file name, use the lake name (max 8 characters)
    f. Leave the site name blank
    g. Select the View params to log to verify that everything is set to record
    h. Select Start logging and confirm

i. Review the logging parameters and press Esc twice to return to Sonde menu

13. Test the Sonde before deploying in the field.
    a. Set the Sonde to log hourly
    b. Ensure that the storage cup is filled with tap water so that the sensors are sumberged
    c. Stop and download the Sonde after about a week of logging.
    d. Check the sensors against calibration solutions and record the readings
    e. If there was significant drift in the readings from the calibration to the readings taken after one week, calibrate the sensors again and retest. If the problem persists, send the sensors in for maintenance.
14. Set the Sonde to log in the field
    a. Calibrate the sensors just prior to deploying the Sonde. Note that Turbidity sensors should only be calibrated in the lab; the remaining probes can be easily calibrated in the field.
    b. Set the start date and time to the earliest possible time of deployment
    c. Set the filename to the lake name where it will be deployed.
    d. Mark the outside of the Sonde casing with the lake name where it will be deployed.

Downloading HOBO Dataloggers

Temperature Loggers

HOBO Pendant Temperature Loggers (UA-002-08)

1. Connect the Pendant Coupler to the USB port
2. Open HOBOware Pro
3. Insert a pendant into the coupler
4. When HOBOware recognizes the pendant, click OK
5. Click the Readout Device button and when the Stop Logger? window pops up, click Stop
6. Save the .hobo file using the naming convention and file location described in Instruction Sheet "Continuous Monitoring File Storage"
7. Include all series and events in the Plot Setup, and click Plot
8. Click the Export Table Data button to export in text file format, choose to Export to a single file, and click Export
9. Save as a .csv file using the same naming convention as for the .hobo file
10. Mark the downloaded logger with a blue dot sticker labeled with the date to indicate that the data has been downloaded.

HOBO External Temperature Loggers (H08-001/2-02)

1. Connect the communication cable to the serial port
2. Open BoxCar Pro 4
3. Attach a logger to the communication cable
4. Click the Readout Logger button to download data
5. Take note of the battery level, and record in the database
6. Unplug the logger at the prompt, and click OK
7. Save the .dtf file using the naming convention and file location described in Instruction Sheet "Continuous Monitoring File Storage"
8. Select the Temperature to display in Celsius
9. Click the Export to Excel Spreadsheet button, and make sure that the Temperature in Celsius is selected to export. Include Serial Number In Data Export.
10. Save as an .xls file using the same naming convention as for the .dtf file
11. Close the view window in BoxCar Pro
12. Mark the downloaded logger with a blue dot sticker labeled with the date to indicate that the data has been downloaded.
13. Note that when the .xls files are opened using Microsoft Excel 2007, there will be an error message warning that some information may have been lost. This appears to be only related to formatting, and does not impact the data or the logger information.

Water Level Loggers

HOBO 30' Water Level Loggers (U20-001-01)

1. Connect the Optic USB Base Station to the USB port
2. Open HOBOware Pro
3. Insert a logger into the base station
4. When HOBOware recognizes the logger, click OK
5. Click the Readout Device button and when the Stop Logger? window pops up, click Stop
6. Save the .hobo file using the naming convention and file location described in Instruction Sheet "Continuous Monitoring File Storage"

   (note that the reference loggers placed onshore will be labeled with a "BP", while the loggers submerged to track the water level will be designated "WL").

   ** It's a good idea to download the BP reference loggers first so that the reference files are available for processing the water level loggers. The files from the reference loggers do not need to go through the next steps; they are complete once the .hobo file is saved. Mark the downloaded logger with a blue dot sticker labeled with the date to indicate that the data has been downloaded.
7. Calculate the depth based on barometric pressure (If the reference logger has already been downloaded, this can be done in the Plot Setup immediately after the water level logger has been downloaded. Otherwise, the .hobo file can be opened at any time to process the data).
   a. Open the .hobo file to be corrected
   b. In the Data Assistants section of the Plot Setup, click the Process… button
   c. Click on the Use Barometric Datafile button, and click the Choose… button to select the downloaded file for the nearest reference logger (BP)
   d. Click the Create New Series button, and note that the series list now includes Sensor Depth. Verify that the units are in meters, and click the Plot button to view the data.
   e. There should now be a column for Sensor Depth, meters
8. Click the Export Table Data button to export in .csv format, choose to Export to a single file, and click Export
9. Save as a .csv file using the same naming convention as for the .hobo file
10. DO NOT export the Hobo file until it has been edited to add the sensor depth. Only data ready to be imported into the database should be exported as csv.
11. If desired, click the Save button to save the data as a hobo project (.hproj). This will retain the additional columns added by the Data Assistant process. If not saved as a project, the .hobo file will revert to its original dataset, not including Sensor Depth. To view a project, open HOBOware and select "Open Project" from the file menu rather than "Open Datafile". Saving as a project is a good way to verify that the .hobo file was processed to add the sensor depth before export.

Field Downloads Using HOBO Waterproof Shuttle

To download data in the field, use the HOBO Waterproof Shuttle. Note that any loggers downloaded using the HOBO Waterproof Shuttle must have been launched using HOBOware 2.2 or greater, and unless HOBOware 3.0 or greater was used, the delayed start of any loggers offloaded with the shuttle must have been less than 24 hours.

Preparing Shuttle for Use in the Field

1. Connect the Shuttle to a PC by unscrewing the center cap and plugging in a USB cable
2. Open HOBOware Pro software, and verify that it recognizes the Waterproof Shuttle
3. Select *Manage Shuttle* from the *Device* menu
4. Click the *Sync Shuttle Clock* button to synchronize the shuttle to the computer time. Make sure that the computer time is correct before using it for synchronization! The shuttle clock is used to set the logger clock at relaunch, so it is important to have the correct time.
5. Make sure that the battery level is good. If the battery level is weak, replace the battery, and re-sync the shuttle clock. The clock stops when the batteries are changed, and it will not read out loggers until the shuttle is relaunched in HOBOware, so it is important not to have low battery readings when heading to the field.
6. Ensure that all previously downloaded files have been transferred off the shuttle and saved in a secure location, and delete them from the shuttle. Make sure that there is enough space for the files to be offloaded from field loggers. The shuttle has 63 "banks", and one logger readout can be stored in each bank.
7. Launch the Shuttle by clicking the *Launch Shuttle* button. This writes the shuttle header, sets the clock, and erases all files from the shuttle. This only needs to be done the first time the shuttle is used, and after each battery change.
8. Make sure that the shuttle's large cap and center cap are closed securely. Tighten the center cap until it is just flush with the large cap, or until the O-ring is no longer visible.

Downloading and Relaunching Loggers in the Field

1. Make sure that the communications end of the logger is clean, and attach the appropriate coupler. Each logger type has a different couple adapter that slides on to the end of the shuttle.
2. Insert the logger into the coupler, and push the lever on the coupler towards the body of the shuttle, releasing the lever as soon as the amber light glows (the lever is quite stiff; you have to push fairly hard to get the lever close enough to the shuttle for activation to occur). The amber LED blinks continuously while readout and relaunch are in progress; do not remove the logger while the amber light is blinking.
3. After reading out the logger, the shuttle automatically synchronizes the logger's clock to the shuttle's clock, and relaunches the logger, using the same description, channels, logging intervals and other settings from the previous deployment. The



first reading will be delayed to match up with the next scheduled logging interval (if the logger was set to take readings every two hours, and the last reading before download was at 8:00 before it was downloaded at 8:45, the first reading of the new file will be at 10:00), so that it continues the previous dataset.

4. When the relaunch is complete, the green LED blinks. It will blink for 15 minutes, or until the lever is pressed. Remove the logger. If the red LED blinks, it indicates an error in the downloading process, and the logger should be taken back to the lab for downloading and/or troubleshooting.

Offloading Data from the Shuttle

1. Connect the Shuttle to a PC by unscrewing the center cap and plugging in a USB cable
2. Open HOBOware Pro and select *Manage Shuttle* from the *Devices* menu
3. Check the box next to the files to be downloaded (files that have not already been downloaded are automatically checked when the Management window is opened)
4. Click the *Offload Checked* button at the bottom of the screen, and select the destination folder for the saved files. They should be saved to the appropriate folder in J:\Monitoring\Water_Quality_Macroinvert\Field_Data\Continuous_Data\Hobo_data

   The Datafile Name of the files to be offloaded may be changed at this point, if desired
5. Click the *Save Checked* button to complete the process
6. Check that the files have been successfully saved to the network drive, and then delete any offloaded files from the shuttle in the Waterproof Shuttle Management screen
7. Check the battery level, and sync the shuttle's clock, if necessary
8. Click the *Close* button on the Management screen, disconnect the shuttle from the computer, and close the center cap securely

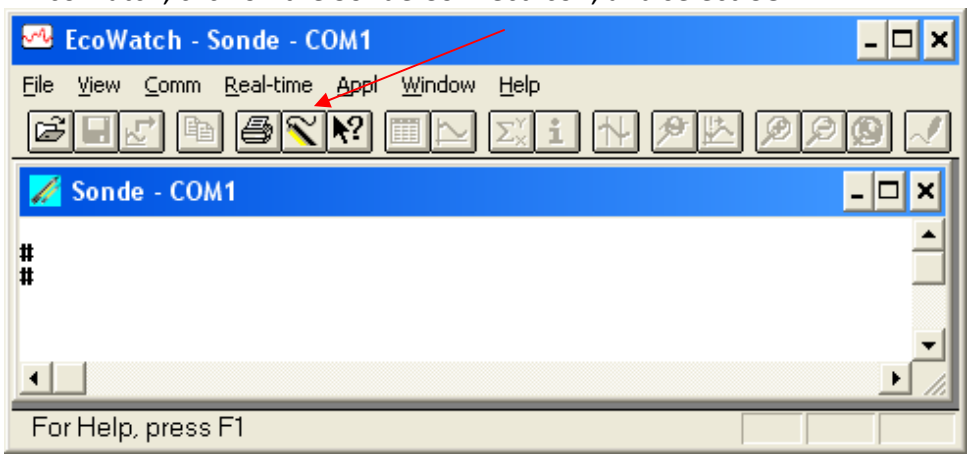
Using the Shuttle as a Base Station

The shuttle can also serve as a base station, connecting a logger directly to a computer.

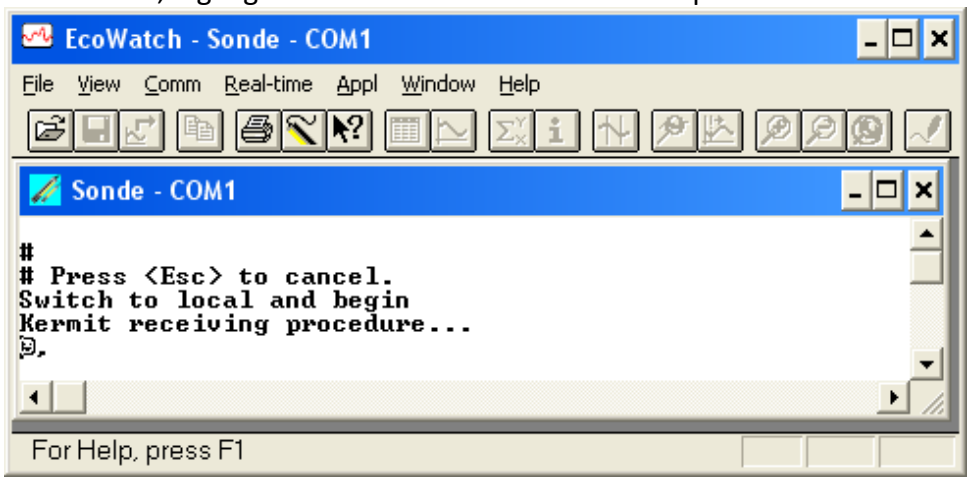
1. Connect the shuttle to a computer running HOBOware using the USB cable
2. Attach the appropriate coupler to the shuttle, and insert a logger
3. Press the coupler lever until the amber light glows, then release the lever (do not hold it down too long). The green light should glow to indicate that the device is ready to communicate with HOBOware
4. Verify that HOBOware recognizes the logger, and continue with logger launch or download as if the shuttle was merely a base station.
5. When the process is complete, remove the logger from the shuttle. The green light should go off. To communicate with another logger, insert the logger and press the lever.

Downloading Data from YSI MDS

1. Open EcoWatch on the laptop or desk computer
2. Connect the MDS 650 to the computer, and turn on the power
3. In EcoWatch, click on the Sonde Connect icon, and select COM1



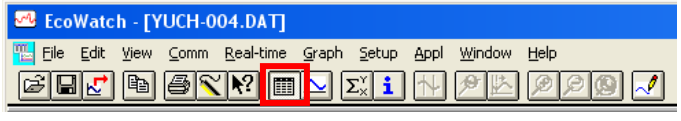
4. In the 650 Main Menu, select File, then Upload to PC. Note that the Sonde screen in EcoWatch must have the # sign, indicating that it has located the MDS unit and is ready for accepting downloads.
5. On the MDS, highlight the file to be downloaded and press the enter button

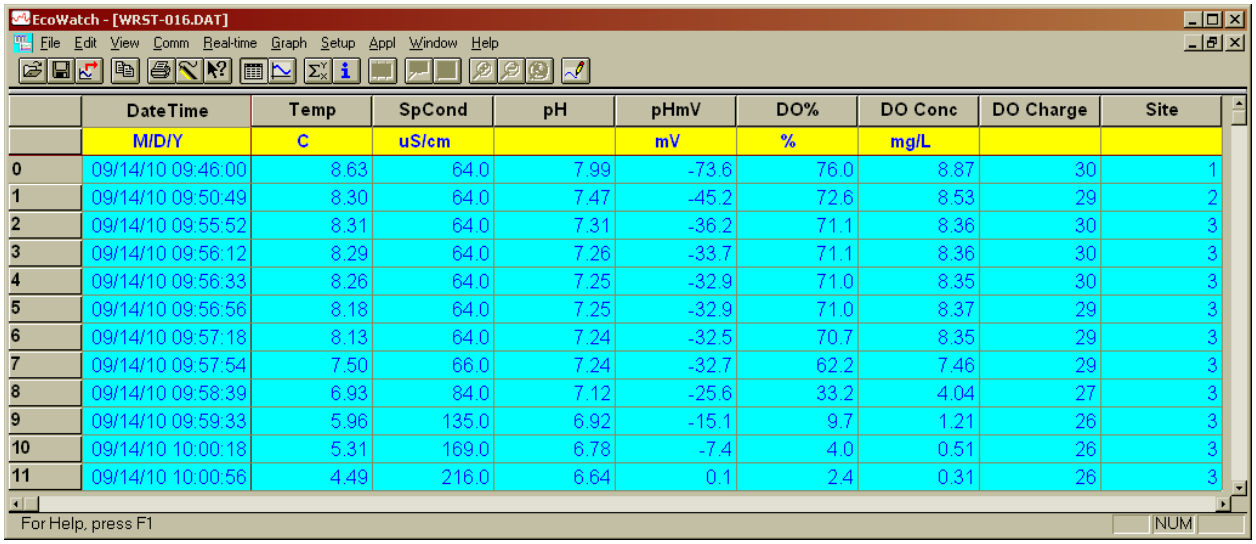


6. When the file has downloaded, the MDS will beep, and the EcoWatch screen will display the above message. The next file can now be downloaded by highlighting and selecting it on the MDS.
7. In EcoWatch, click on the Open icon, and open all of the files that were downloaded (they will need to be opened one at a time, but they all open in the same window of EcoWatch).



8. Click the Table View icon, and verify that all of the appropriate fields are shown, and that the units are correct (see example below).

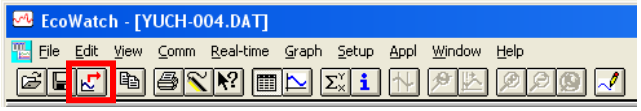




	DateTime	Temp	SpCond	pH	pHmV	DO%	DO Conc	DO Charge	Site
	M/D/Y	C	uS/cm		mV	%	mg/L		
0	09/14/10 09:46:00	8.63	64.0	7.99	-73.6	76.0	8.87	30	1
1	09/14/10 09:50:49	8.30	64.0	7.47	-45.2	72.6	8.53	29	2
2	09/14/10 09:55:52	8.31	64.0	7.31	-36.2	71.1	8.36	30	3
3	09/14/10 09:56:12	8.29	64.0	7.26	-33.7	71.1	8.36	30	3
4	09/14/10 09:56:33	8.26	64.0	7.25	-32.9	71.0	8.35	30	3
5	09/14/10 09:56:56	8.18	64.0	7.25	-32.9	71.0	8.37	29	3
6	09/14/10 09:57:18	8.13	64.0	7.24	-32.5	70.7	8.35	29	3
7	09/14/10 09:57:54	7.50	66.0	7.24	-32.7	62.2	7.46	29	3
8	09/14/10 09:58:39	6.93	84.0	7.12	-25.6	33.2	4.04	27	3
9	09/14/10 09:59:33	5.96	135.0	6.92	-15.1	9.7	1.21	26	3
10	09/14/10 10:00:18	5.31	169.0	6.78	-7.4	4.0	0.51	26	3
11	09/14/10 10:00:56	4.49	216.0	6.64	0.1	2.4	0.31	26	3

9. Units can be changed, or parameters may be added or removed from the view, by accessing the Parameters menu under the Setup menu. Select Units to change the units for any of the parameters, and select Add/Remove to change the parameters displayed.

10. Click on the Export icon, make sure the "Separate Date/Time" option is NOT checked, and click the Export button. Close the file once it's been exported. Repeat for all of the open files. Close EcoWatch when exports are complete.



11. Open Microsoft Excel, and open all of the exported .cdf files. In the Text Import Wizard, the delimiter must be set as comma in step 2. Note that in the Open dialog, the document type must be set to All Files.

12. Make any changes, if necessary (i.e. if errors were noted while measurements were being taken in the field), then save each file in .xlsx format.

13. When downloading files to a laptop in the field, move all the files (.xlsx, .dat, .ini, .cdf) from the EcoWatch Data folder to the folder being used to store the MDS data on the laptop. Be sure to MOVE the files, not just copy them. The only files that should remain in the EcoWatch Data folder are those that have not yet been transferred. The default storage location for EcoWatch on the laptop is C:\Program Files\EcoWatch\Data.

14. The final location for Water Profile data files, once the data is back at the office, will be: J:\Monitoring\Water_Quality_Macroinvert\Field_Data\YYYY\YSIProfiles

    Note that the .dat and .ini and .cdf files can be retained in a subfolder called EcoWatch Downloads, so that the final .xlsx products are easy to view. Files downloaded from Continuous Monitoring Sondes should be stored according to SOP 8, in: J:\Monitoring\Water_Quality_Macroinvert\Field_Data\Continuous_Data\Sonde_data

    Data will be imported into the database as described in Instruction Sheet "Data Import: YSI Files".

15. Disconnect the MDS from the computer, and delete the files on the MDS
    a. In the 650 Main Menu, select File
    b. Select Delete all files.

Downloading YSI Sondes

Sondes can be downloaded by transferring the data from the Sonde to an MDS 650 and then from the MDS 650 to a PC, or by downloading the data directly from the Sonde to a PC. Direct download of the data can be performed using either EcoWatch or StreamlineENV software. Files are then exported in comma delimited format. This document provides detailed instructions for downloading Sondes using an MDS or by direct transfer with EcoWatch software. Refer to Instruction Sheet "Using StreamlineENV" for instructions on downloading Sondes using StreamLineENV.

Downloading Files from YSI Sondes

Direct Transfer to PC Using EcoWatch Software

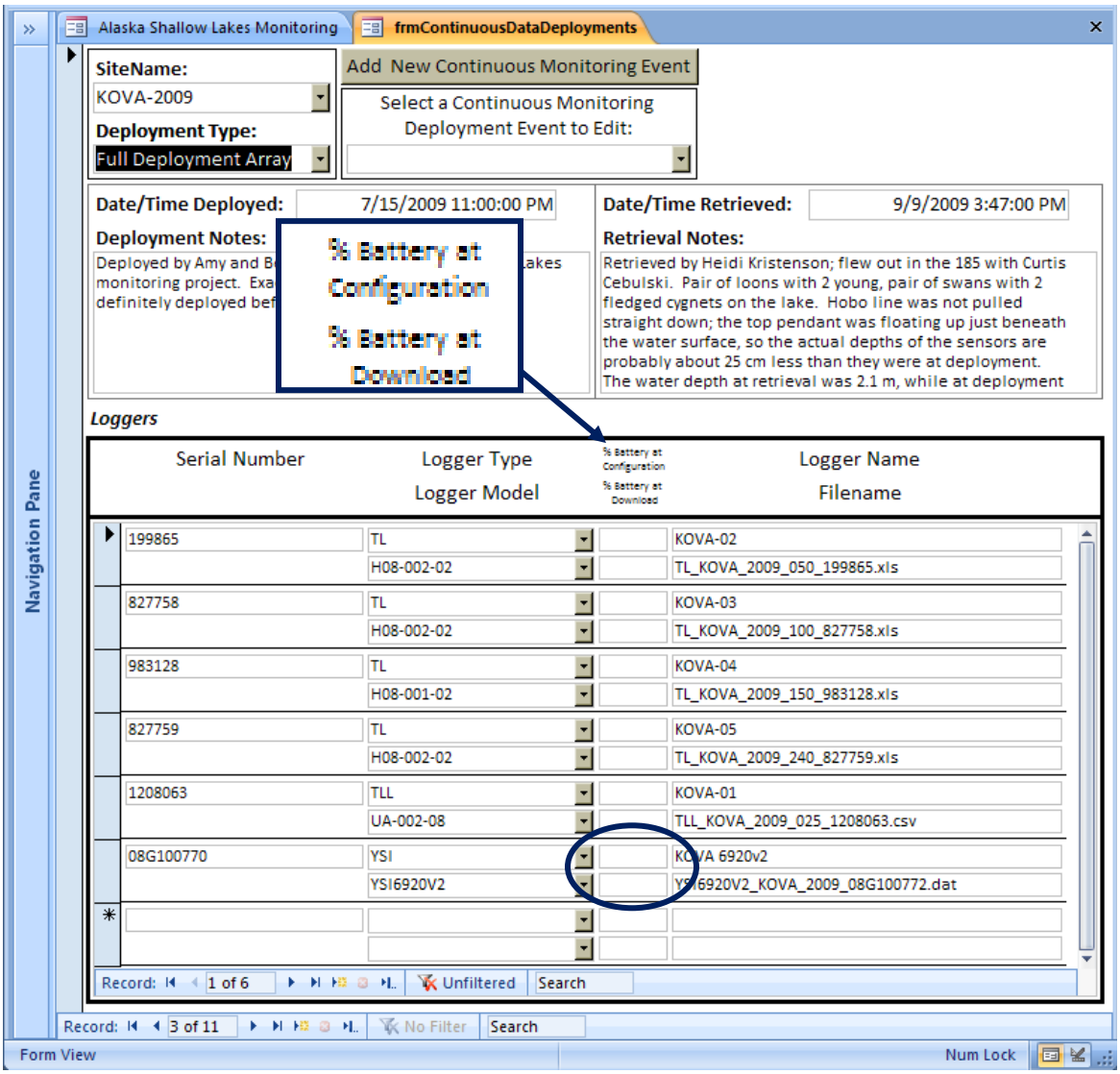
1. Connect the Sonde to the serial port of a PC using the connector cable
2. Open EcoWatch on the PC
3. Click the Sonde icon in EcoWatch and select Com Port COM1
4. If the Sonde – COM1 screen comes up with a # sign, type menu and Enter to access the Sonde menu screen
5. Press 3 (File), 3 (Quick Upload), 1 (PC6000) to download the file
6. Stop the logger
7. Navigate back through the menus to the main Sonde menu screen, and press 1 (Run), 2 (Unattended sample), C (Stop logging), 1(Yes)
8. Record the battery life reading

Transfer using MDS 650

1. Connect the Sonde to the MDS 650
2. Select Sonde menu, select File, select Quick Upload (this uploads the most recent file on the Sonde. The Upload menu can be used to upload older files collected).
3. Select the PC6000 as the file type, which will initiate the upload of the data from the Sonde to the MDS. The PC6000 is the data format used by the EcoWatch software, and maximizes export options and file functionality.
4. Stop the logger
    a. Select Run from the Sonde menu, select Unattended sample
    b. Scroll down to Stop logging and press Enter; confirm when prompted
    c. Scroll down again to confirm that the Stop logging option has been replaced with Start logging.

5. Record the battery life reading

    a. In the Unattended sample menu, scroll down to the Bat life line, and record the value in the database.



6. Transfer the data from the MDS 650 to a PC

    a. Connect the MDS 650 to the PC serial port using the connector cable

    b. Open EcoWatch on the PC.

    c. Turn on the power to the MDS 650

    d. Click the Sonde icon in EcoWatch and select Com Port COM1

        i. Note that if you have ActiveSync on your computer, it may interfere with the use of COM1. If an error message comes up saying that the port is unavailable, open Microsoft ActiveSync, and select Connection Settings under the File menu. Remove the check from the Allow connections to one of the following: COM1 and click OK. This should free the Com port for use.

e. On the MDS 650, select File from the 650 Main menu, select Upload to PC, and select the file downloaded from the Sonde

   i. If there are multiple files to be transferred from the MDS 650, they can all be done at this time, selecting the first file and letting it download, scrolling down to the next file and clicking it, and so on until all of the files have been transferred.

   ii. Close the Sonde COM1 window in EcoWatch once all the files have been transferred

Exporting Data to Comma Delimited Files

1. Export the data in comma delimited file format to a network drive

   a. In EcoWatch, click the File Open icon and double click the newly downloaded file to open the graph view. Click the Table View icon, and verify that the following columns are present in the following order below, with the proper units. To add or remove columns, to change their order, or to change units, select Parameters under the Setup menu.

6920

i.	DateTime	M/D/Y
ii.	Temp	C
iii.	SpCond	uS/cm
iv.	pH	
v.	pHmV	mV
vi.	DO%	%
vii.	DO Conc	mg/L
viii.	DO Charge	
ix.	Turbidity+	NTU
x.	ORP	mV
xi.	Battery	V

6920 V2

i.	DateTime	M/D/Y
ii.	Temp	C
iii.	SpCond	uS/cm
iv.	pH	
v.	pHmV	mV
vi.	ODO%	%
vii.	ODO Conc	mg/L
viii.	Turbidity+	NTU
ix.	ORP	mV
x.	Battery	V

600XLM

i.	DateTime	M/D/Y
ii.	Temp	C
iii.	SpCond	uS/cm
iv.	pH	
v.	pHmV	mV
vi.	DO%	%
vii.	DO Conc	mg/L
viii.	DO Charge	
ix.	ORP	mV
x.	Battery	V

   b. Click the Export icon to save the file in CDF format

      i. **Remove the check mark from the Separate Time/Date option in the File Export window.** The time and date should be exported together in one field.

      ii. Select the J drive (CAKN network drive), and navigate to the location designated in the File Storage section.

      iii. Rename the file according to the Naming Conventions for Logger Files section. Note that EcoWatch filenames are limited to 8 characters, so it works best to export the file with the lake name, and then rename the file with the complete filename later in Windows Explorer.

iv. Click the Export button to complete the export.

v. Keep a copy of the .dat file in the same folder as the exported CDF file. It can either be saved there directly, or all the .dat files moved together from their default location after all processing is complete.

c. Close the .dat file in EcoWatch

d. If there are multiple files to be transferred from the MDS 650, they can be selected one after the other in the file list before opening any of the files in EcoWatch.

2. Once the data (including the original .dat files) has all been transferred to a secure location on a network drive, the files can be deleted from the Sonde and the MDS 650.

   a. Select Sonde menu, select File, select Delete all files

   b. Confirm the Delete

   c. Return to the 650 main menu, select File, select Delete all files

   d. Confirm the Delete

Field Data Backups

Backing up data in the Field

1. Create a file folder on the laptop (if available) for storing the data backups.
2. Use the SQL Server Backer-Upper to back up Tablet data to jump drive.
3. Download YSI files to field PC and clear data from the MDS 650 unit. Clear the site list in the 650 and add the sites for the following sampling day.
4. Download Trimble files to field PC, and leave the originals on the Trimble unit.
5. Download Garmin eTrex using MapSource, saving as a .gdb file with the unit number and date as the file name.
6. Download photos from Camera if necessary or desired (see SOP 15 for details).
7. Save a copy of data backups to jump drive. The most important to back up to jump drive is the YSI files, as the data is not saved anywhere other than on the computer. The Trimble and Garmin units retain their data, so are of a lower priority for jump drive backup. The rule of thumb is to have all data in at least 2 places at the end of the field day:
    a. Tablet: on Tablet and jump drive
    b. YSI files: on field PC and jump drive
    c. Trimble: on Trimble and PC
    d. Garmin: on Garmin and PC
    e. Camera: on memory card and/or jump drive and/or field PC as appropriate

Backing up data upon return from Field

1. Move the following backup files from the field PC to J:\Monitoring\Water_Quality_Macroinvert\Field_Data\YYYY
    a. Tablet: to TabletBackups folder
    b. YSI files: to YSIProfiles folder
    c. Garmin: to GarminTrackLogs folder (if more than one park is being visited during the season, it may be helpful to add a subfolder with the park name in order to keep the files more organized).
2. Download Trimble files directly from the unit to J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY
3. Download cameras directly (or move the photos already downloaded to the field PC) to J:\Monitoring\Water_Quality_Macroinvert\Photos\YYYY
4. Do not retain duplicate copies of the data on the field PC. Delete (or clearly mark for deletion) the folders once the data has been transferred to the J drive, in order to reduce potential for confusion about which file is the most recent.

Generating Invertebrate Lab Data Entry Database

The database used for data entry is created from the Shallow Lakes database, and needs to be populated with the sample collection data for the samples being analyzed by the lab. See Figure 1 for a screen shot of the database. This document includes instructions for preparing the database either in Access 2007 format or in Access 2003 format.

As of 2009, ABR Inc., the company that analyzes the invertebrate samples, still uses Access 2003. It is not possible to read Access 2007 databases using the older version of the program, so a 2003 version must be generated. There is an option to save a database as a 2003 Compatible project, but there are problems generated when this function is used. It is better to create the database in Access 2003. There is a template in Access 2003 (.mdb format), and the steps for preparing it to send are similar to those for Access 2007. There are, however, some significant differences.

Microsoft Access 2007

1. Create a query within Alaska Shallow Lakes Monitoring database to include just the samples sent for analysis (i.e. all samples collected in summer 2009)
    a. Select Query Wizard in the Create menu of the ribbon
    b. Select Design View in the New Query window
    c. Add tblInvertebrateSamples (dbo) from the Add Table window, and close the window
    d. Select *(All Columns)
    e. In the criteria table, add a row with the following:
        i. Column: YEAR(SAMPLEDATE)
        ii. Criteria: =2009 (or whatever year is being queried)
    f. Save the query with the following naming convention:
        i. qryYYYYInvertSamples
        ii. if there are multiple shipments of samples from the same year, add a letter after the year, ascending for each subsequent shipment (qry2009AInvertSamples, qry2009BInvertSamples, etc.)
2. Import the query into the NPS_ShallowLakes_Inverts_Template.accdb
    a. In the J:\Monitoring\Water_Quality_Macroinvert\Database, copy the NPS_ShallowLakes_Inverts_Template.accdb file and paste it in the same folder.
    b. Rename the copied file with the following naming convention:
        i. NPS_ShallowLakes_Inverts_YYYY
        ii. As with the query, if there are multiple shipments of samples from the same year, add a letter after the year.
    c. Open the new file
        i. Note that there will be a message that “The record source ‘qryInvertSamples’ specified on this form or report does not exist”. Click OK
    d. Under the External Data menu in the ribbon, click the More button in the Import section
    e. Select ODBC Database to open the Get External Data – ODBC Database window

f. Select "Import the source data into a new table in the current database." DO NOT link the table! Click OK.
g. In the Select Data Source window, click on the Machine Data Source tab, and select InvertConnector. If there is not an InvertConnector option listed, follow these steps:
    i. Select the File Data Source tab in the Select Data Source window
    ii. Click the New… button
    iii. In the Create New Data Source window, scroll to the bottom and select SQL Server. Click Next.
    iv. Type InvertConnector as the name of the file data source. Click Next.
    v. Click Finish to open the Create a New Data Source to SQL Server window.
    vi. In the Server field, enter INPYUGAMS08\SQLEXPRESS. Click Next.
    vii. Click Next again.
    viii. Click the check box next to "Change the default database to:", and select AK_ShallowLakes. Click Next.
    ix. Click Finish.
    x. Click the Test Data Source to make sure the setup was successful, then click OK.
    xi. The InvertConnector will now be available for ODBC connection.
h. In the Import Objects window, select the query created in step 1 and click OK. This will add the query to the list of Tables displayed in the Navigation Pane.
i. Rename the table to remove the dbo_qry from the newly imported query.

3. Edit the data entry form to reference the newly imported query
    a. Right click on the form frmInvertLabForm and select Design View
    b. Right click on the top left corner of the form and select Properties (so that the square where the rulers intersect shows a small black square inside of it)
    c. Click on the Data tab in Properties
    d. The record source should read qryInvertSamples. Using the dropdown button for the field to set the source to the newly imported and renamed query.
    e. Save the form, and change to Form View to verify that the header is populated with data from the correct source.
4. Ensure that the most up-to-date reference tables are included in the new database
    a. If ever the lookup tables (or the format of the tblInvertebrates) included in this database are updated in the Alaska Shallow Lakes Monitoring database, they need to be updated in the template database.

tluFFGCodes	list of functional groups with codes
tluInvertTaxa	table of taxonomic nomenclature for each taxon
tluLifeStageCodes	list of life stages with codes
tblInvertebrates	the table where the lab data will be entered (this table is empty in the template; it will only need to be replaced if the format of the table is changed)

    b. When these tables are updated, the old versions in the Inverts Template database should be deleted. The updated tables can either just be copied from the Alaska Shallow Lakes Monitoring database and pasted into the Navigation Pane of the NPS ShallowLakes Inverts Template, or imported using the ODBC InvertConnect tool. For

large tables, it may be easiest to export to an Excel file from the AK_ShallowLakes database and import from an Excel file in the Inverts Template database.

c. Rename the new tables so that they have the same names as the tables they replaced.
    i. As long as the names of the tables are consistent, the forms should be able to recognize the new tables without any edits. If there are problems finding the reference data, data sources may need to be reset in the properties of the form frmInvertLabFormDetail.

d. Set the dropdown boxes in any replaced forms anywhere that TAXONSHORT, FFG or LIFESTAGE appear (tblInvertebrates, tluInvertTaxa)
    i. In the Design View of a table including one or more of these fields, click the Lookup tab for these fields, change the Display Control to Combo Box
    ii. For the Row Source, select the proper tlu table from the dropdown list.

Microsoft Access 2003

1. The template is called NPS_ShallowLakes_Inverts_2003_Template.mdb. Make a copy, rename it with the year in place of "2003_Template".
2. While ODBC is the best method for importing the new qryYYYYInvertSamples in Access 2007, it is best to Export/Import the query via Excel when using Access 2003.
    a. Export the query from the AK_ShallowLakes database as an Excel file. It MUST be exported in .xls format (Access 2002-2003), because Excel 2007 files (.xlsx) are not recognizable by Access 2003.
    b. Import the new query into the database as a table
        i. In the Database window, select Tables from the Objects and click the New button and double-click Import Table in the New Table window.
        ii. Navigate to the exported query (.xls file) and select it for import.
        iii. In the Import Spreadsheet Wizard window, indicate that the First Row Contains Column Headings, store the data In a New Table, Choose my own primary key: SAMPLEID, and name the table YYYYInvertSamples.
3. When updating the properties in InvertLabForm, not only does the Record Source need to be set to match the newly imported table, but the order also must be set for the records. To set the order, a query must be built for the Record Source:
    a. Select the new table from the dropdown box in the Record Source field
    b. Right click in the Record Source field and select Build. Confirm that you want to create a query based on the table.
    c. Double-click the * in the table window to add it to the first column of the query.
    d. Double-click PONDNAME, SAMPLEDATE, SAMPLENUMBER so that they are shown in the columns below, and remove the check-mark from the Show field for these three columns. In the Sort field for each of these fields, select Ascending from the dropdown list.
    e. Close the SQL Statement: Query Builder window, and confirm that you want to save the changes made to the SQL statement and update the property.
    f. The Record Source should now read:

    SELECT test2InvertSamples.* FROM test2InvertSamples ORDER BY test2InvertSamples.PONDNAME, test2InvertSamples.SAMPLEDATE, test2InvertSamples.SAMPLENUMBER;

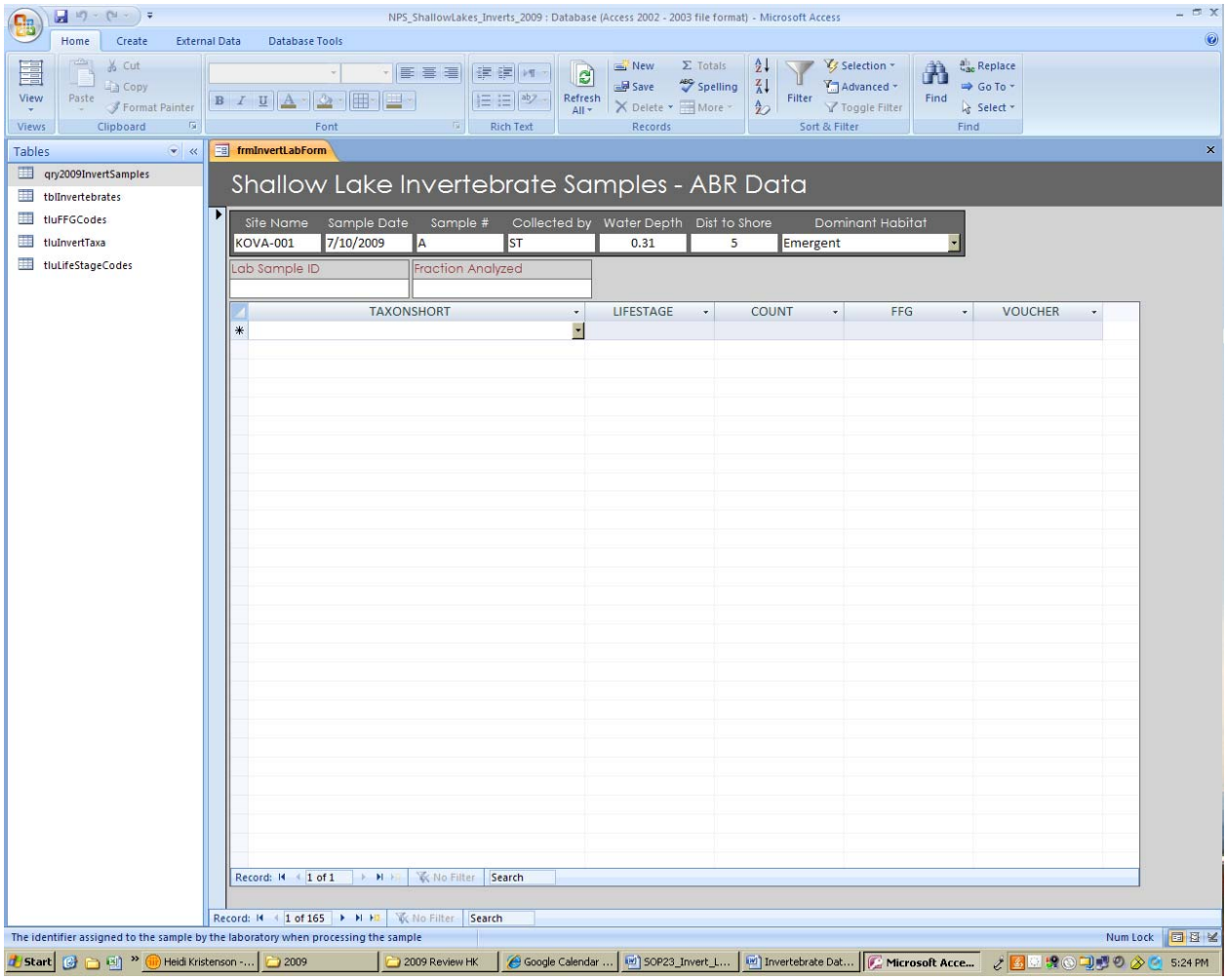


Figure 1. Screen shot of the Invertebrate database sent to the lab for data entry.

Generating Sample Lists

To assist the labs in analysis and minimize errors in sample identification, an inventory of the samples shipped to the lab for analysis should be generated and forwarded to the lab. These lists can all be generated from the database as follows:

Water Samples

Use the vwSampleListWaterChem in the database to generate a list of the samples from the field season.

1. Open the query in Design View and set the Criteria for YEAR (last row in the query) to the data year. Export the query to Excel, and print it to use as a reference to check the samples as they are packed for transport to the lab.
2. Note that there is a Saved Export for this, called Export-SampleListWaterChem. You can access this using the Saved Exports button, which will generate the Excel file and save it in the Water Chem folder. Rename the file with the year, and save it in the folder for the appropriate year. Change the page margins to 0.25 in all directions in order to maximize dimensions for printing.
3. Ensure that the site name, sample date and sample number written on all three bottles collected at each sample location match the information on the inventory list. Investigate any discrepancies before sending the samples for analysis. Record the presence of each different type of sample (125 mL Si/DOC; 250 mL Ions; 500 mL TN/TP) and shipping date and packing information on the list. Email a copy of the spreadsheet to the lab for them to use as a reference when inventorying the shipments of samples upon arrival.

Chlorophyll

Use the vwSampleListChlorophyll in the database to generate a list of the samples from the field season.

1. Open the query in Design View and set the Criteria for YEAR (last row in the query) to the data year. Export the query to Excel, and use it to check the samples as they are packed for transport to the lab.
2. Note that there is a Saved Export for this, called Export-SampleListChlorophyll. You can access this using the Saved Exports button, which will generate the Excel file and save it in the ChlA folder. Rename the file with the year, and save it in the folder for the appropriate year. The Excel file ChlorophyllSamplesTemplate may be used as a reference as well (particularly for the notes worksheet), when preparing the spreadsheet to send to the lab.
3. Ensure that the site name, sample date, sample number and volume filtered that are written on the foil packet match the information on the inventory list. Investigate any discrepancies before sending the samples for analysis. Email a copy of the inventory spreadsheet to the lab to be populated. If the data is populated in this template, it is easier to import into the database. Note that the Kielland lab does

not yet use Microsoft Access 2007, so be sure to convert it to the Excel 2003 (.xls) format before sending it to the lab.

Invertebrates

The data management for the invertebrate samples is relatively complicated, as a small database must be prepared for the lab to use for data entry. See Instruction Sheet "Generating Invertebrate Lab Data Entry Database" for details on preparing the database for the lab to populate. To assist in preparation of samples for shipment, use the vwSampleListInvertebrates in the database to generate an inventory list.

1. Open the query in Design View and set the Criteria for YEAR (last row in the query) to the data year. Export the query to Excel, and print a copy to use as an inventory and packing slip when preparing the samples for shipment.
2. Note that there is a Saved Export for this, called Export-SampleListInvertebrates. You can access this using the Saved Exports button, which will generate the Excel file and save it in the Invertebrates folder. Rename the file with the year, and save it in the folder for the appropriate year. Change the page margins to 0.25 in all directions in order to maximize dimensions for printing.
3. Ensure that the site name, sample date and sample number written on the bottle match the information on the inventory list, and that the number of bottles per sample is recorded correctly. Investigate any discrepancies before sending the samples for analysis. Record the shipping date and packing information on the list, and send a copy with the samples as a packing slip.

USGS

There are samples collected for the USGS, which are sent in for analysis. The USGS shared the data with us. Use the vwSampleListUSGS in the database to generate an inventory list.

1. Open the query in Design View and set the Criteria for YEAR (last row in the query) to the data year. Export the query to Excel, and print a copy to use as an inventory and packing slip when preparing the samples for shipment.
2. Note that there is a Saved Export for this, called Export-SampleListUSGS. You can access this using the Saved Exports button, which will generate the Excel file and save it in the USGS folder. Rename the file with the year, and save it in the folder for the appropriate year. The list can be printed in columns to use less paper.
3. Ensure that the site name, sample date and sample number written on all of the sample bottles collected at each sample location match the information on the inventory list. Investigate any discrepancies before sending the samples for analysis. Record the presence of each different sample type collected (Methane, DOC, 18O). Email a copy of the spreadsheet to the lab for them to use as a reference when inventorying the shipments of samples upon arrival.

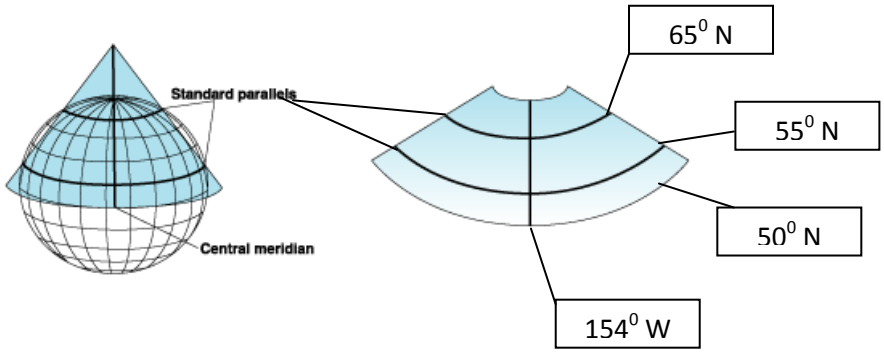
GIS: Alaska Albers Map Projection

The National Park Service in Alaska uses the Alaska Albers Projection as the standard map projection and coordinate system for GIS themes in Alaska. Many different sources of satellite imagery are available today, but care must be taken to ensure that all imagery used is either already projected into Alaska Albers, or is projected into Alaska Albers before use.

Alaska Albers Projection

A projected coordinate system is defined on a flat, two-dimensional surface. Unlike a longitude/latitude, a projected coordinate system has constant lengths, angles, and areas across the two dimensions. A projected coordinate system is always based on a geographic coordinate system that is based on a specific datum.

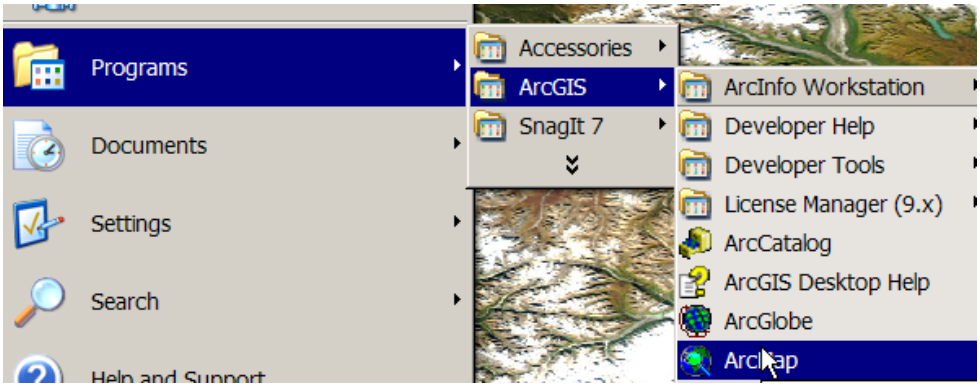
The Alaska Albers Projection is a conic projection.



The standard parallels are at latitudes of 55 and 65 degrees North. Map properties such as shape, direction, distance and area are minimally distorted in areas near the standard parallels. An X,Y coordinate system is applied to the Alaska Albers Projection with the origin at a central meridian of 154 degrees west longitude and a Y origin at 50 degrees north latitude. Therefore X values are positive east of 154 degrees west longitude, and negative west of 154 degrees west longitude. Y values are positive north of 50 degrees latitude. The units of the Alaska Albers X,Y coordinate system are meters. Typically the projection is used based on either the NAD27 or NAD83 datum.

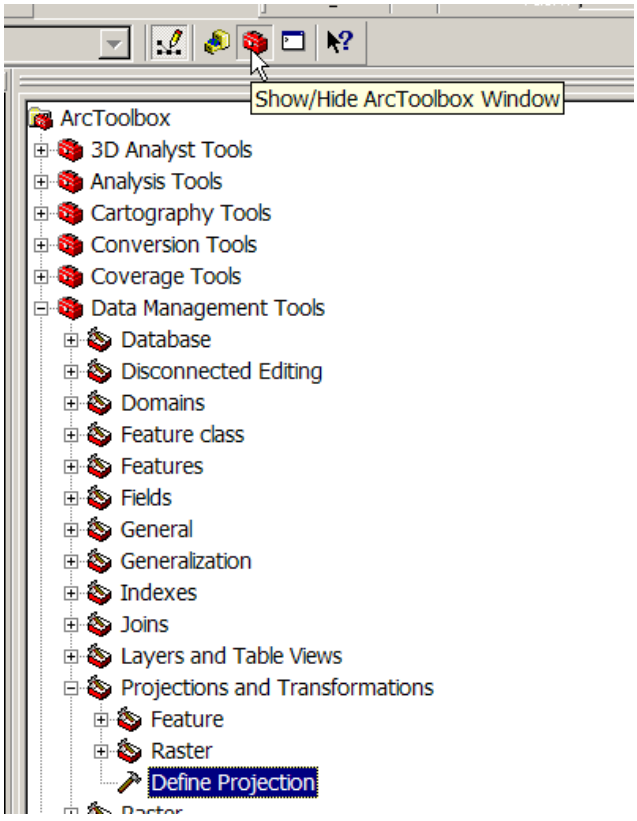
Projecting Images to Alaska Albers in ArcGIS

1. Start ArcMap

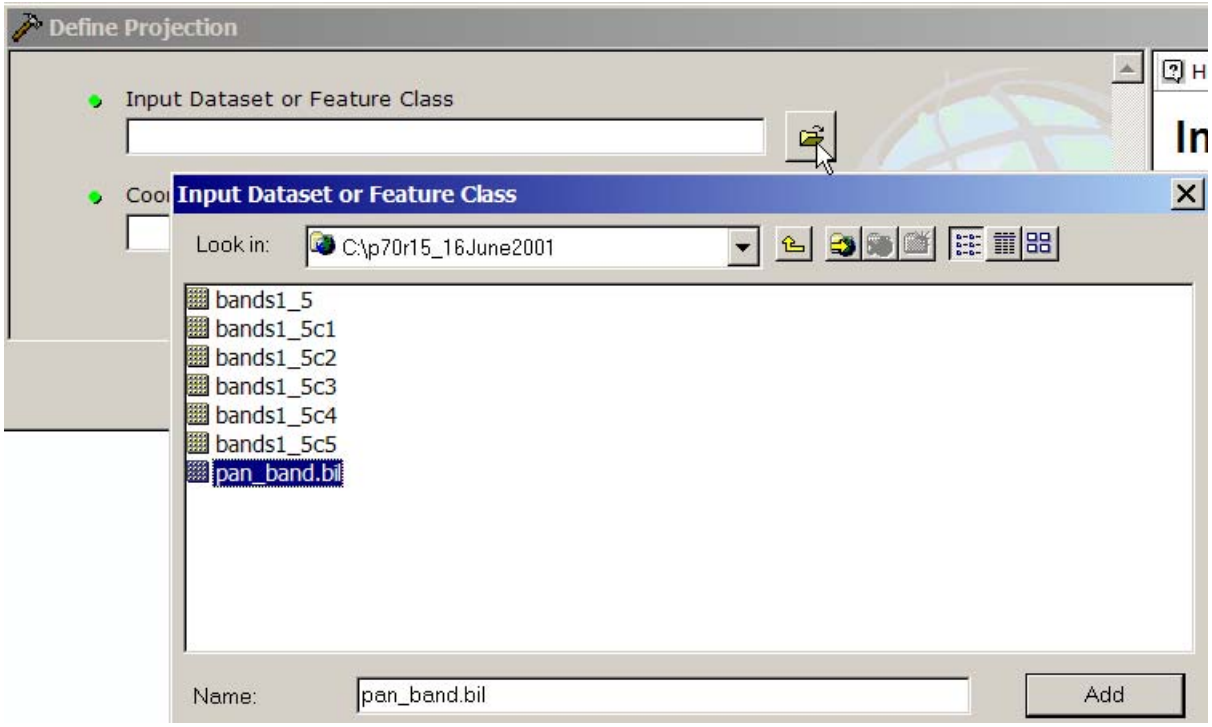


2. Define the map projection of your image

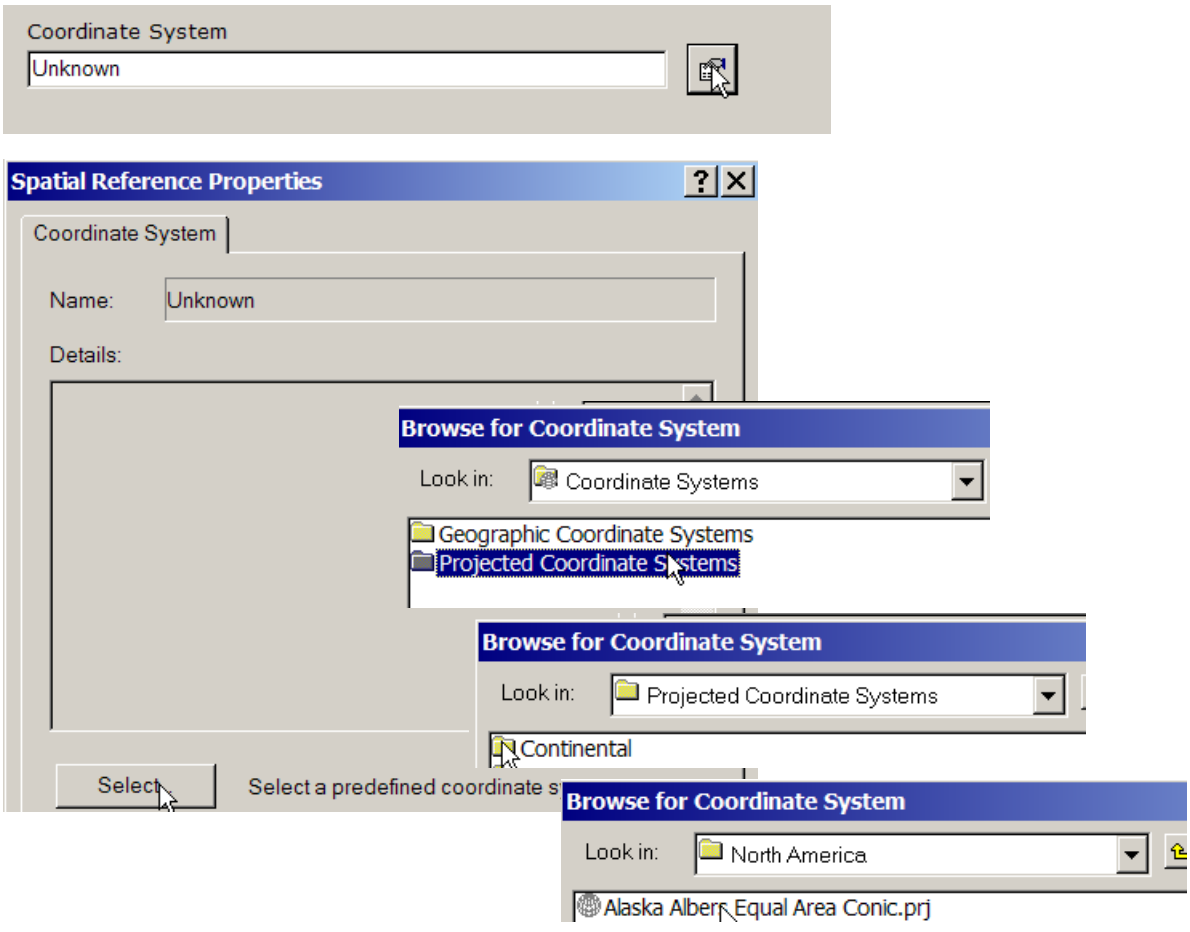
   a. Show the ArcToolbox and select *Define Projection* from the *Projections and Transformations* toolset inside the *Data Management Tools* toolbox

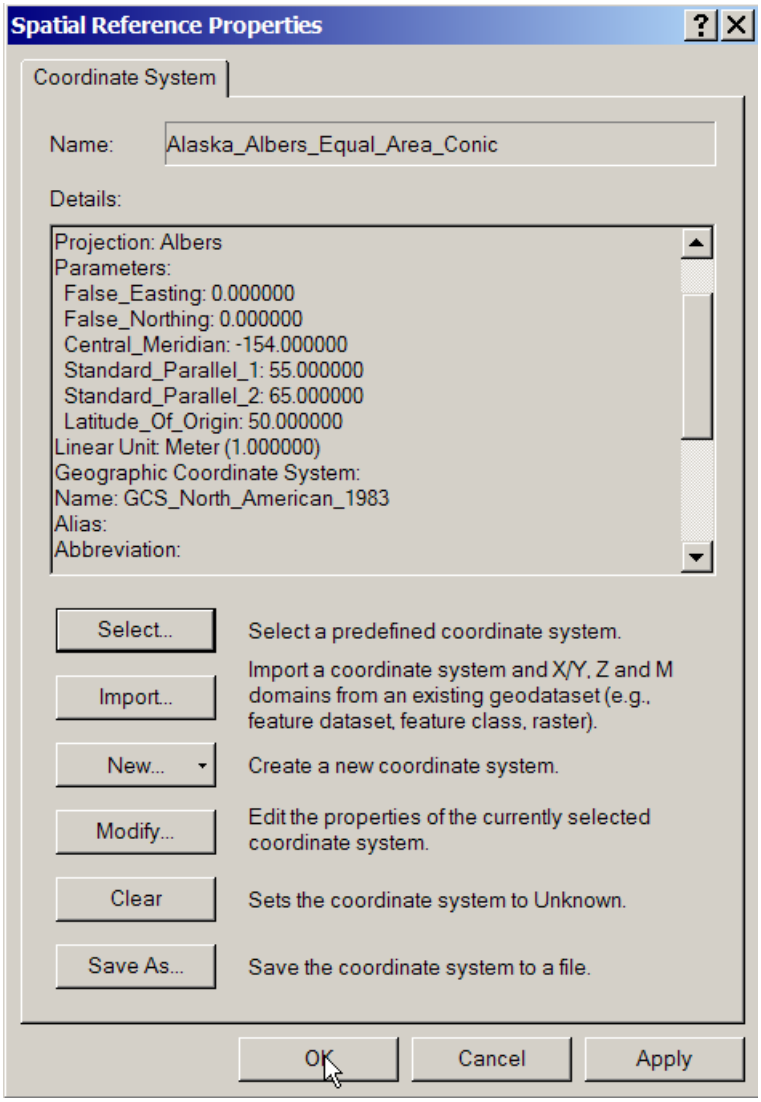


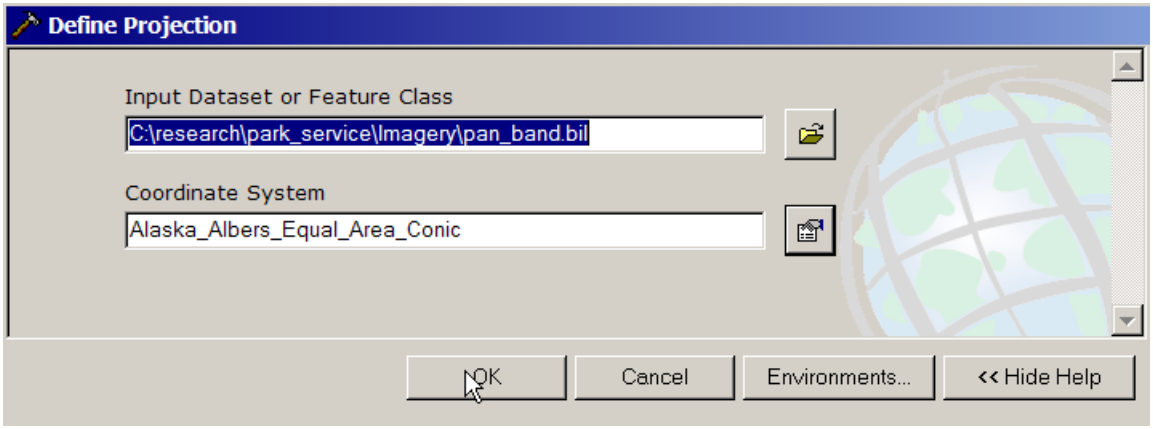
3. Browse to the folder containing your images. Add your image as the input dataset.



4. Define the Coordinate System of your image





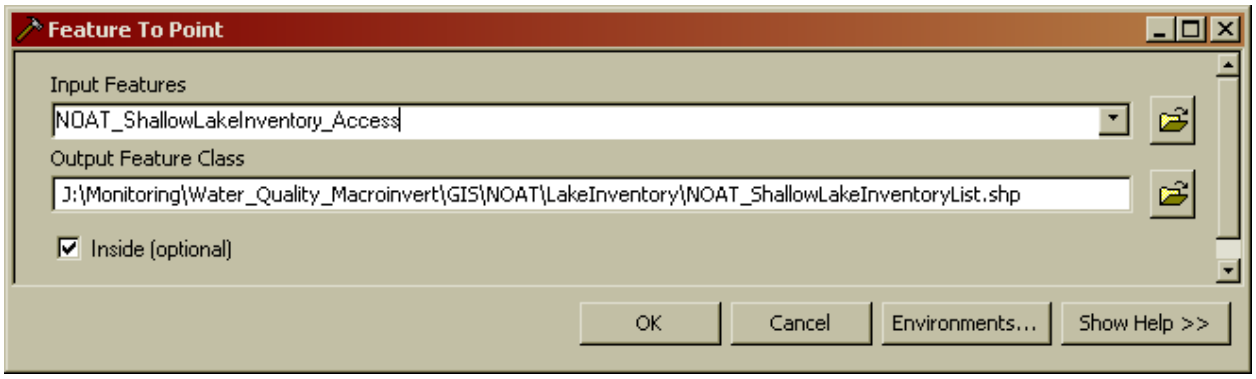


Your image map projection will be defined, and then your image will be added to your ArcMap Data Frame.

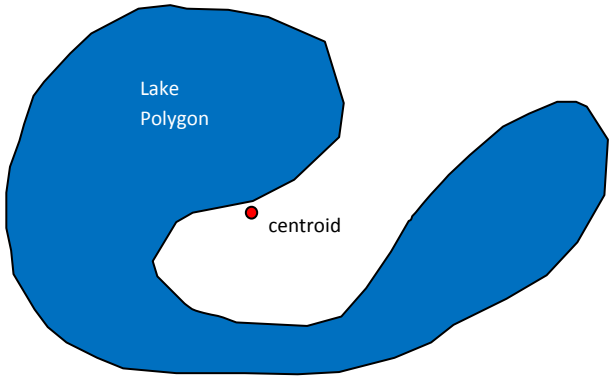
GIS: Converting Polygons to Points

There are some cases when a polygon feature class must be converted to a point feature class. One such case is during the preparation of GIS layers for inventorying all potential shallow lakes in a given park unit. A polygon feature shapefile is generated from the NHD (Instruction Sheet "Lake Inventory Using NHD"), then all potential sampling lakes are attributed with access information (Instruction Sheet "Lake Inventory Access Designation"). At that point, a point feature shapefile must be generated for use in analysis and navigation. This scenario will be used to illustrate the conversion process here.

1. Open ArcMap and add the polygon shapefile (i.e. PARK_ShallowLakeInventory_Access)
2. Open the Arc Toolbox, and select Data Management Tools – Features – Feature to Point



3. Set the input features as the final polygon file, and set the output file as appropriate (for Lake Inventory, use the name PARK_ShallowLakeInventoryList.shp), and check the Inside option. This forces the point to be somewhere inside the polygon. If the box is not checked, the point will be placed at the centroid of the polygon (center of gravity), but in some irregularly-shaped polygons the point can end up outside the actual polygon

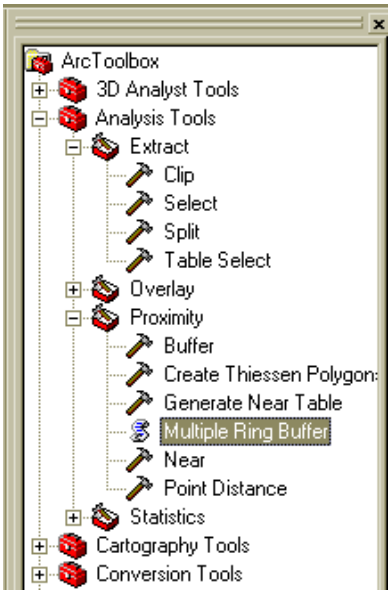


4. Add metadata to the point feature shapefile.

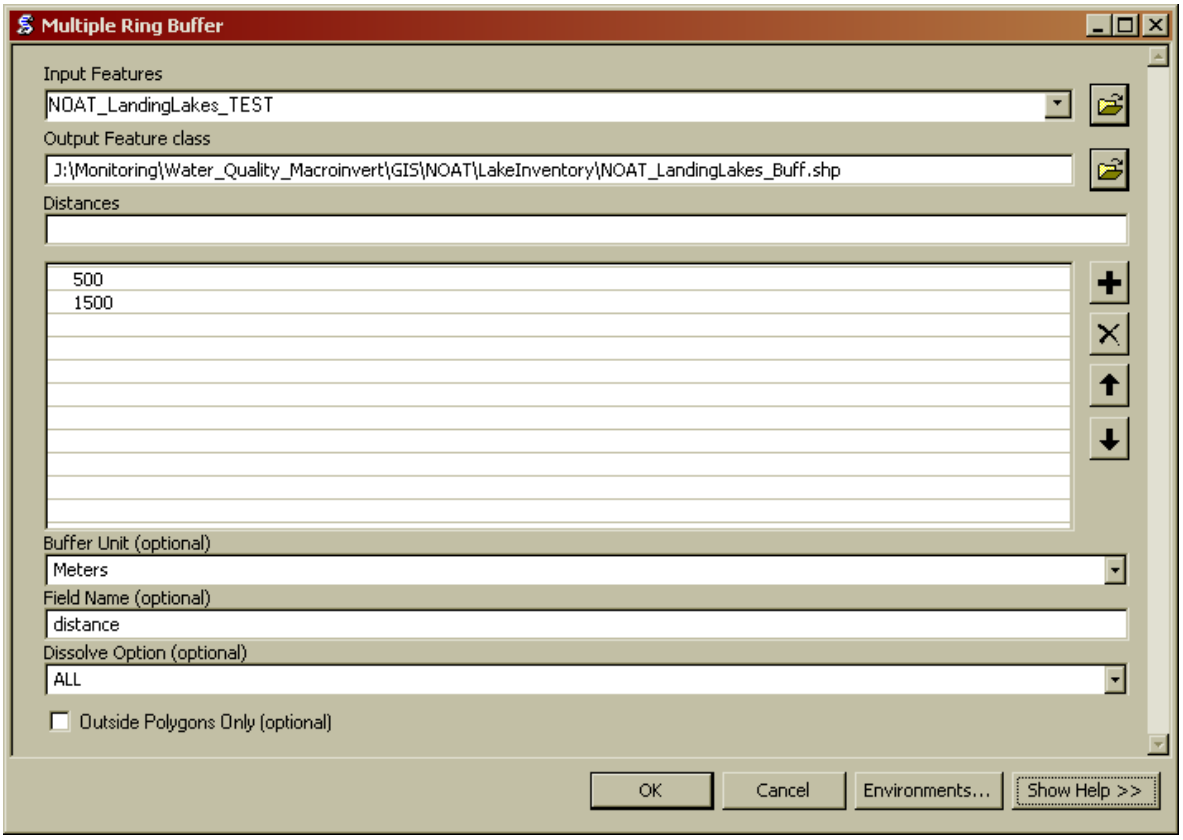
GIS: Multiple-Ring Buffers

For the Shallow Lakes project, access points are often buffered at two distances: 500 m and 1500 m. Multiple-Ring buffering allows both distances to be buffered together in one file. Buffer files can then be Spatially Joined to the Lake Inventory file, which allows the distance attributes to be applied to lakes falling within the buffers.

The script for Multiple-Ring buffers is found in the Arc Toolbox, under Analysis Tools – Proximity – Multiple Ring Buffer

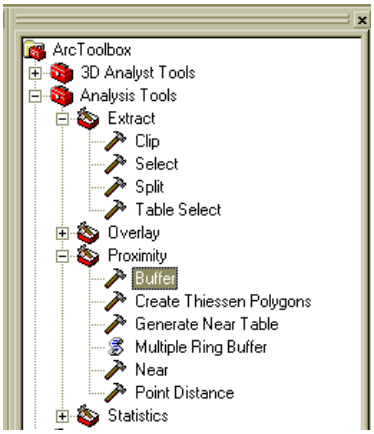


1. Open ArcMap
2. Open the ArcToolbox window
3. Search for or navigate to Multiple Ring Buffer
4. Select the Input Features (i.e. the access file to have buffers applied; generally landing lakes or roads)
5. Enter the distances to be applied, one at a time, clicking the + button after each one, so that they are added to the list.
6. Enter the units to be used for the buffer (meters), enter an appropriate field name (i.e. LLBUFF for landing lakes, RDBUFF for roads, RVBUFF for rivers), and set the Dissolve Option to ALL
7. Click OK

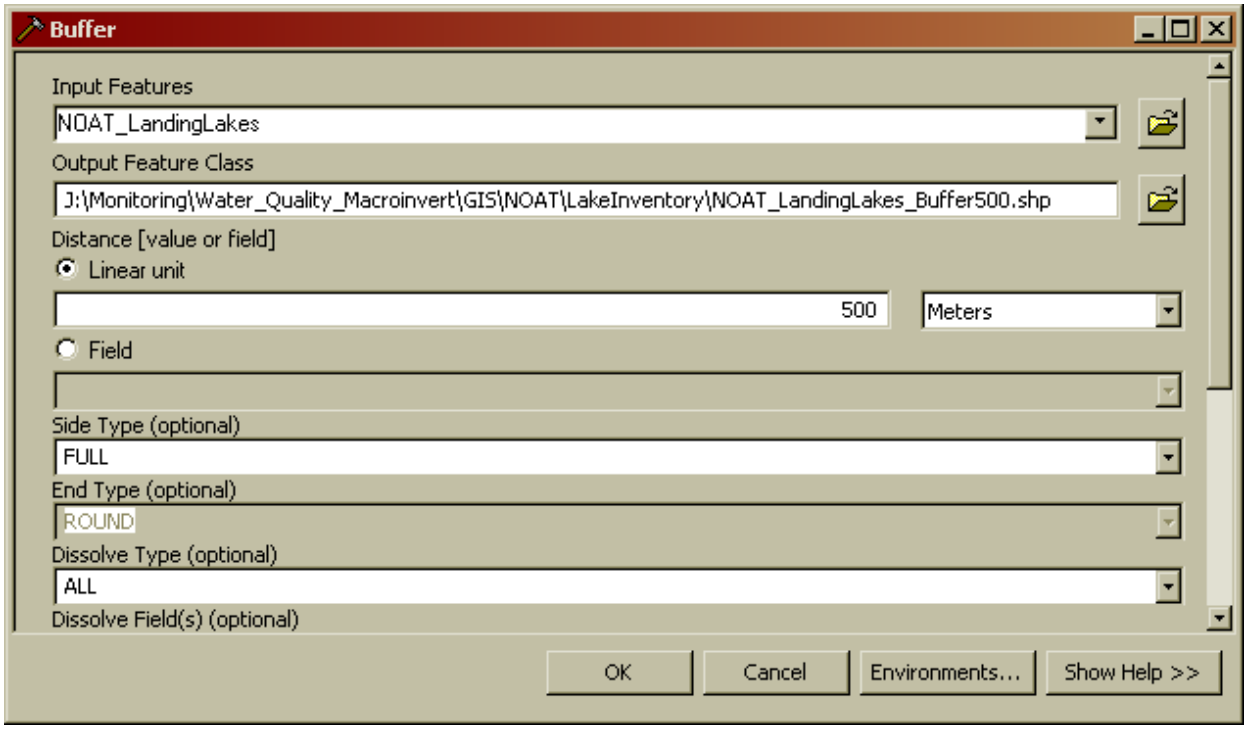


Manual Alternative

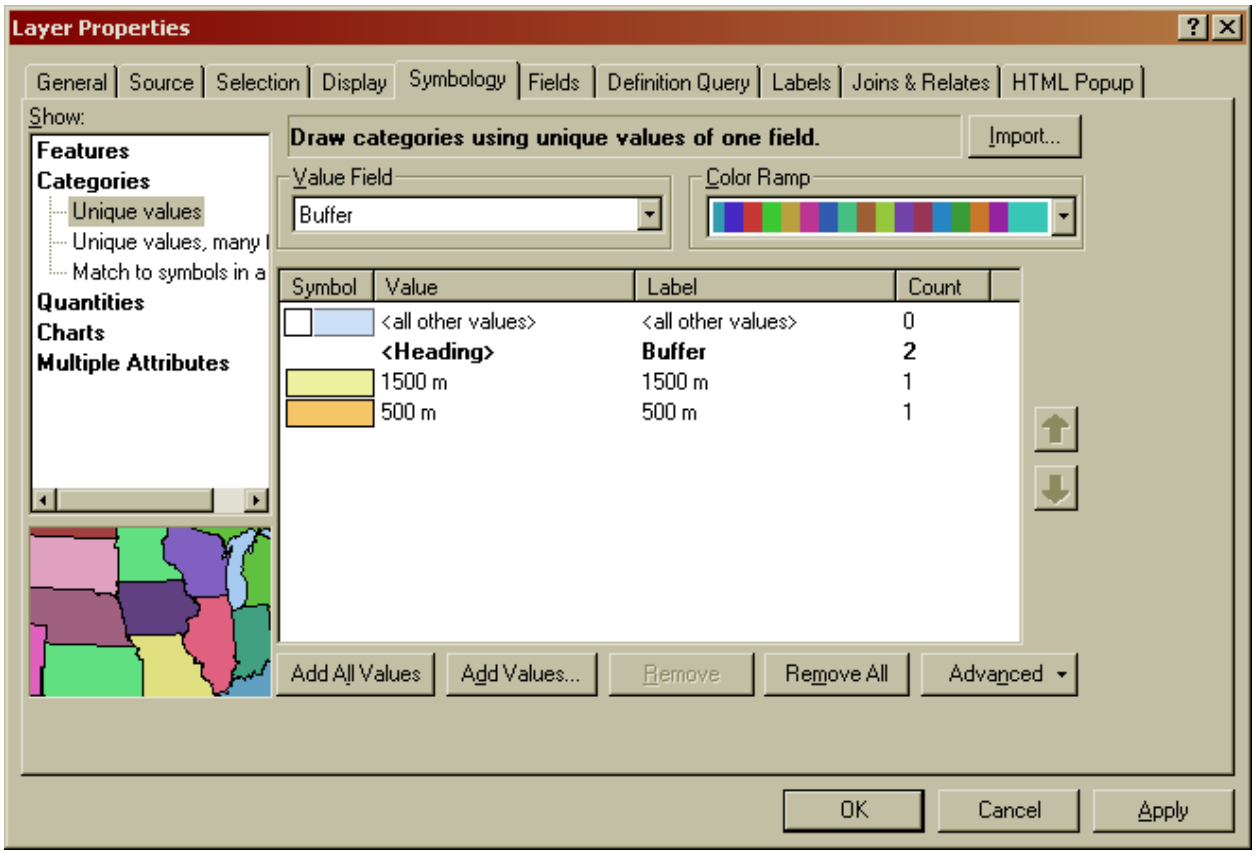
In some cases, the Multiple Ring Buffer script fails. It is unclear why this may happen, but if difficulties are encountered with the script, it may be easier to create two separate buffers and join them together manually.

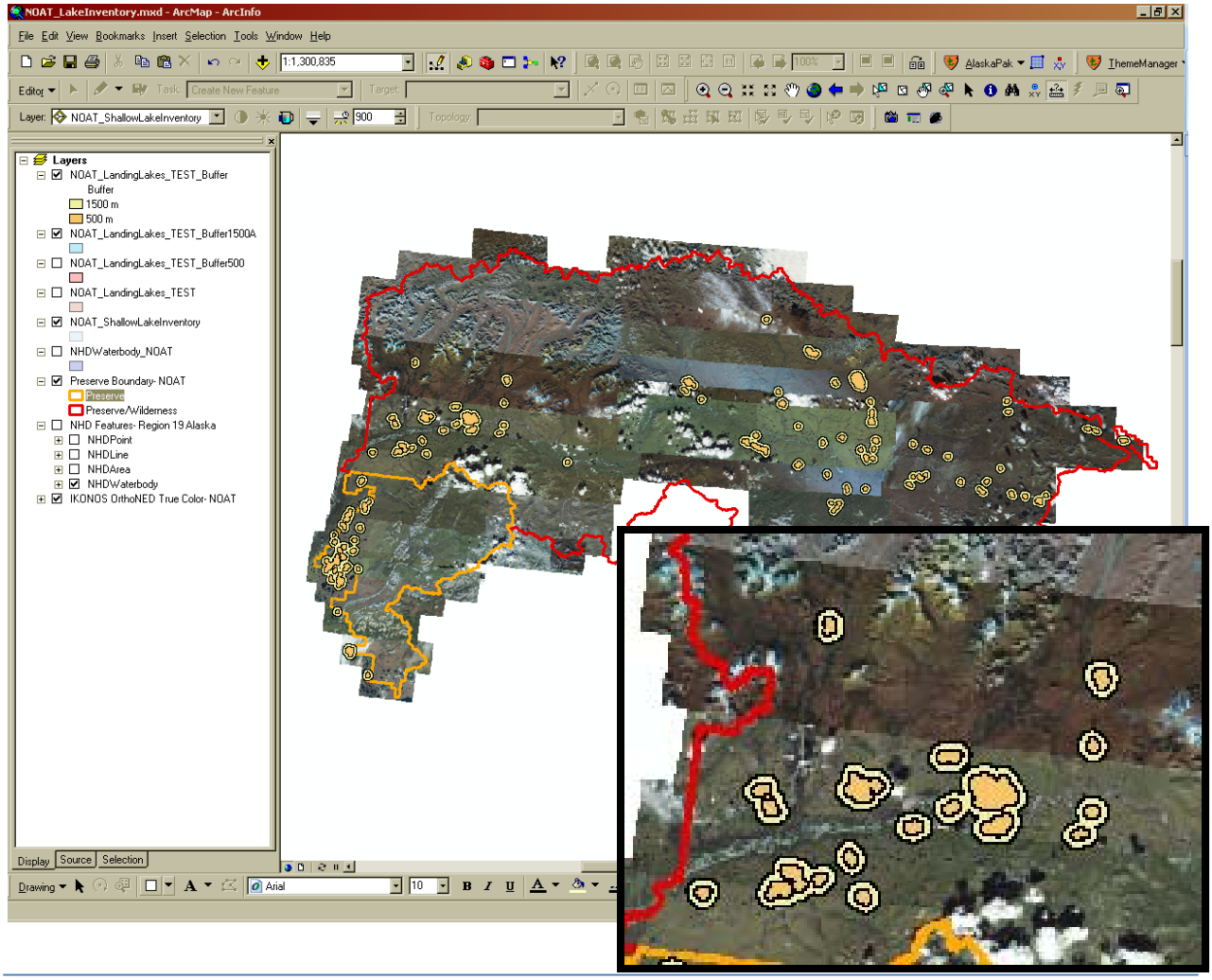


1. Buffer the feature by selecting the Buffer tool from the Arc Toolbox – Analysis Tools – Proximity
2. Set the Input Features to the appropriate file, set the linear unit to 500 meters, and perform a Full side type All dissolve type buffer.
3. Save the buffer as PARK_AccessType_Buffer500
4. Repeat the buffer process to create a 1500 m buffer file named PARK_AccessType_Buffer1500



5. Use the Erase tool from the Arc Toolbox – Analysis Tools – Overlay to cut out the 500 m buffer from the 1500 m buffer, using the 1500 m buffer file as the input and the 500 m buffer as the output features.
6. Add a field to the attribute table of each buffer. Name the field appropriately (i.e. LLBUFF for landing lake buffers, RDBUFF for roads, RVBUFF for rivers), and set it to a 10-character text field. Populate the field with “500 m” for the 500 m buffer file and “1500 m” for the 1500 m buffer file.
7. Merge the two buffer files using the Merge tool in Arc Toolbox – Data Management Tools – General – Merge to create one file named PARK_AccessType_Buffer
8. Delete the intermediate buffer files, retaining only the final buffer file. Change the symbology to display the different buffer distances as different colors.


Layer Properties
General
Source
Selection
Display
Symbology
Fields
Definition Query
Labels
Joins & Relates
HTML Popup
Show:
Features
Categories
Unique values
Unique values, many
Match to symbols in a
Quantities
Charts
Multiple Attributes
Draw categories using unique values of one field.
Import...
Value Field
Buffer
Color Ramp
Symbol
Value
Label
Count
<all other values>
<all other values>
0
<Heading>
Buffer
2
1500 m
1500 m
1
500 m
500 m
1
Add All Values
Add Values...
Remove
Remove All
Advanced
OK
Cancel
Apply


NOAT_LakeInventory.mxd - ArcMap - ArcInfo
File Edit View Bookmarks Insert Selection Tools Window Help
Layers
NOAT_LandingLakes_TEST_Buffer
Buffer
1500 m
500 m
NOAT_LandingLakes_TEST_Buffer1500A
NOAT_LandingLakes_TEST_Buffer500
NOAT_LandingLakes_TEST
NOAT_ShallowLakeInventory
NHDWaterbody_NOAT
Preserve Boundary- NOAT
Preserve
Preserve/Wilderness
NHD Features- Region 19 Alaska
NHDPoint
NHDLine
NHDArea
NHDWaterbody
IKONOS OrthoNED True Color- NOAT
Display
Source
Selection
Drawing

Imagery: Landsat ETM+

The Multi-Resolution Land Characteristics (MRLC) Consortium is a group of federal agencies who first joined together in 1993 (MRLC 1992) to purchase Landsat 5 imagery for the conterminous United States. In 1999, a second-generation MRLC consortium was formed to purchase three dates of Landsat 7 imagery for the entire United States (MRLC 2001). Landsat ETM+ imagery that has been terrain-corrected to the Alaska Albers Projection is available from the MRLC and from the USGS.

Procuring Landsat ETM+ Imagery

1. Start a web browser and open the website: www.mrlc.gov/download_data.asp
2. Click the *MRLC Scene Library* button
3. Select *Alaska Dataset* from the list of Terrain Corrected MRLC 2001 Imagery (Figure 1)

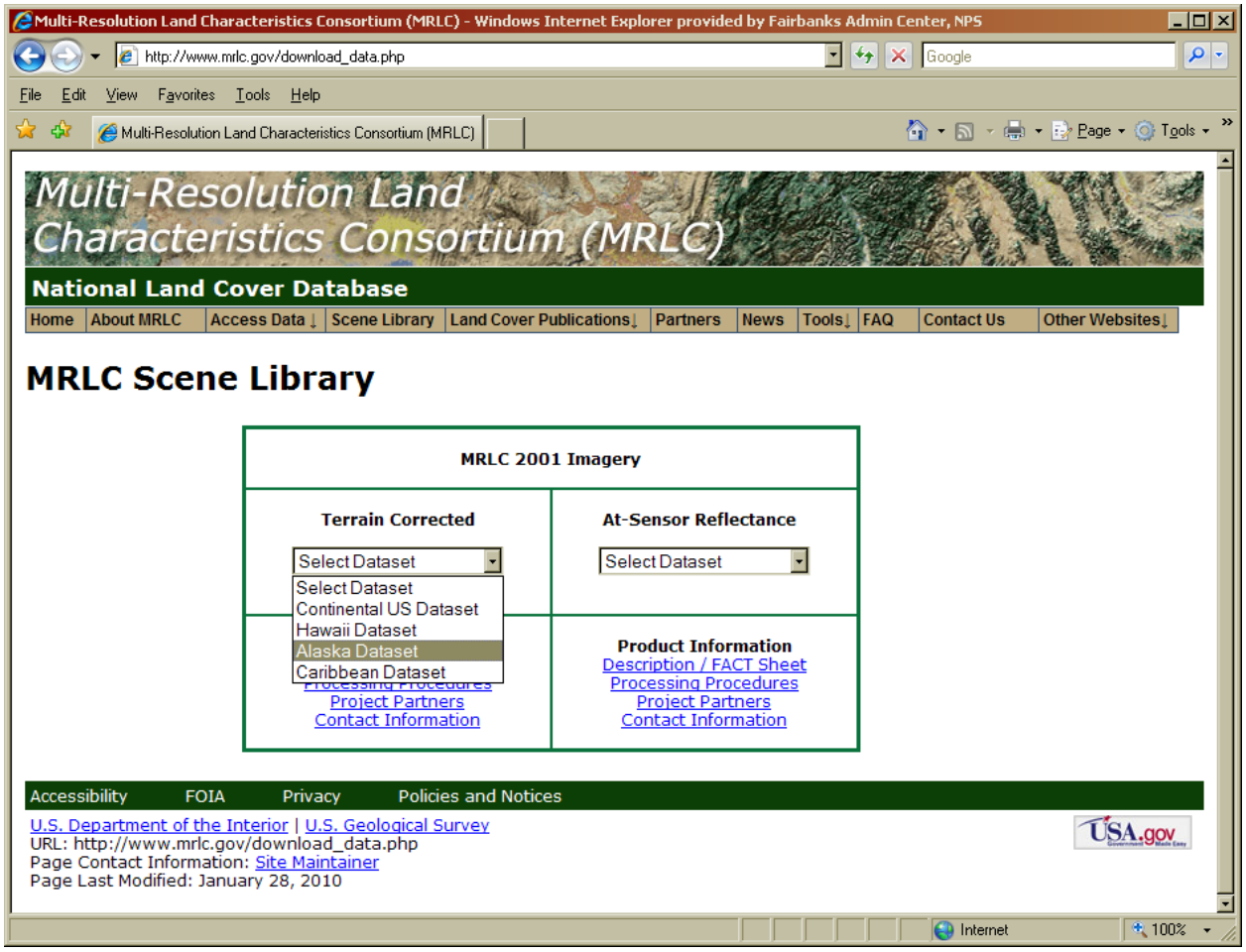


Figure 1. Screen-shot of MRLC Consortium Scene Library website

4. Select NPS Zones and then click the *Load Layer* button. This will display the boundaries of most Alaska National Parks over the Landsat Path/Row Scenes (Figure 2)
5. Click the target icon on the toolbar (last icon on the right) to activate the Map Query function



6. Click on a rectangular scene of interest (one of the rectangles within the boundaries of a park of interest) to bring up a window of all imagery available for that scene (Figure 3)
7. Select the *Show* link next to an item of interest to display a preview image (Figure 3)
8. If the preview image (Figure 4) does not contain the area you are interested in, try a different Path/Row. Rows increase going north to south and Paths increase going east to west (Figure 5).
9. Each Landsat 7 scene is available to order from the website. You can order imagery on CD ROM media, or via FTP downloads for a price of $45 per scene (subject to change).

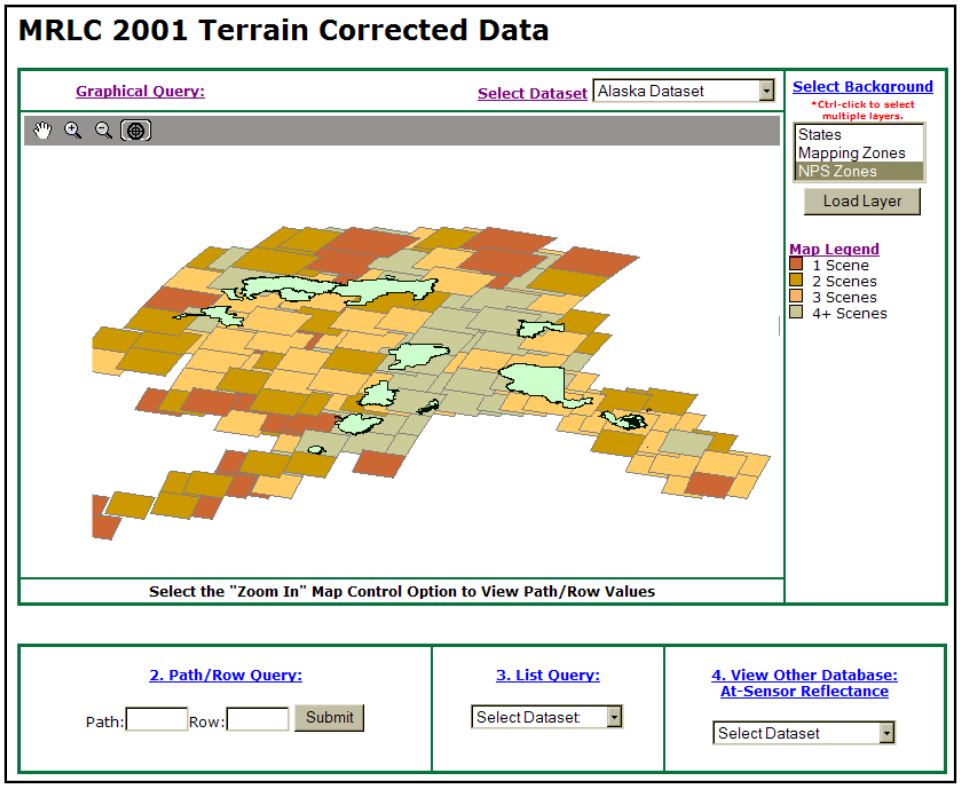
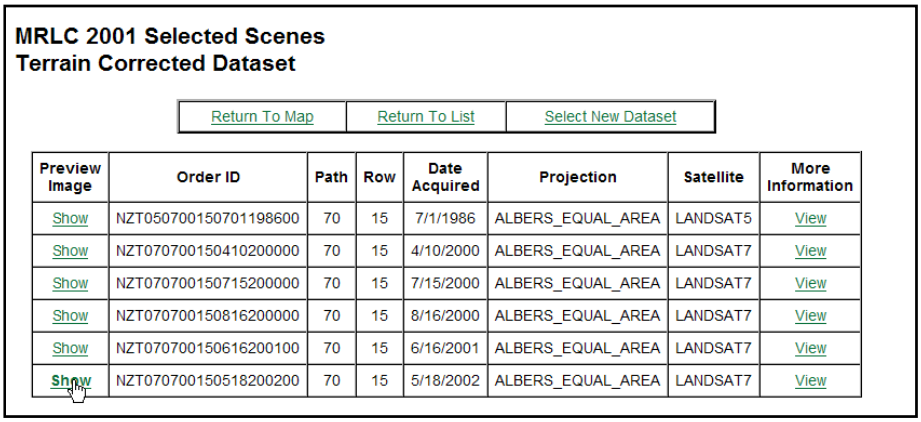


Figure 2. Screen-shot of the Terrain Corrected Data page of the MRLC website



Preview Image	Order ID	Path	Row	Date Acquired	Projection	Satellite	More Information
Show	NZT050700150701198600	70	15	7/1/1986	ALBERS_EQUAL_AREA	LANDSAT5	View
Show	NZT070700150410200000	70	15	4/10/2000	ALBERS_EQUAL_AREA	LANDSAT7	View
Show	NZT070700150715200000	70	15	7/15/2000	ALBERS_EQUAL_AREA	LANDSAT7	View
Show	NZT070700150816200000	70	15	8/16/2000	ALBERS_EQUAL_AREA	LANDSAT7	View
Show	NZT070700150616200100	70	15	6/16/2001	ALBERS_EQUAL_AREA	LANDSAT7	View
Show	NZT070700150518200200	70	15	5/18/2002	ALBERS_EQUAL_AREA	LANDSAT7	View

Figure 3. Screen-shot of the Selected Scenes dataset listing on the MRLC website

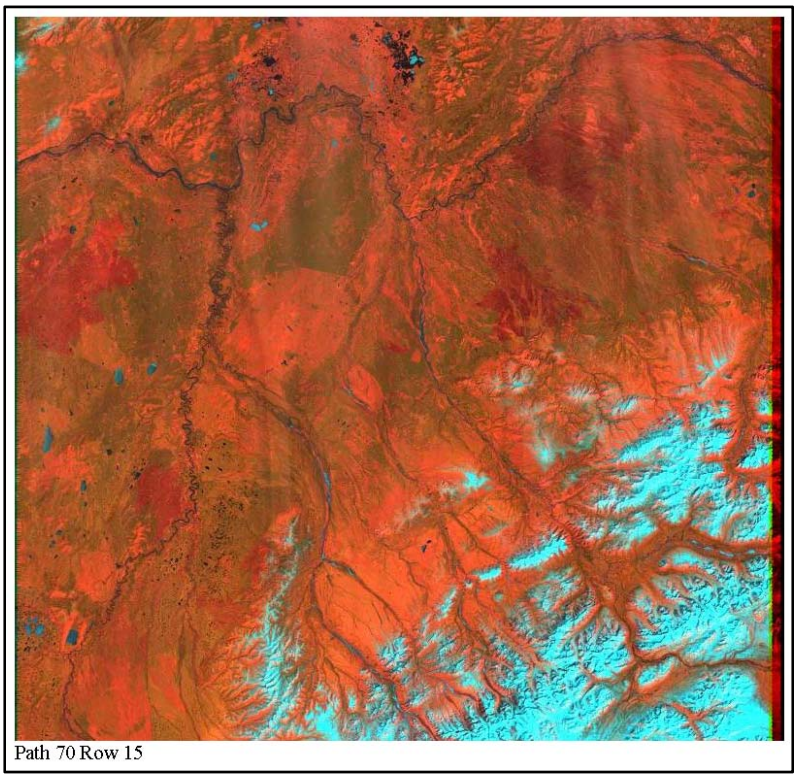


Figure 4. Sample image previewed from the MRLC website

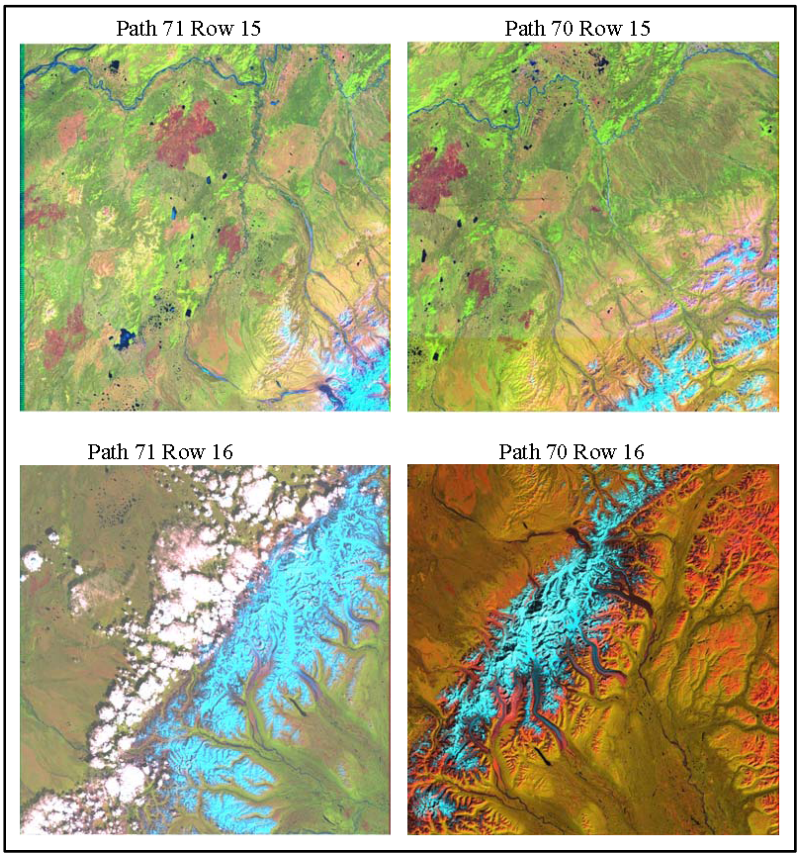


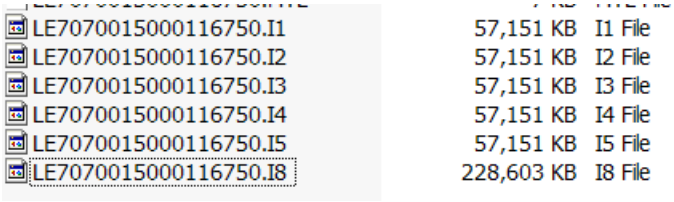
Figure 5. Example of selecting imagery from adjacent Paths and Rows available at the MRLC website

Preparing Image Files for Use with ArcGIS

The ETM+ imagery is archived as separate files for each spectral band as follows:

File extension	Spectral Region	Wavelengths (microns)	Pixel Size (m)
I1	Blue	0.45-0.52	30
I2	Green	0.53-0.61	30
I3	Red	0.63-0.69	30
I4	Near-IR	0.78-0.90	30
I5	Mid-IR	1.55-1.75	30
I6	Thermal (low gain)	10.4-12.5	60
I7	Mid-IR	2.09-2.35	30
I8	Panchromatic	.052-0.90	15
I9	Thermal (high gain)	10.4-12.5	30

Image files are named with extensions indicating the spectral band.



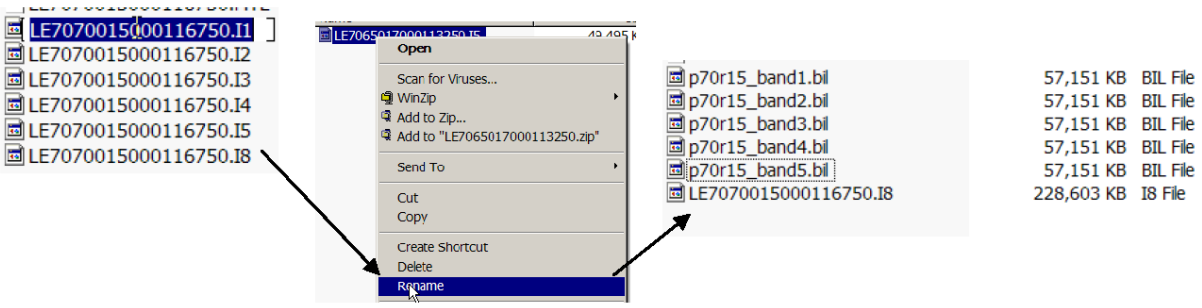
The files are named using the following convention, as illustrated above:

- LE stands for Landsat Enhanced Thematic Mapper sensor
- 7 stands for Landsat-7 satellite
- 070 stands for the path (70)
- 015 stands for the row (15)
- 001 stands for the year (20010)
- 167 stands for the Julian day of image acquisition (167)

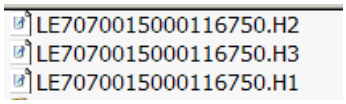
30-meter bands

The 15-meter (I8) panchromatic band will have a file size four times larger than the 30-meter bands. Therefore, for the purpose of exploring the imagery for regions that have a high density of lakes, the 30-meter bands 1-5 are recommended. In addition, color settings can be adjusted to enhance the appearance of lakes, making them easier to see.

1. Rename the I1 through I5 files so that they have the file extension .bil by right-clicking the file and selecting *Rename*



2. Determine image information by opening the file containing information about the image. The H1 file contains information about the 30-meter bands, the H2 file contains information about the 60-meter thermal band, and the H3 file contains information about the 15-meter panchromatic band.



   a. Open the H1 file with a text editor such as Wordpad, and determine the following information:

```
PIXELS_PER_LINE=  7776;
LINES_PER_DATA_FILE= 7526;

UPPER_LEFT_CORNER=
1515014.6532W,0651754.9252N,100920.000,1705980.000;

MAP_PROJECTION_NAME=  ALBERS_EQUAL_AREA
HORIZONTAL_DATUM=  WGS84;
PIXEL_SPACING=  30.0000,30.0000;
```

3. Create an image header file.

   a. Use a text editor to create a new text file and enter the following keywords into the new file, populating each category with the appropriate information:

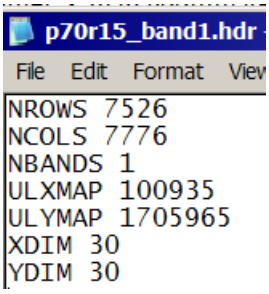
      NROWS
      NCOLS
      NBANDS
      ULXMAP
      ULYMAP
      XDIM
      YDIM

      Example:

      NROWS 7526
      NCOLS 7776
      NBANDS 1
      ULXMAP 100935
      ULYMAP 1705965
      XDIM 30
      YDIM 30

      NROWS stands for number of lines in the image file (7526 in this example)
      NCOLS stands for the number of pixels per line (7776 in this example)
      NBANDS stands for the number of bands in the image file (1 in this example)
      ULXMAP stands for the Albers Y-map coordinate for the center of upper left pixel (in this example, the H1 information gives you the longitude/latitude and then the Albers map X,Y for the upper left corner. Since the pixel is 30-meters in size, to get to the center of the pixel, add 15 to the upper left corner X map coordinate: 100920 + 15 = 100935)
      ULYMAP stands for the Albers Y-map coordinate for the center of upper left pixel (since the pixel is 30-meters in size, come down 15-meters from the upper left corner: 1705980 – 15 = 1705965)
      XDIM stands for the pixel spacing in the X-dimension (30 in this example)
      YDIM stands for the pixel spacing in the Y-dimension (30 in this example)

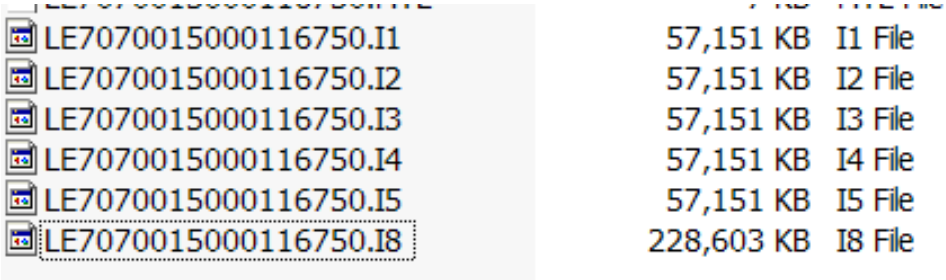
b. Save your header file with the same name as your image file and an extension of .hdr



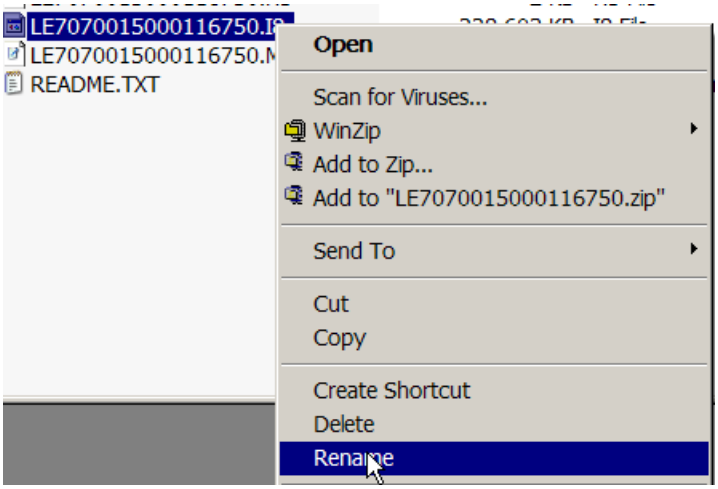
c. Copy your header file to create an identical header file for each of the five bands.

15-meter bands

For higher resolution images, the 15-meter panchromatic band should be used. Because the panchromatic band has the highest spatial resolution of all the bands, it also has the largest file size. The file extension is typically I8.



1. Rename the I8 file so that it has a file extension of .bil. Name the file pan_band.bil by right-clicking the file and selecting *Rename*.



2. Determine image information

   a. Locate the H3 file containing information about the image. The H1 file contains information about the 30-meter bands, the H2 file contains information about the 60-meter thermal band, and the H3 file contains information about the 15-meter panchromatic band

   b. Open the H3 file with a text editor such as Wordpad and determine the following information:

```
PIXELS_PER_LINE=  15552;
LINES_PER_DATA_FILE= 15052;
UPPER_LEFT_CORNER= 1515015.2126W,0651755.1753N,100912.500,1705987.500;
MAP_PROJECTION_NAME=  ALBERS_EQUAL_AREA
HORIZONTAL_DATUM=  WGS84;
PIXEL_SPACING=  15.0000,15.0000;
```

3. Create an image header file.

   d. Use a text editor to create a new text file and enter the following keywords into the new file, populating each category with the appropriate information:

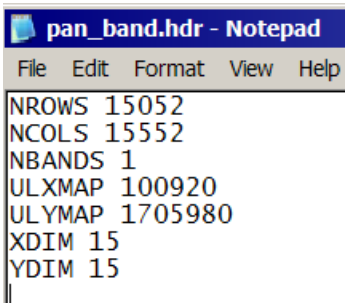
      NROWS
      NCOLS
      NBANDS
      ULXMAP
      ULYMAP
      XDIM
      YDIM

      Example:

      NROWS 15052
      NCOLS 15552
      NBANDS 1
      ULXMAP 100920
      ULYMAP 1705980
      XDIM 15
      YDIM 15

      NROWS stands for number of lines in the image file (15052 in this example)
      NCOLS stands for the number of pixels per line (15552 in this example)
      NBANDS stands for the number of bands in the image file (1 in this example)
      ULXMAP stands for the Albers Y-map coordinate for the center of upper left pixel (in this example, the H1 information gives you the longitude/latitude and then the Albers map X,Y for the upper left corner. Since the pixel is 15 meters in size, to get to the center of the pixel, add 7.5 to the upper left corner X map coordinate: 100912.500 + 7.5 = 100920)
      ULYMAP stands for the Albers Y-map coordinate for the center of upper left pixel (since the pixel is 15-meters in size, come down 7.5 meters from the upper left corner: 1705987.500 – 7.5 = 1705980)
      XDIM stands for the pixel spacing in the X-dimension (15 in this example)
      YDIM stands for the pixel spacing in the Y-dimension (15 in this example)

   e. Save your header file with the same name as your image file and an extension of .hdr

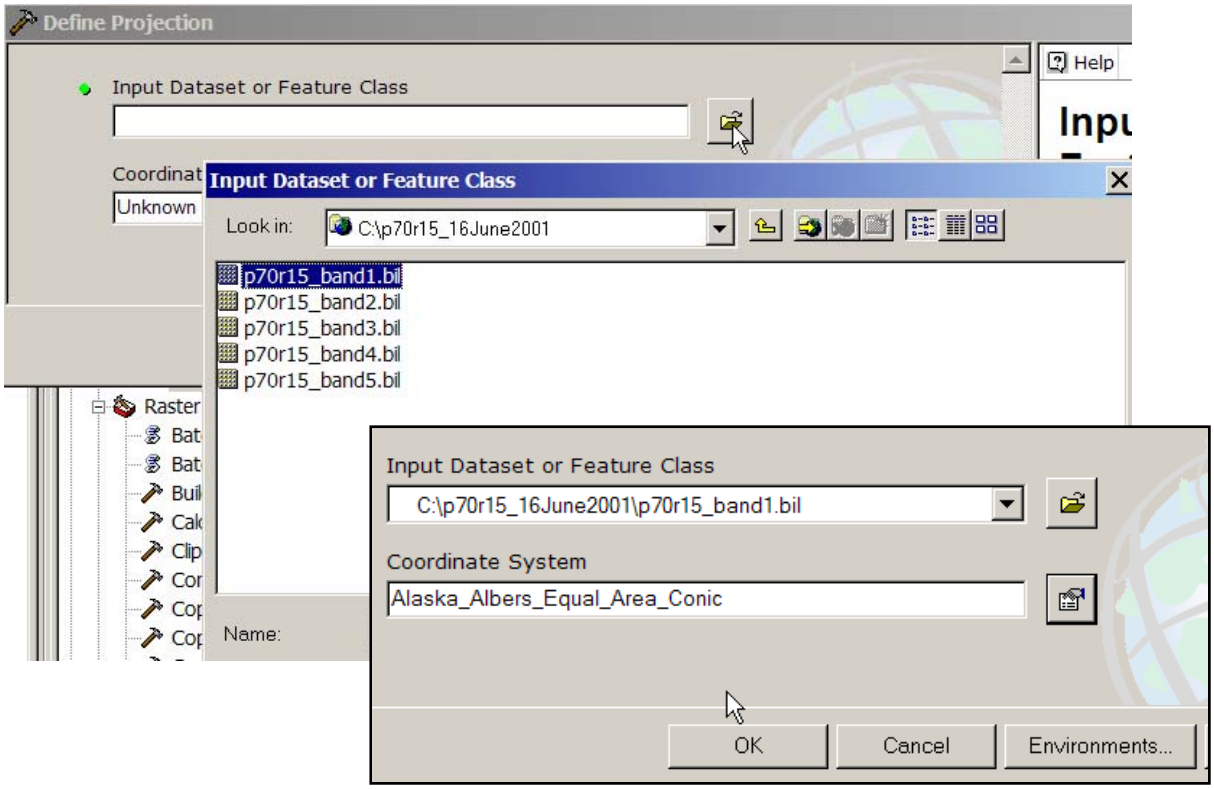


Viewing Base Imagery in ArcGIS

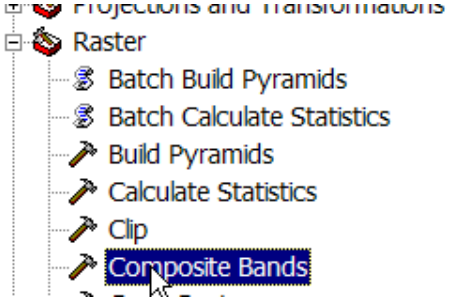
To view any type of imagery in ArcGIS, start the ArcMap program, and make sure that the image is in the Alaska Albers map projection. If necessary, define the map projection of the image, as described in the Instruction Sheet "GIS: Alaska Albers Map Projection".

30-meter bands

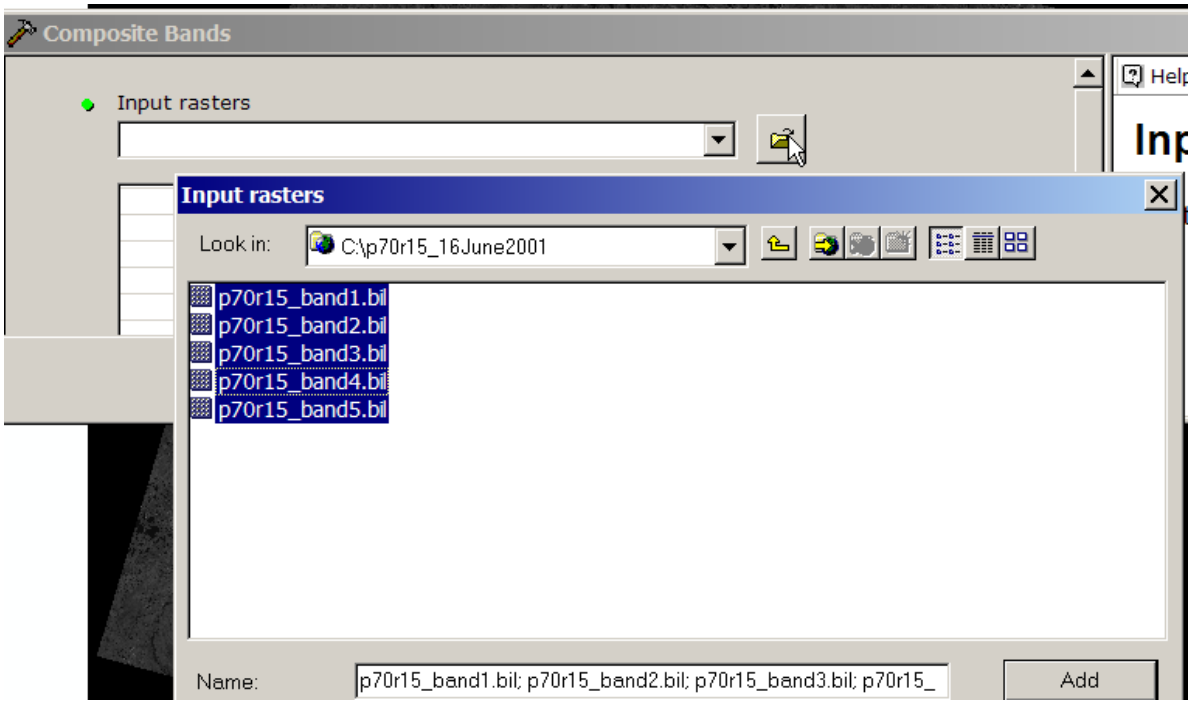
1. The projection will need to be defined for each band file.

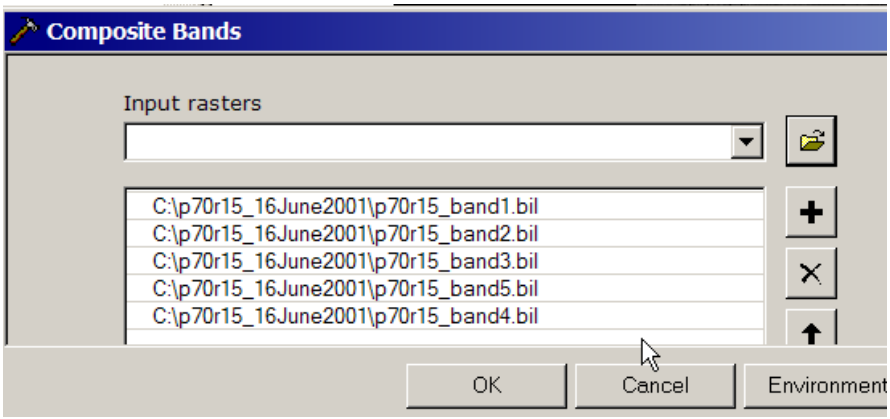


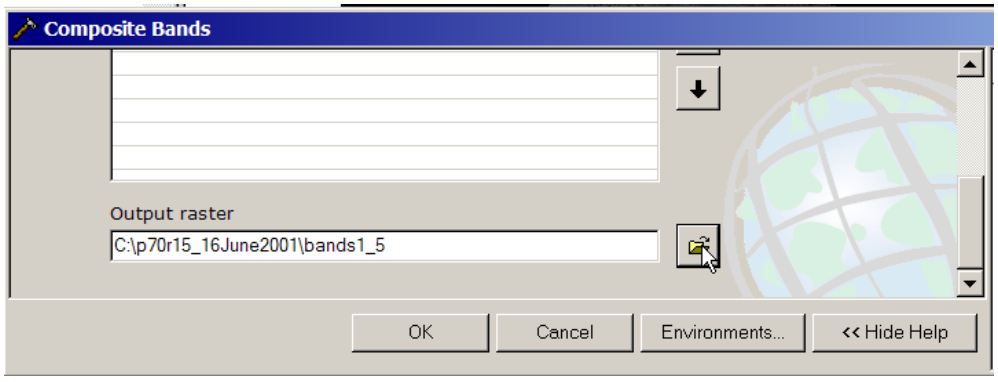
2. Merge the five separate .bil files into one file that will contain the five spectral bands.



   a. Choose the Composite Bands Tool from the Raster toolset inside the Data Management Toolbox
   b. Browse to the folder containing your five .bil files
   c. Hold the Ctrl key down and select all five files
   d. Click the *Add* button to add the files to a list
   e. At the bottom of the Composite Bands window, browse to an output folder and specify a file name for your composited image file
   f. Press the *OK* button to composite the five separate files into one file

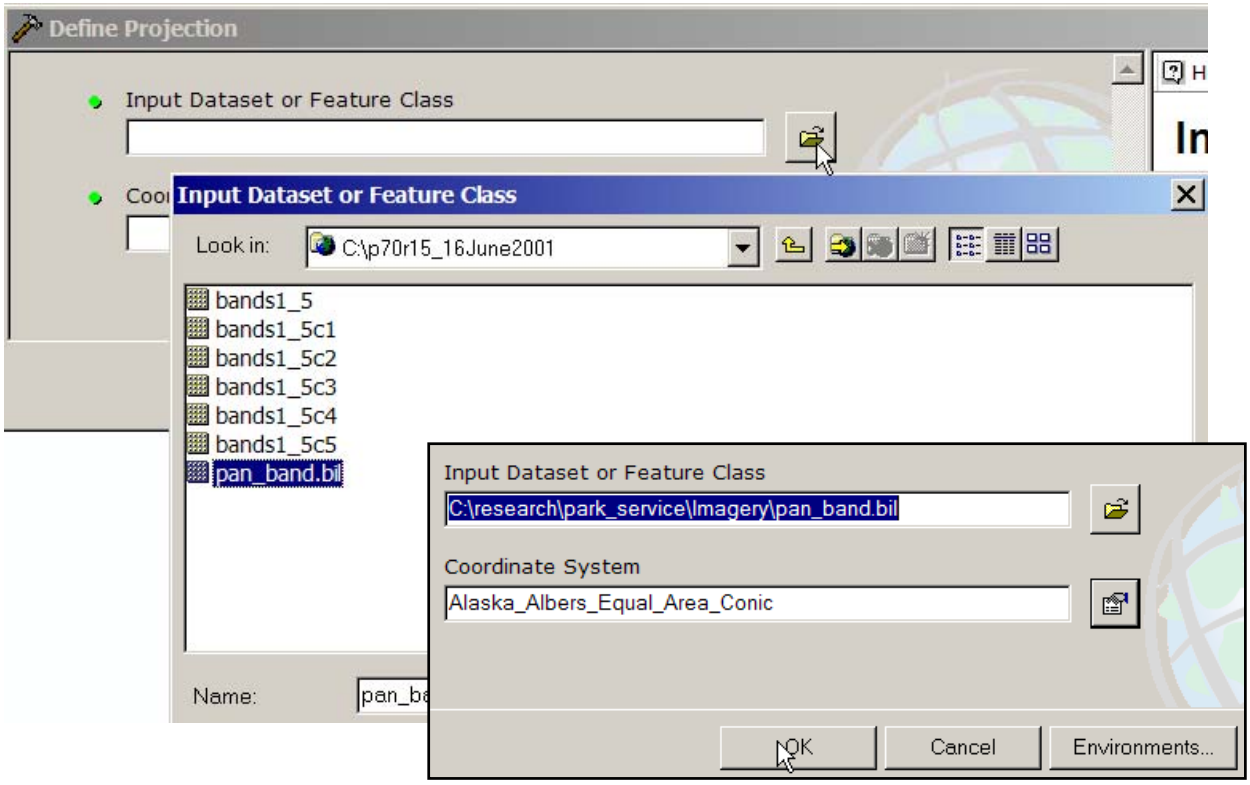

Composite Bands
Input rasters
Input rasters
Look in:
C:\p70r15_16June2001
p70r15_band1.bil
p70r15_band2.bil
p70r15_band3.bil
p70r15_band4.bil
p70r15_band5.bil
Name:
p70r15_band1.bil; p70r15_band2.bil; p70r15_band3.bil; p70r15_
Add


Composite Bands
Input rasters
C:\p70r15_16June2001\p70r15_band1.bil
C:\p70r15_16June2001\p70r15_band2.bil
C:\p70r15_16June2001\p70r15_band3.bil
C:\p70r15_16June2001\p70r15_band5.bil
C:\p70r15_16June2001\p70r15_band4.bil
OK
Cancel
Environment

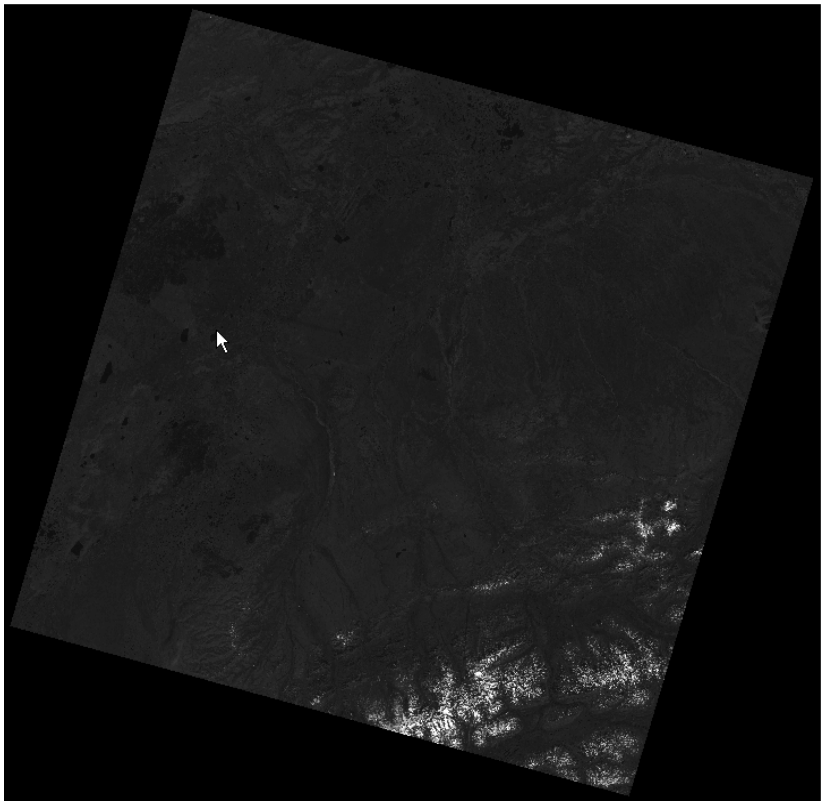

Composite Bands
Output raster
C:\p70r15_16June2001\bands1_5
OK
Cancel
Environments...
<< Hide Help

15-meter bands

1. The projection will need to be defined for the panchromatic file.

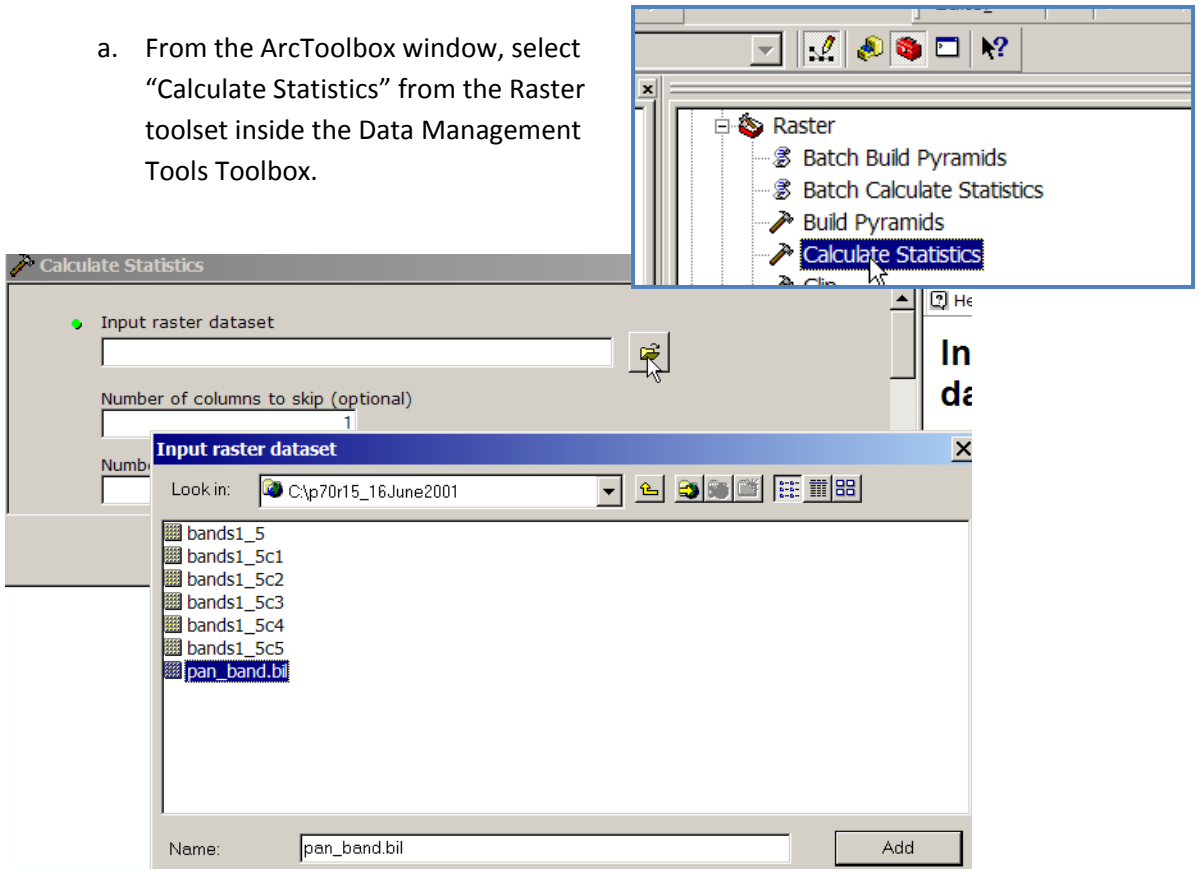


After projecting the file, it will be added to the ArcMap data frame. The image will appear dark because image statistics have not yet been determined.

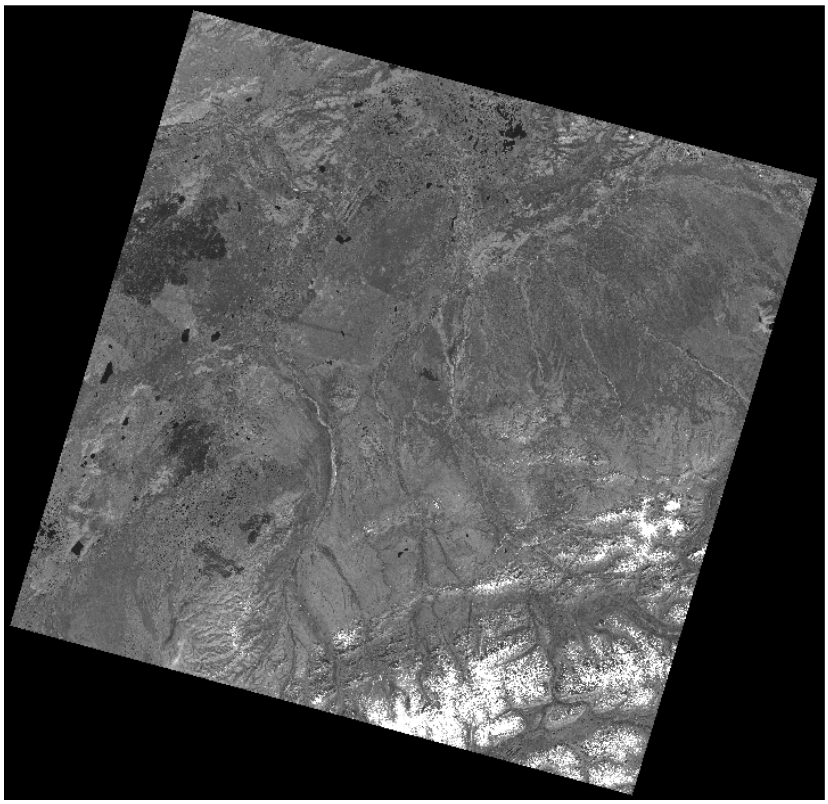


2. Compute descriptive statistics for your image. Once descriptive statistics such as minimum and maximum image pixel values have been computed, the image contrast will be improved using the descriptive statistics information.

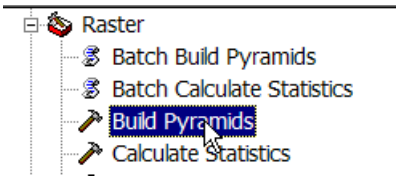
   a. From the ArcToolbox window, select "Calculate Statistics" from the Raster toolset inside the Data Management Tools Toolbox.



   b. After image statistics have been computed, the image will be displayed automatically with improved contrast.

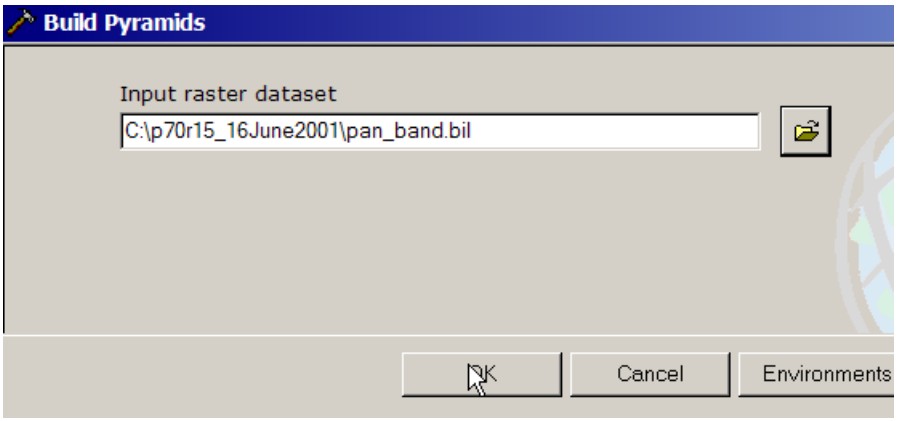


3. Build an image pyramid. An image pyramid is a reduced-resolution dataset that facilitates rapid zooming of imagery.



   a. From the ArcToolbox window, select *Build Pyramids* from the *Raster* toolset inside the *Data Management Tools* toolbox.

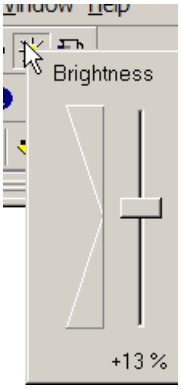
   b. Browse to the folder containing your image, select the image file, then click *OK* at the bottom.

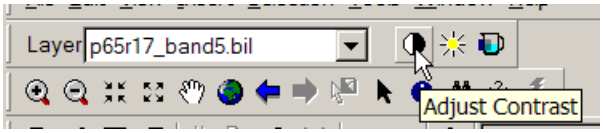


4. Adjust image contrast and brightness.

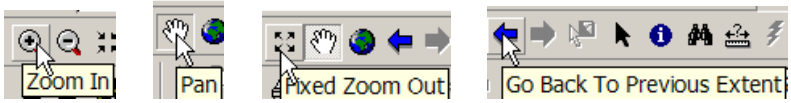
   a. Change the contrast by using the *Adjust Contrast* tool on the *Effects* toolbar

   b. Change the brightness by using the *Brightness* tool on the *Effects* toolbar





5. Use the Zoom In, Pan, Zoom Out, and Go Back buttons to navigate within the image.



Imagery: USGS Datasets

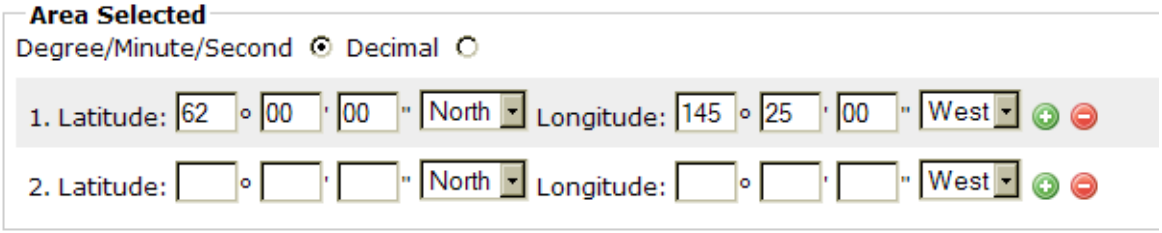
The U. S. Geological Survey has a number of datasets available from their Earth Explorer website. This instruction sheet details the process of searching and downloading applicable imagery for this project.

The National Park Service in Alaska uses the Alaska Albers Projection as the standard map projection and coordinate system for GIS themes in Alaska. Any imagery used for this project should either already be in Alaska Albers, or should be projected before use (refer to Instruction Sheet "GIS: Alaska Albers Map Projection" for details).

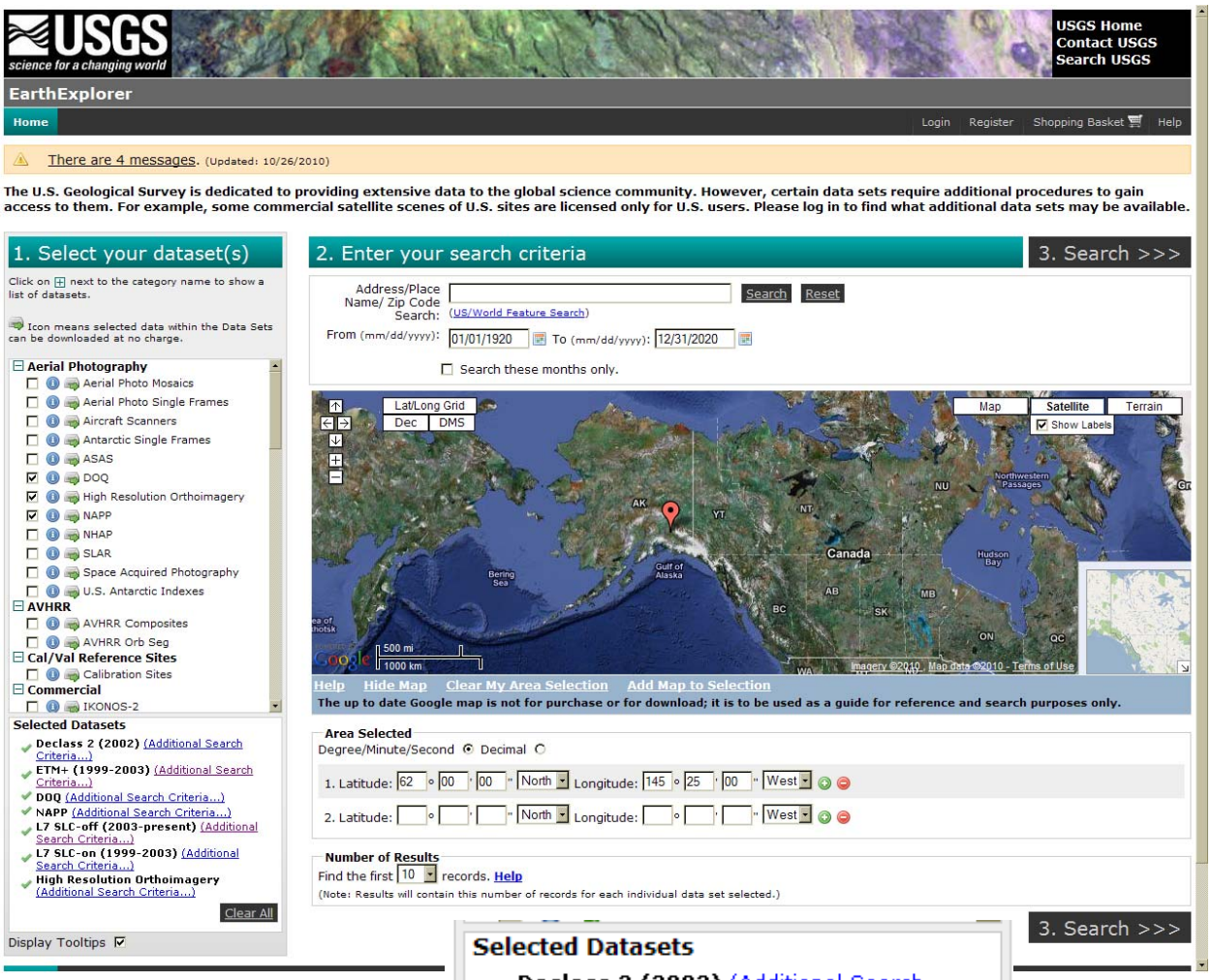
Procuring USGS Imagery

As an example, we will use the Copper River Study Region located in Wrangell Saint Elias National Park.

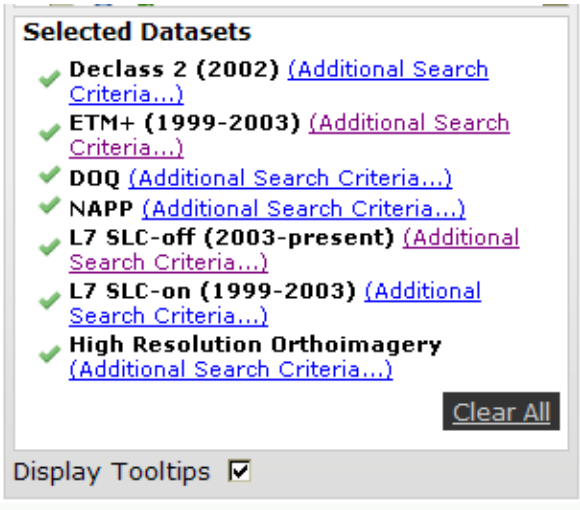
1. Start a web browser and open the EarthExplorer website: edcsns17.cr.usgs.gov/EarthExplorer
2. Enter the latitude and longitude for the location(s) for which imagery is desired

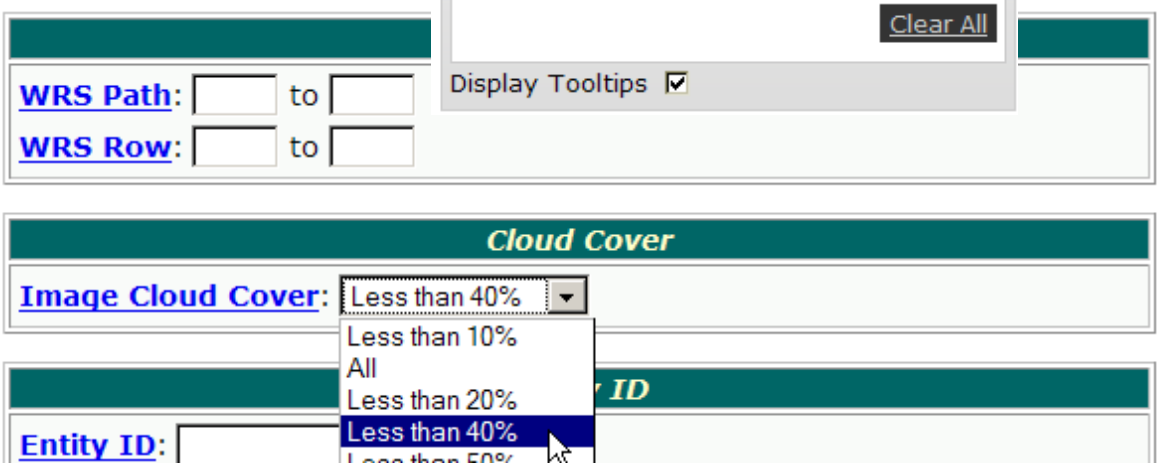


3. Select the desired imagery datasets, including:
    - Declassified Satellite Imagery (2002)
    - ETM+ (Landsat 7, June 1999 – May 2003
    - ETM+ SLC-off (Landsat 7, July 2003 – present)
    - Digital Orthophoto Quadrangles
    - National Aerial Photography Program
    - Survey Photography
    - USGS High Resolution Photography



Additional search criteria may be entered for certain datasets. For Landsat imagery, cloud cover maximums can be set. Select Less than 40% when possible.





4. Enter the date range over which to search for imagery
5. Set the maximum number of image returns in the Number of Results section at the bottom of the page



6. Start the search by clicking the *Search* button

Results Summary

Select	Data Set	Matches	Status	Comments
	Declass 2 (2002)	0	Complete	
☐	ETM+ (1999-2003)	3 of 3	Complete	
	DOQ	0	Complete	
	NAPP	0	Complete	
☐	L7 SLC-off (2003-present)	10 of ?	Complete	
☐	L7 SLC-on (1999-2003)	10 of ?	Complete	
	High Resolution Orthoimagery	0	Complete	

7. Select a dataset by clicking the link

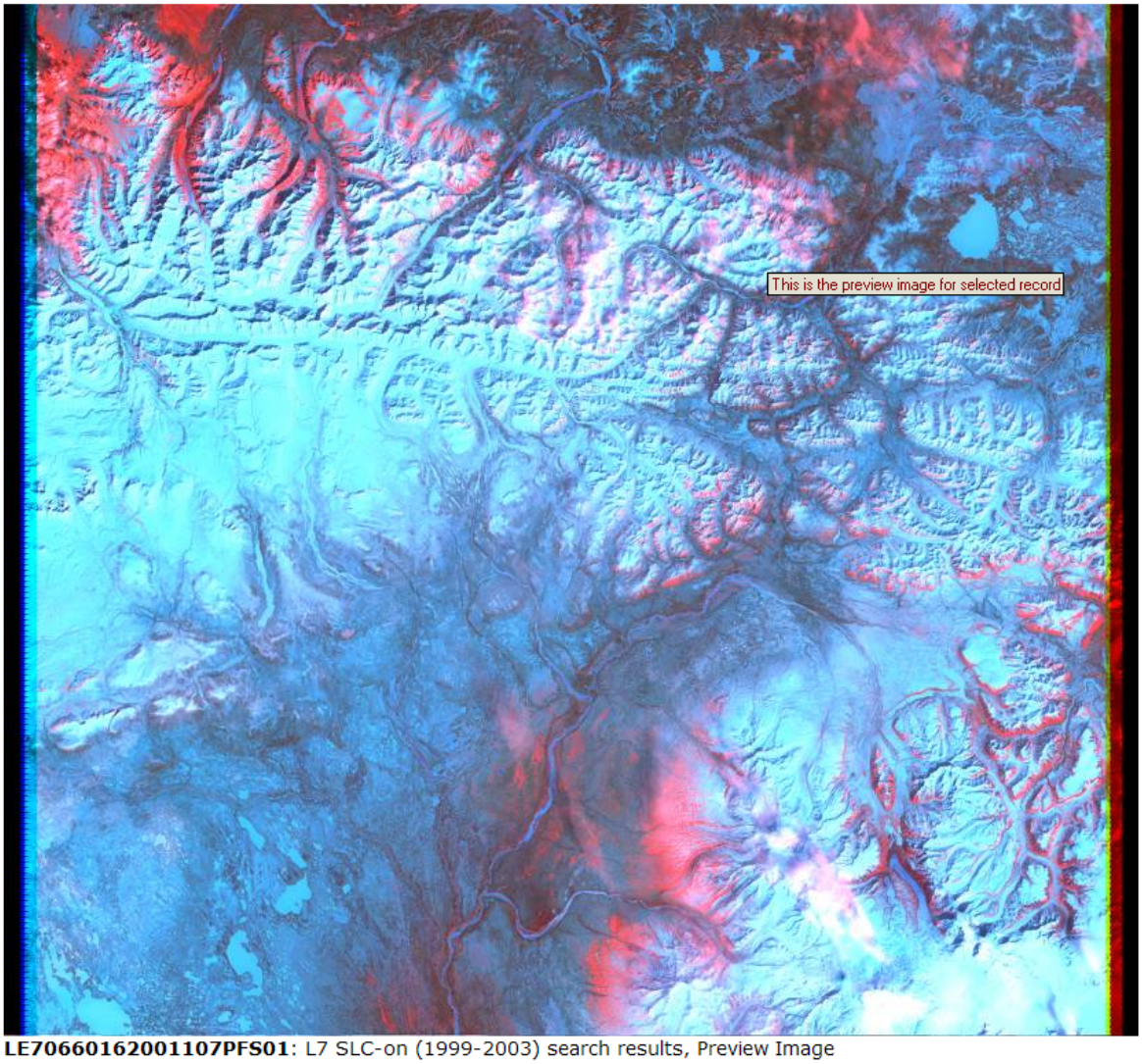
L7 SLC-on (1999-2003)
10 metadata records retrieved. **Showing 1-10**

	Preview Image	Show Footprint	Show All Fields	Exclude	Order	Qty	Price	Download	Landsat Scene Identifier	Date Acquired	WRS Path	WRS Row	Cloud Cover	Sun Elevation	Sun Azimuth	On Demand
1		Show	Show	☐	☐		$0	Available by ordering	LE70660162003145EDC00	2003/05/25	066	016	59.43	47.2469978	162.1884308	Y
2		Show	Show	☐	☐		$0	Available by ordering	LE70660162000329AGS00	2000/11/24	066	016	61.23	6.0391207	170.7601318	Y
3		Show	Show	☐	☐		$0	Available by ordering	LE70660162001075AGS00	2001/03/16	066	016	19.95	24.6615772	163.1546478	Y
4		Show	Show	☐	☐		$0	Available by ordering	LE70660162001091PFS00	2001/04/01	066	016	10.49	31.0382595	163.5189056	Y
5		Show	Show													Y
6		Show	Show													Y
7		Show	Show													Y
8		Show	Show													Y
9		Show	Show													Y
10		Show	Show													Y

Date Acquired	WRS Path	WRS Row	Cloud Cover	Sun Elevation	Sun Azimuth	On Demand
2003/05/25	066	016	59.43	47.2469978	162.1884308	Y
2000/11/24	066	016	61.23	6.0391207	170.7601318	Y
2001/03/16	066	016	19.95	24.6615772	163.1546478	Y

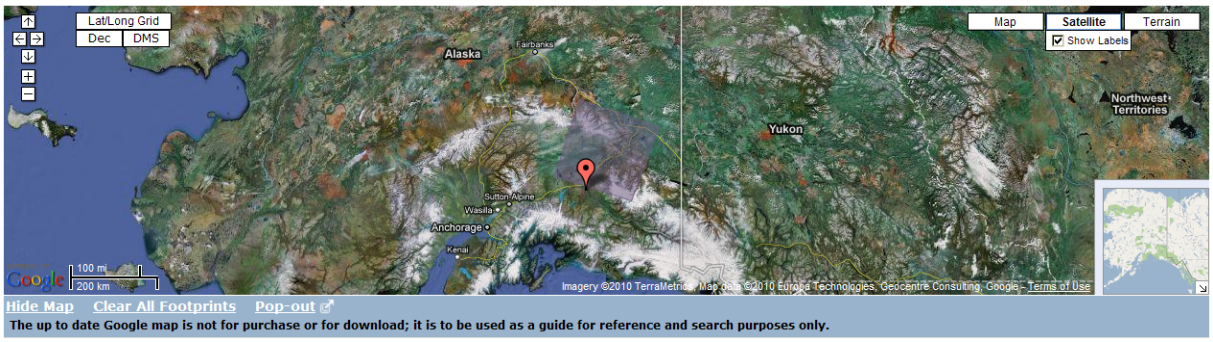
8. Browse the list for images with low cloud cover, and which were taken during a summer month. Images may be previewed by clicking the thumbnail.

LE70660162001107PFS01: L7 SLC-on (1999-2003) search results, Preview Image



LE70660162001107PFS01: L7 SLC-on (1999-2003) search results, Preview Image

9. Select *Show Footprint* to see the footprint of the image in relation to the user-specified latitude/longitude coordinates. A square will be displayed in the satellite map at the top of the page. The specified location is shown with a location pin.



10. Check the Order box to add images to your shopping cart

11. Contact Customer Services for a special request to have the imagery Terrain-Corrected to the Alaska Albers map projection.

Lake Inventory Access Designation

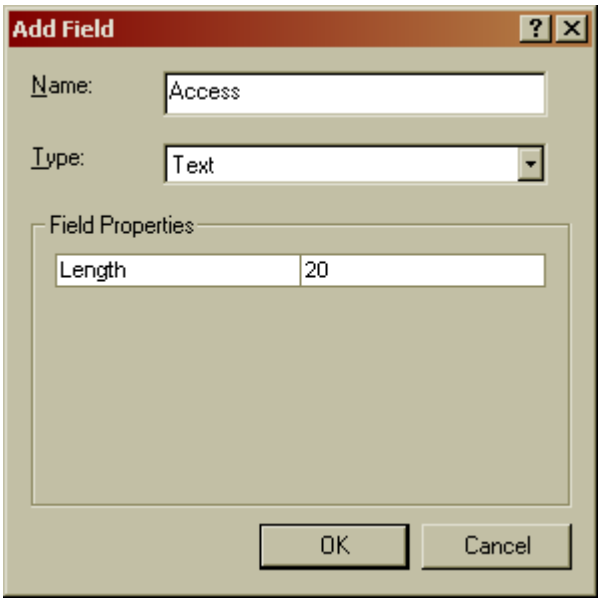
Once a polygon feature class has been created for all lakes that can potentially be sampled in a park unit or study area, access designations must be added to each lake as an attribute.

Lakes may be accessed by hiking in from navigable rivers or roads, or by landing on lakes with a float plane. The only other way to access the lakes for this project is by helicopter. It is important to know what type of access is available, and how far away each lake is from an access point. Each lake should be attributed with an access designation, based on the closest and most convenient access point.

Access Identification

Landing Lakes

1. Identify landing lakes
    a. Use the clipped NHD waterbody shapefile created as described in the Instruction Sheet "Lake Inventory Using NHD", and use the *Select by Attributes* option to select all lakes greater than 0.4 km^2
    b. Add a field to the attribute table for Access information
        i. Right-click on the layer in the TOC window, select *Open Attribute Table*
        ii. Click the Options button, and select *Add field*
        iii. Name the field Access, set the Type to Text with a length of 20



        iv. Click *OK* to add the new field.
    c. Examine each lake, and determine if it is suitable for landing a floatplane. The best lakes will have 1 km lengths in several orientations, but suitability will

depend on topography, lake orientation, and many other factors. Consult with pilots for advice when selecting landing lakes.

d. Any lakes deemed suitable for landing a floatplane should be designated "Landing" in the Access field.

e. Export the polygons designated with Landing Access into a shapefile named PARK_LandingLakes.

2. Buffer the landing lakes in the newly-created shapefile to 500 m and 1500 m using multiple-ring buffers. See Instruction Sheet "GIS: Multiple-Ring Buffers" for details on applying multiple-ring buffers. Save the buffer file as PARK_LandingLakeBuffers.

Roads

1. Locate or create shapefiles for road systems within a park unit. If multiple files are present for different roads within one park unit, merge the files. If there are no existing files, a line feature can be digitized from satellite imagery.
2. Apply a multiple-ring buffer to the roads, as described in the Instruction Sheet "GIS: Multiple-Ring Buffers", and save the buffer file as PARK_RoadBuffers.

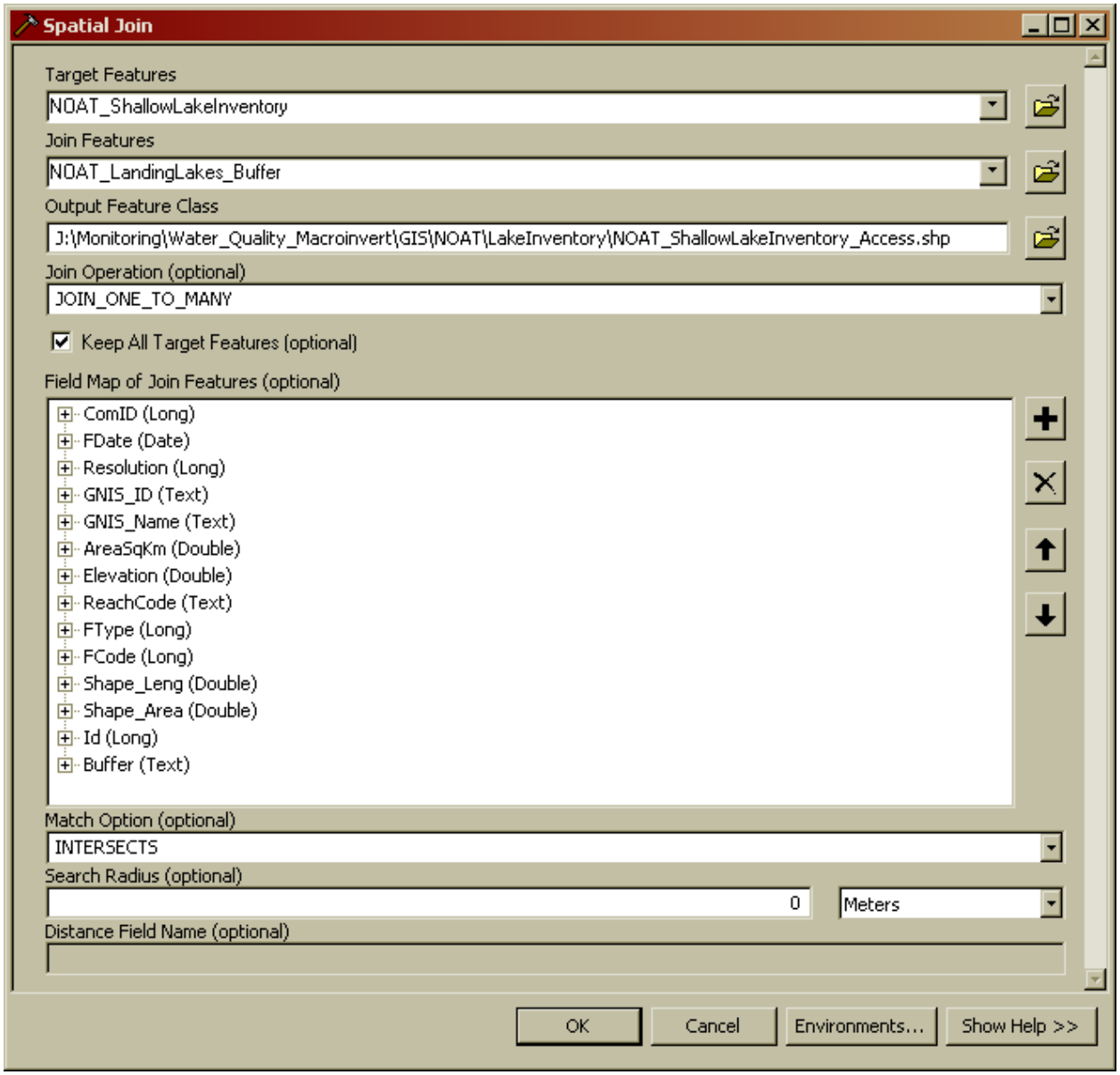
Rivers

1. Locate or create shapefiles for navigable rivers within a park unit. The NHD may be used as a source, or there may be administrative base files available on the NPS Theme Manager. Rivers may also be digitized from satellite imagery.
2. Apply a multiple-ring buffer to the roads, as described in the Instruction Sheet "GIS: Multiple-Ring Buffers", and save the buffer file as PARK_RiverBuffers.

Access Attribution

The data contained in the buffer files can be attributed to the PARK_ShallowLakeInventory shapefile using a Spatial Join.

1. Select the Spatial Join tool from Arc Toolbox – Analysis – Overlay
2. Set the target features as the PARK_ShallowLakeInventory file, and the join features as the buffer file to be applied. The output feature class should be PARK_ShallowLakeInventory_Access. It may need an access type designator if more than one access type is present in the park unit. Set the Join Operation to JOIN_ONE_TO_MANY, keep all target features, and set the Match Option to INTERSECTS.



3. If multiple buffer files need to be joined, use the newly created output file as the target file for the next buffer file, then use that newly created output file as the target file for the next buffer file.

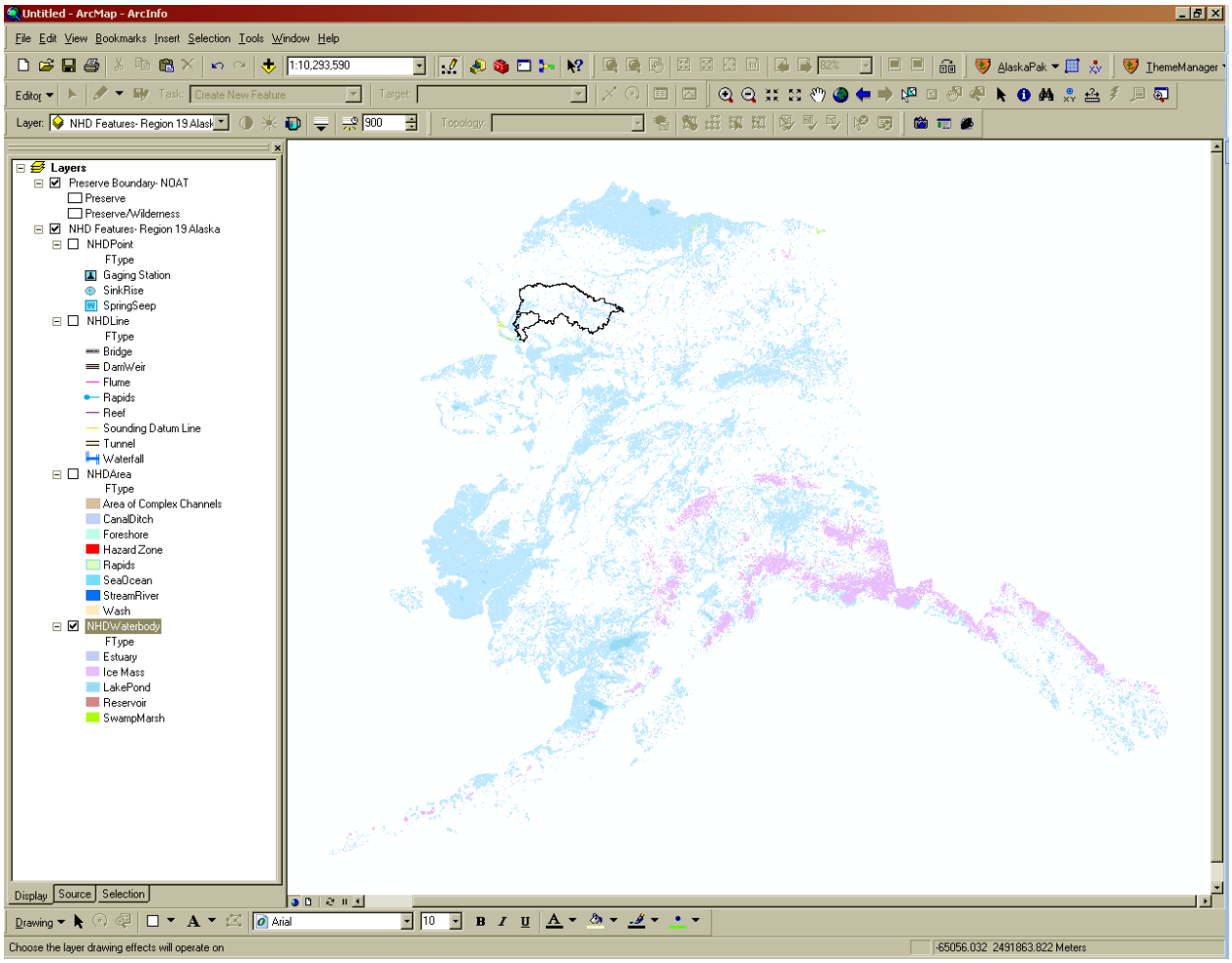
4. Add an Access field to the PARK_ShallowLakeInventory_Access shapefile, and populate it with the preferred access information (generally road access is better than landing lake access, and landing lake access is better than river access, but it depends on the particular lake location). Include the Access type and distance in the Access field (i.e. LL500, LL1500, RD500, RD1500, RV500, RV1500).

Lake Inventory Using NHD

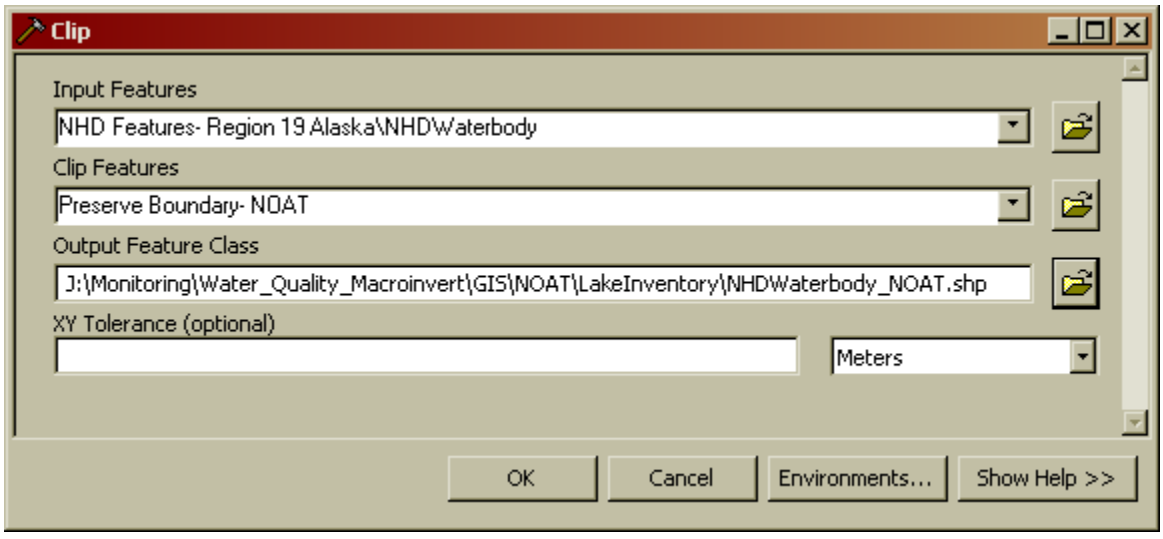
The National Hydrography Dataset (NHD) is a GIS theme that has been developed by the U. S. Geological Survey (USGS) to include all of the surface water features throughout the United States. Some regions of the nation have more accurate and up-to-date information in the NHD than others, and Alaska is on the low end of the spectrum for accuracy. Many of the NHD features for Alaska have been digitized from topographic maps, the most recent of which are still woefully out of date. Even so, it is still a good place to start when looking for digitized lake information, and it forms the foundation of the inventory of shallow lakes used in this project. Efforts are underway to improve the data for Alaska, so it is always prudent to check for the most recent versions of the NHD before starting analysis using the dataset. The NHD is available through the NPS Theme Manager program in ArcGIS.

The specific procedures for downloading and processing the NHD will change over time, as the dataset changes format and as new ArcGIS software upgrades are introduced. These instructions are for the process followed in 2010 for the Noatak National Preserve. The specific steps performed in the processing of the NHD, including references to any intermediate output datafiles, should be recorded in a GIS log for each park unit where analysis is performed. The GIS log should be saved in the GIS folder for that park unit on the CAKN network drive (J:\Monitoring\Water_Quality_Macroinvert\GIS\PARK).

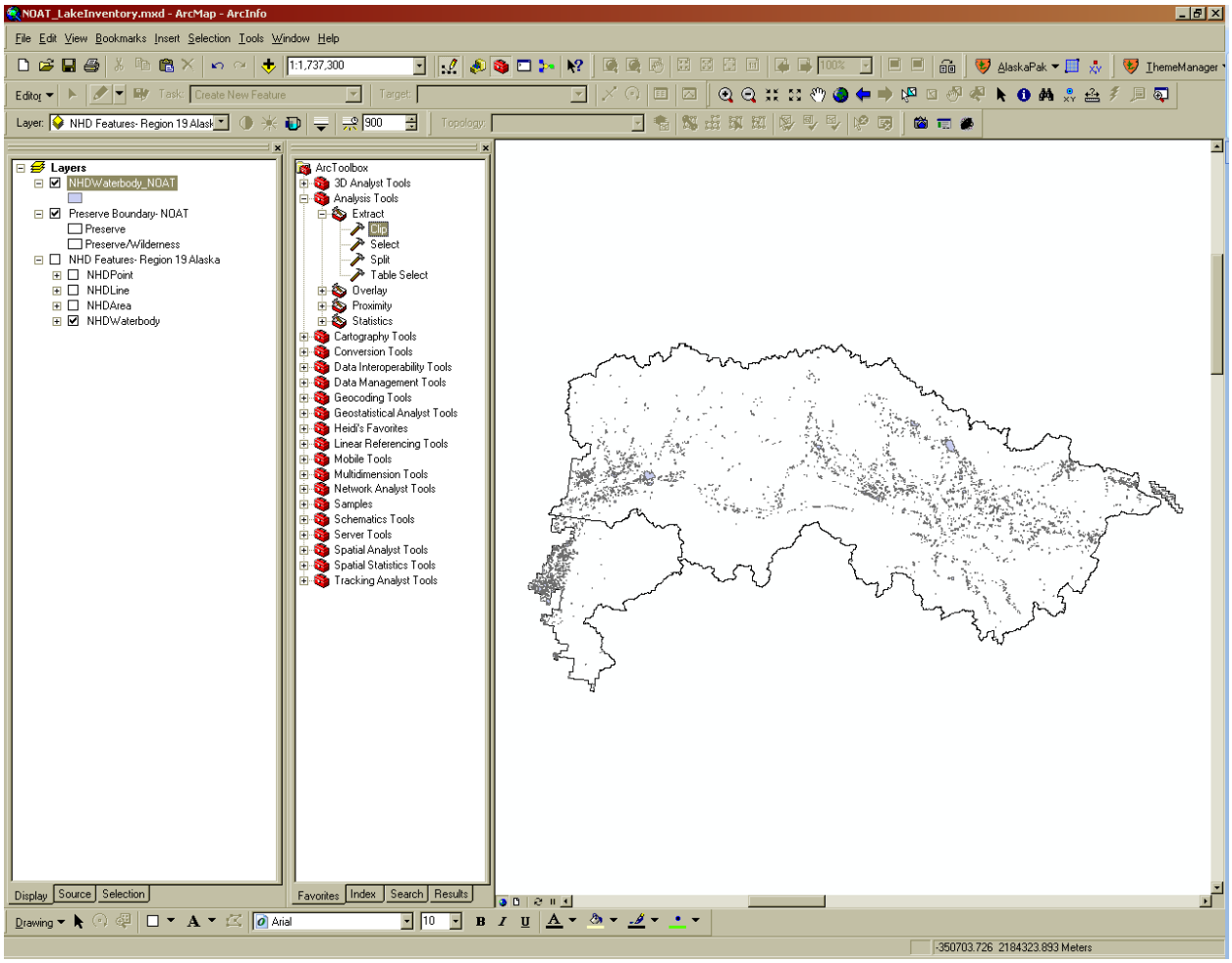
1. Load the most recent NHD into a new ArcMap project, making sure that both the data frame and the dataset are in the Alaska Albers map projection. The NHD theme currently used is NHD Features – Region 19 Alaska.
    a. Open ArcMap with a new blank project
    b. Select *Data Frame Properties* from the *View* menu, select the *Coordinate System* tab, and check that the coordinate system is set to NAD_1983_Alaska_Albers. If not, navigate to the appropriate system (Predefined – Projected Coordinate Systems – Continental – North America – Alaska Albers Equal Area Conic), and apply it.
    c. Open NPS Theme Manager
    d. Search for NHD
    e. Drag the NHD Features – Region 19 Alaska theme into the ArcMap project.
2. View only the features of interest for this project (i.e. the NHD Waterbody polygons), by checking only the box next to the appropriate features in the table of contents window



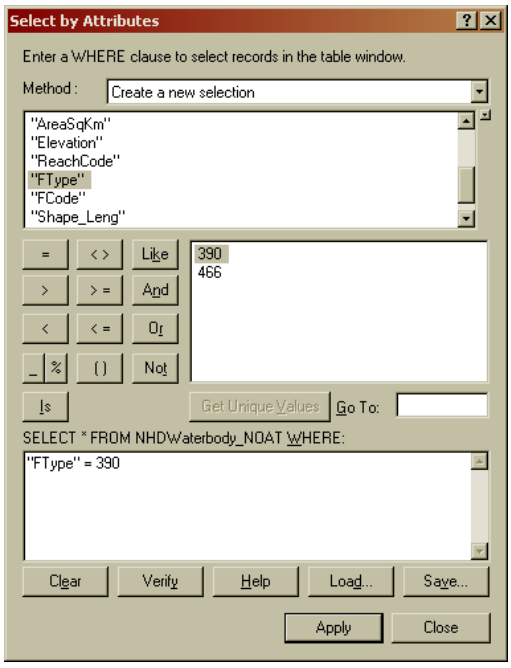
3. Clip the NHDWaterbody feature class to the park unit boundary or study area polygon (see SOP 2: Delineation of Study Region for information on park boundary and study area polygons).



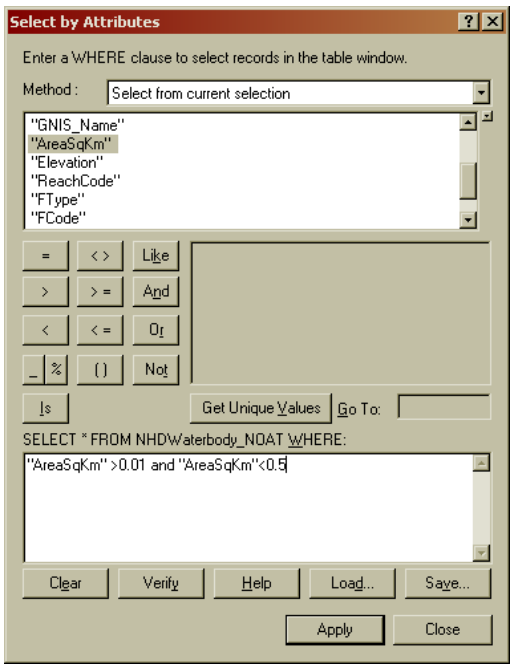
4. Add metadata to the new shapefile in ArcCatalog.



5. Open the Attribute table of the clipped file, and use the *Select by Attributes* option to select only the LakePond waterbody type (390).



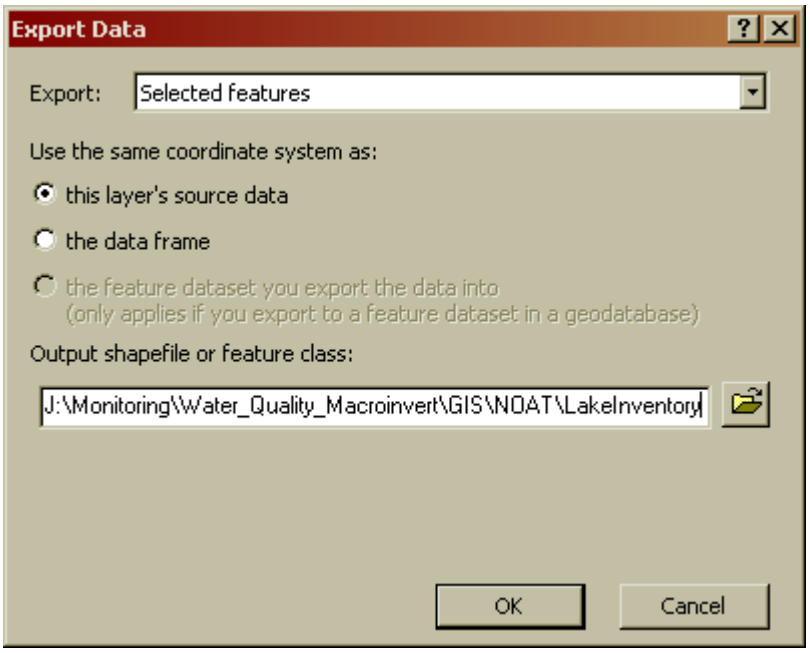
6. Use the *Select by Attributes* option to select only the polygons of LakePond type that are greater than 1 hectares (0.01 km^2)and less than 50 hectares (0.5 km^2) in area



7. Save the selection as a new shapefile

    a. Right-click the clipped boundary file in the Table of Contents window

    b. Select Data – Export Data and save the Selected Features using the appropriate coordinate system with the file name PARK_ShallowLakeInventory.shp in J:\Monitoring\Water_Quality_Macroinvert\GIS\NOAT\LakeInventory



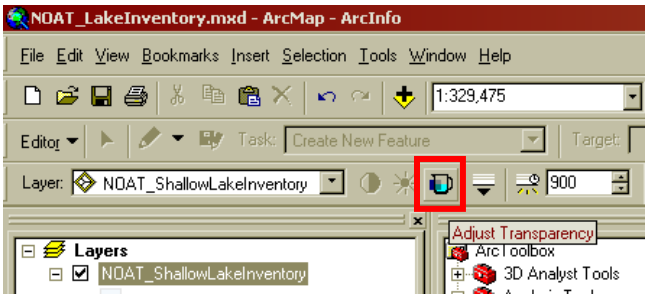
    c. Add the new shapefile to the data frame

    d. Add metadata to the shapefile in ArcCatalog

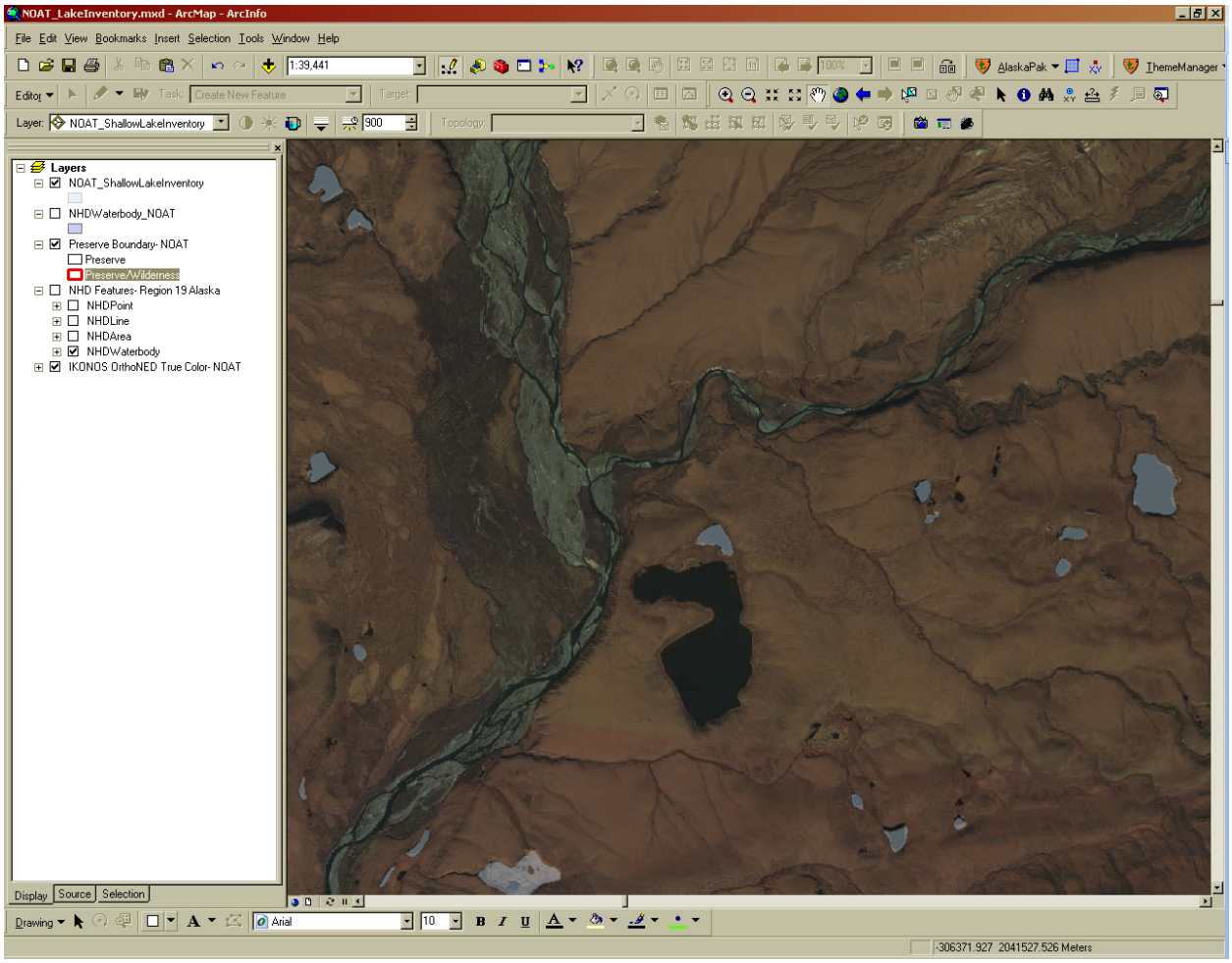
8. Add a background satellite image file, using the highest quality imagery available for the park unit. Most imagery can be found in the NPS Theme Manager and dragged into the TOC in the ArcMap data frame.

9. Check the accuracy of the NHD waterbodies

    a. Set the transparency on the PARK_ShallowLakeInventory layer to a high level (60-70% is generally appropriate), so that the imagery is visible through the lake polygon layer.



    b. Pan through the entire park unit or study area, and ensure that each lake of appropriate size is represented by a polygon. The polygons do not have to match exactly, as long as each lake is approximately represented by a polygon.



c. Add polygons for any lakes that should be included in the lake population, but are not represented by a polygon. It can be helpful to toggle the clipped NHD waterbody file to quickly see if the lake was not included in this dataset because it was outside the size limits. Alternatively, the clipped NHD waterbody file can be used to look for excluded lakes, while the target file for editing (adding additional lakes) is the Inventory file.

   i. Access the Editor toolbar, and select *Start Editing*. Be sure to set the editing target to the correct layer file.

   ii. Select the Sketch tool, and set the task to Create New Feature in the correct Target file.



   iii. Trace the shoreline of the lake to draw the polygon.

   iv. Save edits after each polygon has been drawn. Stop editing when all polygons have been added, making sure that all edits are saved.

d. Add comments for lakes that no longer exist, so that drained lakes are not included in the lake population available for sampling.

e. Save the inventory shapefile in its final form. Make sure that metadata has been entered to indicate the contents of the shapefile.

10. This shapefile will need to be attributed with access information. Refer to Instruction Sheet "Lake Inventory Access Designation" for detailed instructions.

11. Once the polygon features are all finalized, a point feature shapefile must be generated. Refer to Instruction Sheet "GIS: Converting Polygons to Points" for detailed instructions.

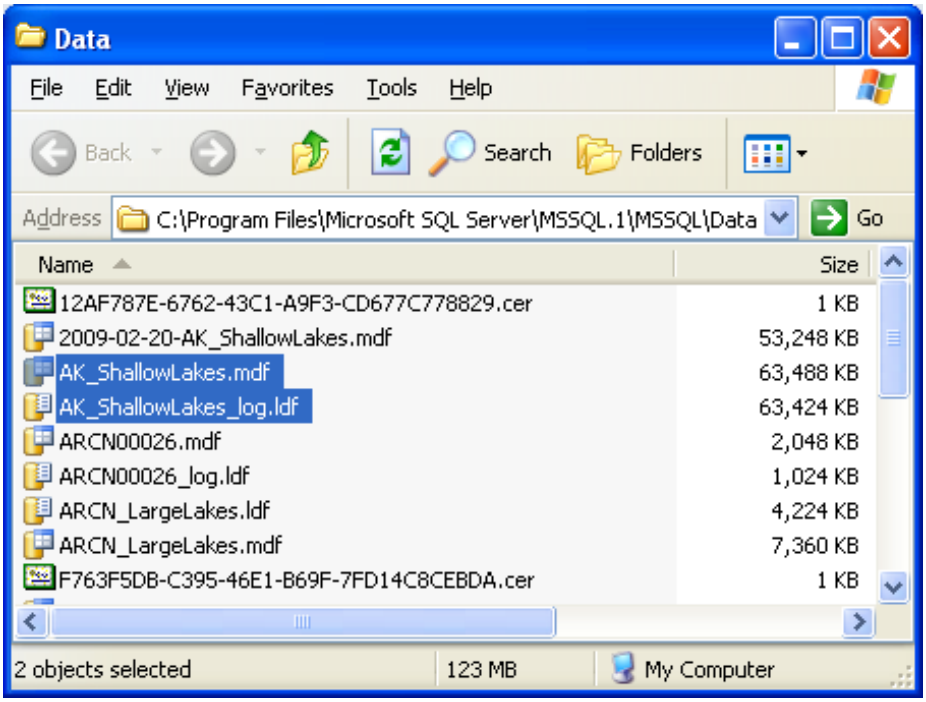
Loading Database onto Field Computer

The SQL Server database must be loaded onto the Tablet PC, along with the Access front end, and then a connection must be established between the two, in order to use the database for data entry in the field. To load the database onto the field computer, follow the following instructions:

1. Remove any old copies of the SQL Server and Access database files from the Tablet PC.
2. Use a thumb drive to transfer the most recent version of the Access ShallowLakes.adp file from the CAKN network drive (J:\Monitoring\Water_Quality_Macroinvert\Database) onto the Tablet PC.
3. Copy a SQL Server database file from a master server to a child server on the Tablet PC.
    a. Request a copy of the SQL data files from the server on which it is kept. The FAC IT Administrator will have to access the data and save it onto a thumb drive. The SQL Server data directory location on the server is as follows:

       C:\Program Files\Microsoft SQL Server\MSSQL.1\MSSQL\Data

        i. Each .mdf file is named according to the database name you see in SQL Server Management Studio Express. Ask the IT Administrator to copy both the .mdf file and the .ldf file, as shown below, onto a thumb drive.

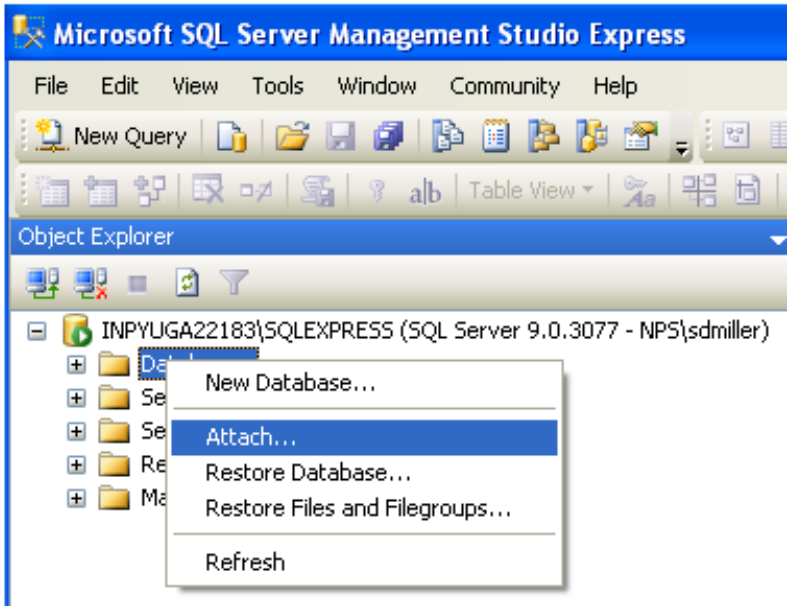


    b. Using the thumb drive, Save the .mdf and .ldf files on the Tablet in the following location:

       C:\Program Files\Microsoft SQL Server\MSSQL.1\MSSQL\Data

       **Note that if there are already AK_ShallowLakes.mdf and AK_ShallowLakes.ldf files in the directory, they should be deleted before the new copies are added.

4. Attach the database file to the field computer's SQL Server
    a. Open the Tablet PC's SQL Server Management Studio program.
    b. Connect to the local SQL Server instance.



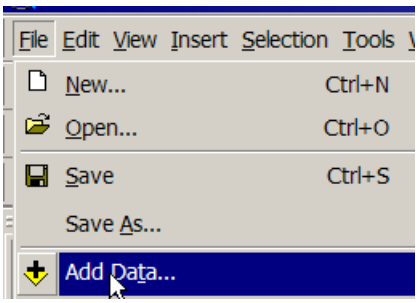
    c. Right click the 'Databases' node
    d. Select 'Attach…'
    e. Click 'Add…'
    f. Navigate to the .mdf file you would like to attach.
    g. Click 'OK'. The SQL Server will attach the database.
5. Connect the SQL Server database to the Access front end
    a. Use the steps outlined in Instruction Sheet "Connecting SQL Server to Access Database" to connect the SQL Server data to the Access front end.

Manual Lake Delineation

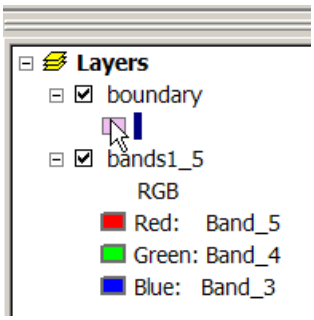
In some cases, lakes must be manually delineated in GIS using imagery. While the NHD works well for creating a polygon file for inventory (as described in Instruction Sheet "Lake Inventory Using NHD"), it may not be appropriate for lake area change studies. When it is vital to have very accurate representations of lake area at a given time, shorelines must be delineated manually.

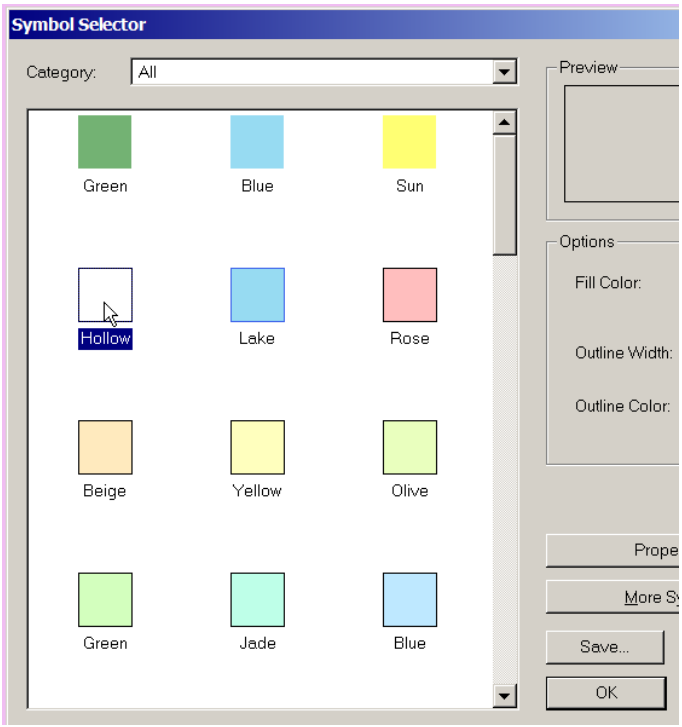
Imagery

1. Start ArcMap
2. Add an image by selecting *Add Data* from the *File* menu and navigating to the folder containing the desired image (refer to SOP 3: Acquisition of Recent Imagery and SOP 4: Image Rectification for details on appropriate imagery to use).

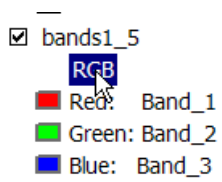


3. Add the park boundary to the ArcGIS project by selecting *Add Data* from the *File* menu, and browsing to the folder containing the park boundary GIS theme. This layer may also be accessed using the NPS Theme Manager. Click the *Add* button to add the layer to the data frame.
4. Change the symbol properties for the boundary polygon, so that it is hollow
   a. Double-click on the polygon symbol of the park boundary to change it from a solid color to a hollow polygon
   b. Select the Hollow Symbol from the Symbol Selector window, then click the OK button



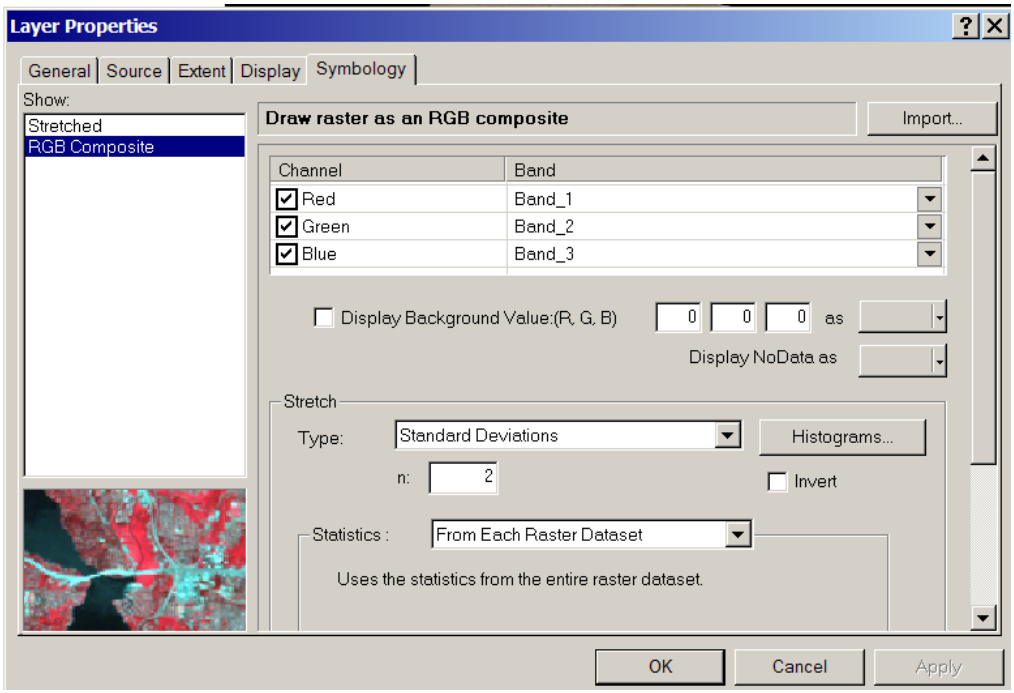


5. Change the image display for the raster image.

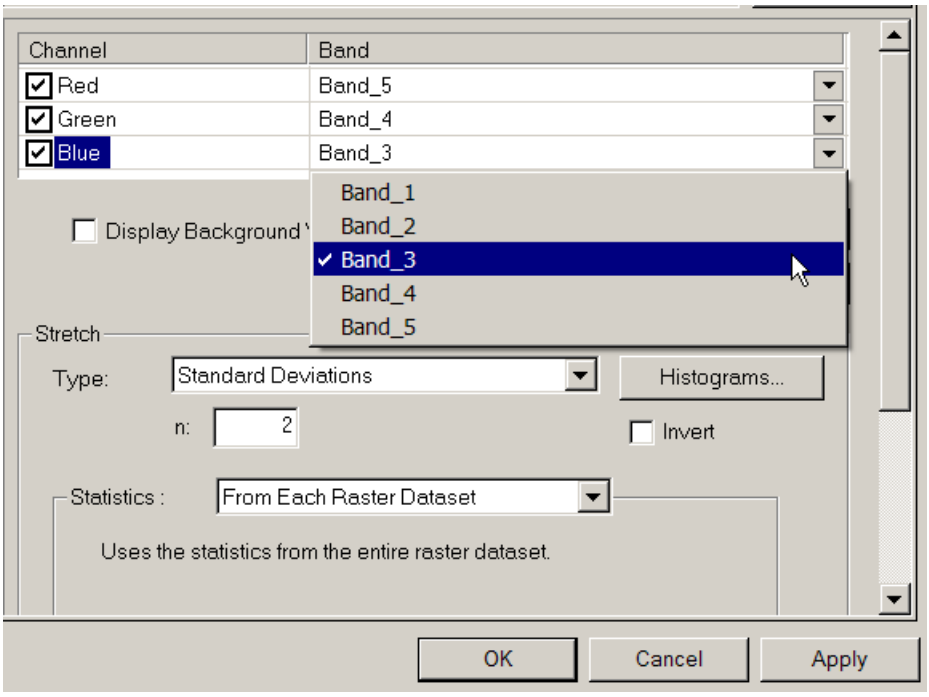


   a. Double-click the RGB heading for the layer in the Table of Contents to access the raster layer properties window

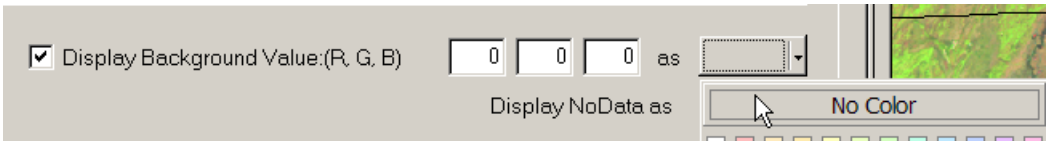
   b. Change the red, green, and blue assignments to Band_5, Band_4, and Band_3.



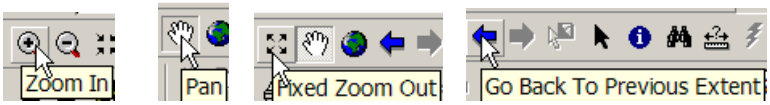
The mid-infrared Band5 controls the red video intensity, the near-infrared Band4 controls the green video intensity, and the red Band3 controls the blue video intensity.



Click the *Apply* button to display the image using these spectral bands. Specify that areas outside the image will be displayed as no color, then select *OK* to apply settings.



6. Navigate to the study area, using the Zoom In, Pan, Zoom Out, and Go Back buttons to navigate within the image.

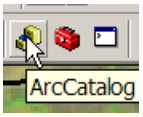


Delineating Shallow Lakes

A shallow lake is defined as a lake with an area greater than one hectare, and less than 50 hectares. In this procedure, the user creates an empty polygon GIS theme and then delineates shallow lake polygons by tracing the shoreline of each shallow lake. The procedure is more time-consuming than automated image classification, but it allows for more accurate delineation of shoreline boundaries and human interpretation of shallow lakes versus dark non-lake features such as cloud shadows, rivers, or recent burn patches.

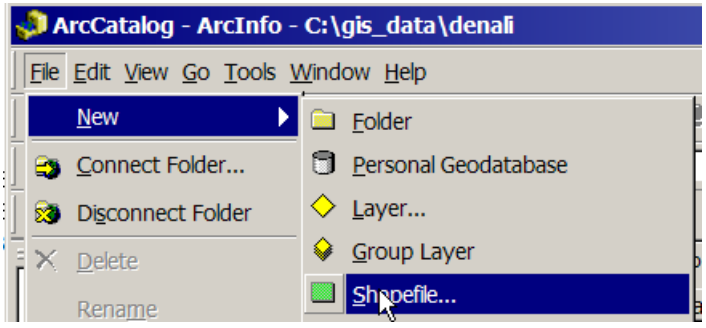
When delineating lakes for the calculation of lake area change over time, refer to SOP 6: Calculating Lake Area Change for additional details.

1. Create an empty polygon GIS theme.



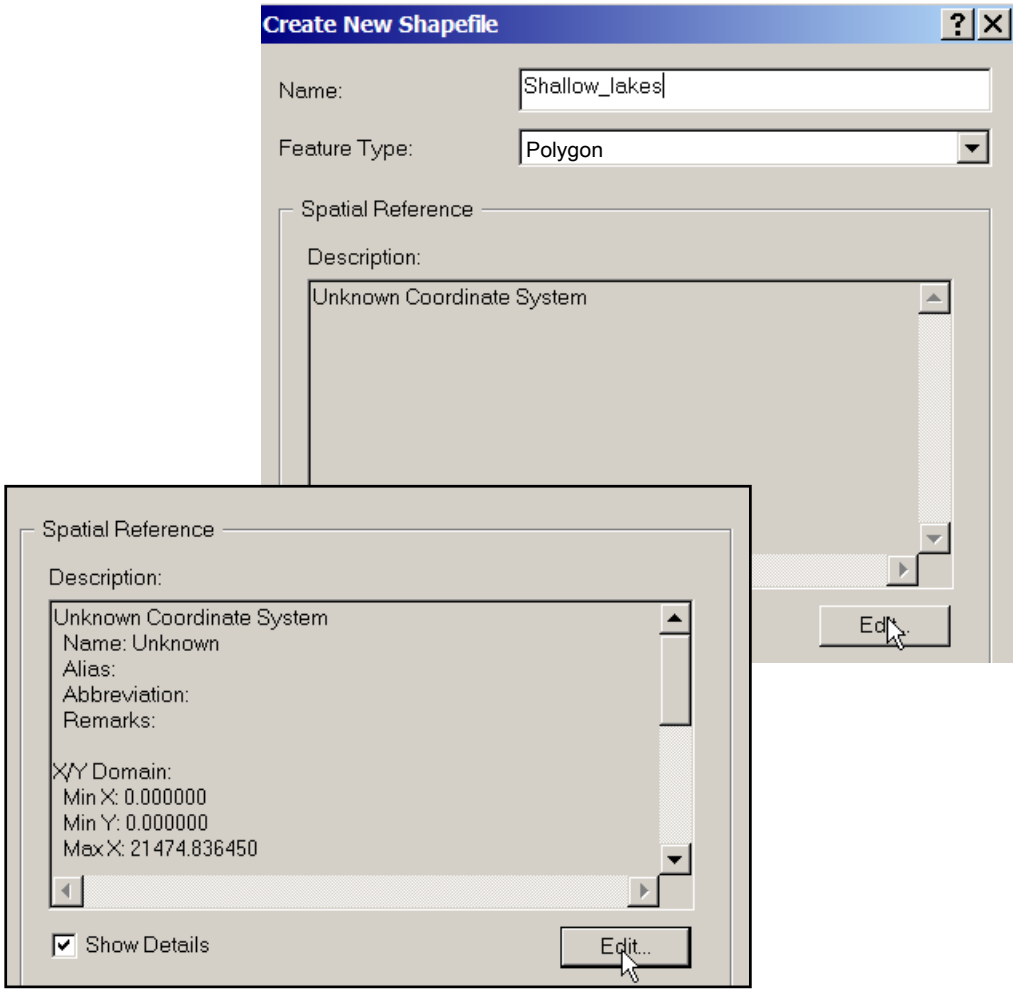
   a. Start ArcCatalog by double-clicking the ArcCatalog icon in the standard ArcMap toolbar.

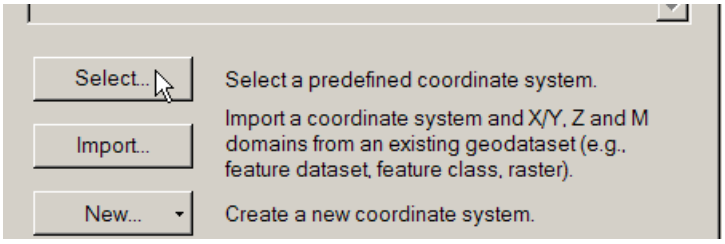
   b. From the ArcCatalog *File* menu, select *New*, then select *Shapefile…*

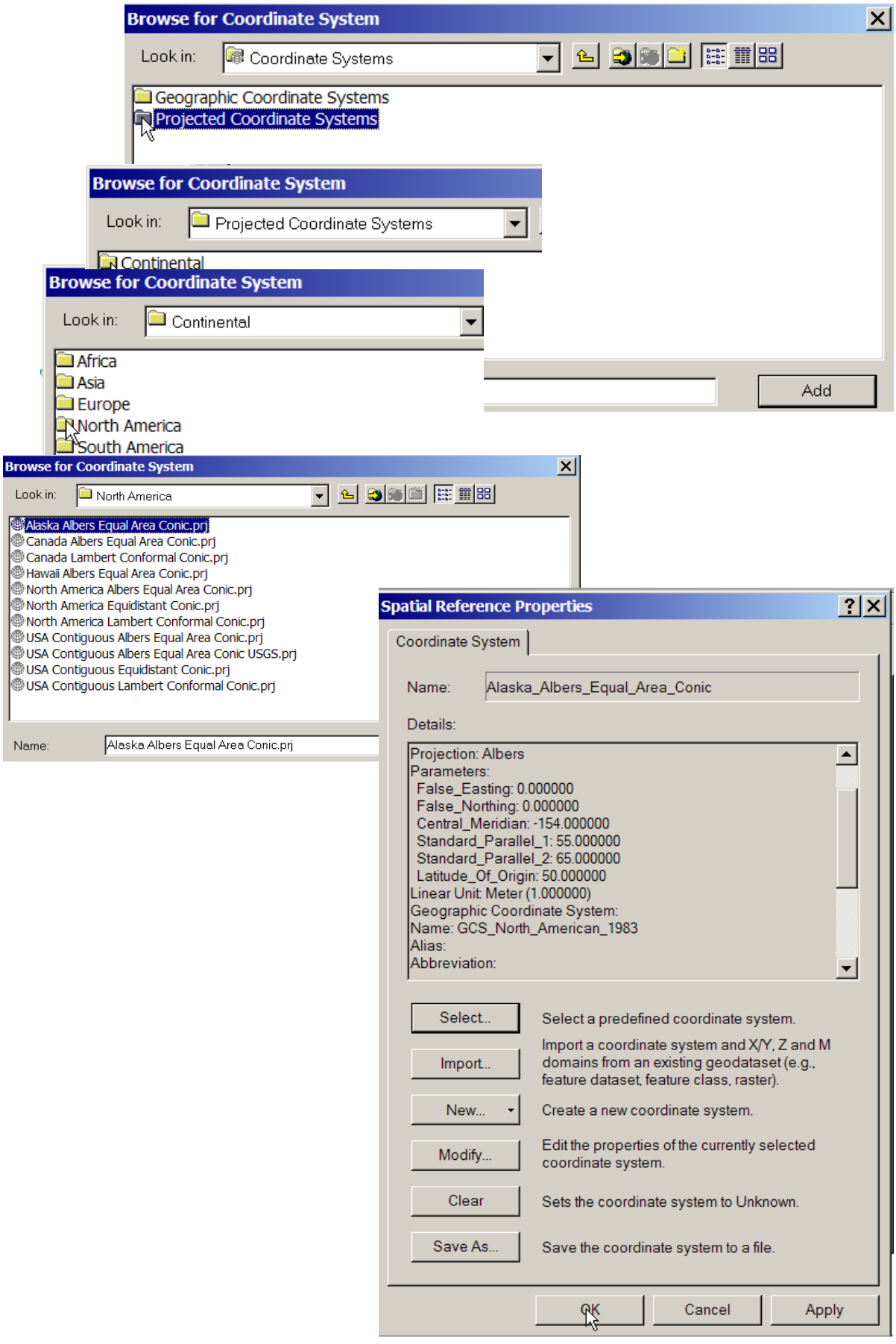


   c. Type in a name (Shallow_Lakes in this example) for the shapefile, and select Polygon as the Feature Type.

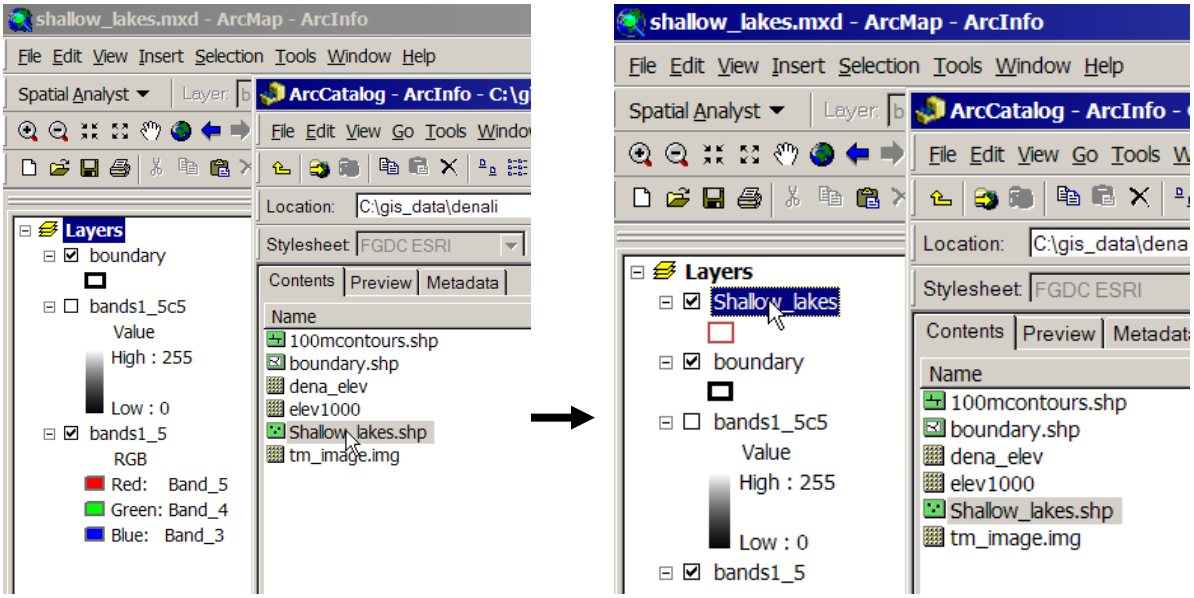
d. Define the projection of the new shapefile by clicking the *Edit* button at the bottom of the Create New Shapefile dialog window. Click *Select* to select a predefined coordinate system, browse to the Alaska Albers Projection, and click the *Add* button. Click *OK* in the Spatial Reference Properties window to apply the projection. Refer to Instruction Sheet "GIS: Alaska Albers Map Projection" for more information on Alaska Albers.






Browse for Coordinate System
Look in: Coordinate Systems
Geographic Coordinate Systems
Projected Coordinate Systems
Add
Browse for Coordinate System
Look in: Projected Coordinate Systems
Continental
Browse for Coordinate System
Look in: Continental
Africa
Asia
Europe
North America
South America
Browse for Coordinate System
Look in: North America
Alaska Albers Equal Area Conic.prj
Canada Albers Equal Area Conic.prj
Canada Lambert Conformal Conic.prj
Hawaii Albers Equal Area Conic.prj
North America Albers Equal Area Conic.prj
North America Equidistant Conic.prj
North America Lambert Conformal Conic.prj
USA Contiguous Albers Equal Area Conic.prj
USA Contiguous Albers Equal Area Conic USGS.prj
USA Contiguous Equidistant Conic.prj
USA Contiguous Lambert Conformal Conic.prj
Name: Alaska Albers Equal Area Conic.prj
Spatial Reference Properties
Coordinate System
Name: Alaska_Albers_Equal_Area_Conic
Details:
Projection: Albers
Parameters:
False_Easting: 0.000000
False_Northing: 0.000000
Central_Meridian: -154.000000
Standard_Parallel_1: 55.000000
Standard_Parallel_2: 65.000000
Latitude_Of_Origin: 50.000000
Linear Unit: Meter (1.000000)
Geographic Coordinate System:
Name: GCS_North_American_1983
Alias:
Abbreviation:
Select...
Select a predefined coordinate system.
Import...
Import a coordinate system and X/Y, Z and M domains from an existing geodataset (e.g., feature dataset, feature class, raster).
New...
Create a new coordinate system.
Modify...
Edit the properties of the currently selected coordinate system.
Clear
Sets the coordinate system to Unknown.
Save As...
Save the coordinate system to a file.
OK
Cancel
Apply

2. Drag the new empty polygon theme from the ArcCatalog window to the ArcMap data frame.



3. Create new shallow lake features by sketching the shoreline of each shallow lake

   a. Select the *Sketch* tool from the *Editor* toolbar Select the Sketch tool, and set the task to Create New Feature in the correct Target file.



   b. Trace the shoreline of the lake to draw the polygon.

   c. Save edits after each polygon has been drawn. Stop editing when all polygons have been added, making sure that all edits are saved.

   d. Save the shapefile in its final form. Make sure that metadata has been entered to indicate the contents of the shapefile.

Preparing Sondes for Longterm Storage

We currently have 4 different models of the YSI Sondes, and each requires slightly different treatment in preparation for storage. The general steps are listed below, followed by specific treatments for some of the Sonde models and Probes with different features. A Longterm Storage Form should be filled out for each Sonde and filed in the Sonde Log Book. Refer also to the YSI Tech Note for the Care, Maintenance, and Storage of YSI 6-Series Probes and Sondes for additional calibration information.

Sonde Preparation

1. Wash the exterior casings of the Sonde (with the calibration cup still attached over the probes) using clean tap water and a sponge. Scrub the probe guard that was attached to the unit during deployment, inside and out, using a long-handled scrub brush.
2. Check for debris in the cable connector socket and use pressurized air to clean out the socket if necessary.
3. Remove the calibration cup from the first Sonde and clean the outside of the sensor probes with clean tap water and a sponge. Take care not to touch the rapid pulse DO sensor membrane if there is one present.
4. Clean the conductivity probe ports using clean tap water and one of the black brushes provided in the YSI maintenance kits. Insert the brush completely into each of the two holes at the tip of the probe 10-15 times.
5. Use a swab and clean tap water to clean the pH sensor tip, including the glass bulb. Take care not to wedge the swab too tightly between the glass bulb and the probe casing.
6. Ensure that the logger has been stopped.
    a. Connect the Sonde to a MDS 650 unit. Under the Sonde Menu, select Run – Unattended Sample – Stop Logging and confirm the stop.
    b. Return to the Sonde Menu, and select Status to verify that the logging status is Inactive.
7. If there are optical probes on the unit, clean the optics (there is an option on the run screen).
8. Test the pH and conductivity probes using calibration standards. Record the readings, and calibrate the sensors. Take note of any unusual readings, so that probes can be sent away for repair or replacement in preparation for the next season.
9. Remove the pH probe using the metal installation tool from YSI. Clean the probe further if necessary. Fill a pH probe storage container with pH 4 buffer solution, insert the probe, and secure using the ring cap with an O-ring. Label the probe with the serial number of the unit from which it was taken. Ensure the connection socket on the probe is clean and dry, then cap with one of the clear plastic sleeves provided. Note that the probes cannot be removed from the 600QS. See Special Treatments section below for further instructions.
10. Remove the turbidity probe if present. Clean the probe further if necessary. Label the probe with the serial number of the unit from which it was taken. This probe is stored dry. If desired,

this probe can also be left attached to the bulkhead and stored wet with the DO and Conductivity probes, but storing dry minimizes probe degradation.

11. Check the remaining probes to make sure they are clean. If there is a rapid pulse DO probe, check to make sure that the membrane is intact and filled with electrolyte. If the membrane is damaged or otherwise compromised, remove it and replace the electrolyte and membrane. Do not store a rapid pulse DO probe without a membrane installed or with low levels of electrolyte.
12. Ensure that the sockets in the bulkhead dry completely before inserting plugs. If there is moisture in the sockets, drape the remaining probes loosely with wet paper towel and slide a plastic bag over the probes, keeping the remaining probes humid while allowing the empty sockets to dry thoroughly. Compressed air can also be used to help dry the sockets. Once they are completely dry, insert port plugs into the sockets and tighten them securely. Do not over-tighten the plugs, as they can break inside the socket.
13. Test the DO probe by adding a small amount of water to the bottom of the storage cup and setting the Sonde in without twisting the cap on. Allow the unit to sit for 10 minutes so that the air can saturate with water. Calibrate the probe. If there are unusual readings, replace the membrane and re-check. Take note of any persistently unusual readings, so that probes can be sent away for repair or replacement in preparation for the next season.
14. Fill the storage cup with clean tap water, and screw it tightly to the bulkhead to prevent evaporation and drying. For long-term storage, the DO sensor should be submersed in water, not just be kept in a humid environment. Tap water is better than DI or distilled water.
15. Remove the batteries from the Sonde.
16. Store the Sonde hanging by its bail in a cool, dry place.
17. It is a good idea to check on the Sondes periodically while they are in storage to make sure that the caps still contain sufficient water levels. Add water if necessary.

Special Treatments and Considerations

- The 6920 version 1 unit has depth sensors, including a pressure port accessed by small holes on either side of the unit just above the bulkhead. This should be flushed with clean tap water using one of the syringes provided in the YSI maintenance kit. Push the water into one hole using the syringe until the water being expelled from the other hole runs clean.
- The 600QS units do not have removable probes. The unit and probes should be cleaned as described above, and the probes tested against calibration solutions. The Nalgene bottle provided for storage should be filled with 350 mL of 2M KCl, and the bulkhead end inserted (with the probe guard attached) into the bottle so that all of the probes are submerged in solution. The ring cap should be tightened, using an O-ring to ensure a good seal. The area around the ring cap (including the adjacent parts of the Sonde unit above and the bottle below) should be wrapped with parafilm to further limit evaporation. Replacement O-rings are available from YSI (item number 063241). 2M KCl is available from VWR (100219-982 for 1L; 100219-992 for 500 mL; manufactured by Teknova).

Trimble Data Collection

The Trimble Data is currently collected predominantly with the Shallow Lakes Trimble GeoXT 2008 GPS unit, but in some cases, units are borrowed from other sources that may be of different models. The software on all of the units are the same, however, so the actual data collection techniques should be consistent across the different models of Trimble GPS units used in this project.

Note that it is possible to edit any closed file by selecting "Existing File" in the Data Screen, and opening the file requiring additions. You can either change the already collected features (select Update Features), or add additional features (select Collect Features) in this screen.

For general information on Trimble operation, see SOP 12: Using the GPS.

Three different files are created using Trimble Data Dictionaries:

1) Monuments
2) Depths
3) VegMat

Monuments

Monument Features

1. Turn on the Trimble unit and open TerraSync from the Start Menu
2. Navigate to the Data screen, and Create New Data File using the current Lake_Mon data dictionary. For the filename, use the lake name followed by the letter m (i.e. WRST-001m).
3. Click Create, and set the antenna height. For areas with low topography and/or vegetation cover, the unit can be placed directly on the monument cap, so the height would be close to zero. In general, it is best to have the GPS unit elevated, and this is particularly important in areas with variable topography or tall vegetation. Set the unit on a tripod above the monument, and set the height accordingly.
4. When the Trimble is in place, highlight Monument in the Feature Name column and click the Create button. Enter the Lake Number and information about the monument location into the appropriate fields. Be sure to include any site descriptions that will assist future observers in relocating the monument. If it is not comfortable or convenient to enter the data while the unit is in place, press the Pause button to suspend logging while entering the data. Press Log to start logging positions again when the unit is in place and stable. To get the most accurate position for the monument, it is very important to keep the unit still while it is logging.
5. Allow the GPS unit to collect positions for a few minutes. Click OK to close the feature. If no positions have been collected, do not store the feature (Click No), and go back to the collection screen until positions have been logged. In some areas it may be necessary to elevate the unit higher in order to improve satellite reception.
6. When you are finished collecting the monument feature, close the file.

Photo Point Features

1. With the monuments file open, hold the Trimble in the place where the photo point should be, highlight PhotoPt in the Feature Name column, and click the Create button.
2. Enter a descriptive title for the photo point, the initials of the photographer, and any comments or additional information desired.
3. Verify that the GPS has collected location data for the feature, and click OK to close the feature. If no positions have been collected, do not store the feature (Click No), and go back to the collection screen until positions have been logged. In some areas it may be necessary to elevate the unit higher in order to improve satellite reception.
4. When you are finished collecting the photo point, take the photos that will be tagged with the photo point. If photos were taken before the photo point was collected, note this in the PhotoPt feature comments, so that the geotagging settings can be adjusted accordingly. Likewise, if the photos are not taken until several minutes after the photo point, make note of this so that the window for geotagging can be extended to include all of the appropriate photos.
5. Additional photo point features may also be collected in the same file. When all photo points have been collected, close the file.
6. Photo point features may also be collected for points unrelated to a particular lake site (they do not need to be included in the monument file for a sampling lake). Create a new file, with a descriptive name (for clarity a "p" can be added to the end of the file name, if desired), and collect the photo points.
7. If a monument file for a sampling lake was already created and closed, photo points at that lake can be added in later by navigating to the existing file to update it:
    a. In the Data screen, select Existing File from the drop-down menu
    b. Highlight the desired file, and click the Open button
    c. Confirm the antenna height
    d. In the Update drop-down menu, select Collect Features
    e. Select PhotoPt from the Feature list, and click the Create button

Depths

Depth Features

1. Turn on the Trimble unit and open TerraSync from the Start Menu
2. Navigate to the Data screen, and Create New Data File using the current Lake_Depth data dictionary. For the filename, use the lake name followed by the letter d (i.e. WRST-001d).
3. Click Create, and set the antenna height (about 30-50 cm would be appropriate).
4. When you reach a location, highlight Depths and click the Create button. Enter the depth in meters, and any comments. The SampleNum field is only used to mark the locations of water chemistry sites, where samples and profiles are collected.
5. Click OK to close the feature. If no positions have been collected, do not store the feature (Click No), and go back to the collection screen until positions have been logged. You may need to lift the unit up high in order to improve satellite reception.
6. Repeat steps d and e for each bathymetry point. When you are finished collecting depth features, close the file.

Secchi Features

1. Paddle to the deepest part of the lake and take a Secchi depth measurement.
2. With the depths file open, highlight Secchi in the list of features, and click the Create button.
3. Enter the lake depth at the point where the Secchi measurement was taken, and enter the Secchi depth measurement. Also indicate if the Secchi disk was visible all the way to the bottom of the lake (there is an OnBottom drop-down menu that should be changed to Yes if the disk is still visible on the bottom). The default setting for OnBottom is No. Enter any comments.
4. Click the OK button to close the feature. If no positions have been collected, do not store the feature (Click No), and go back to the collection screen until positions have been logged. You may need to lift the unit up high in order to improve satellite reception.

VegMat

1. Turn on the Trimble unit and open TerraSync from the Start Menu if necessary
2. Navigate to the Data screen, and Create New Data File using the current VegMat data dictionary. For the filename, use the lake name followed by the letter v (i.e. WRST-001v)
3. Click Create, and set the antenna height (usually about 1.3 m is appropriate).
4. Move to the first sampling point. This is the 0 m location along the first transect nearest the monument. Hold the GPS unit over that point, select the veg point feature type, and click the Create button. Enter the transect number, and the various depths as measured with the avalanche probe (see next step for details), and click OK to close the feature. Note that if the unit needs to be moved off of the sampling point, press the Pause button to stop logging. If the same person is operating both the probe and the Trimble unit, it may work best to collect a good position, then pause the logging while performing the measurements and entering the data.
5. At each point, make the following measurements:
    a. Water depth: the depth of standing water above the vegetation.
    b. Mat depth: the depth of the vegetated layer or thickness of the floating mat. Push the probe through the vegetation until you reach the soil surface beneath. On floating mats, push the probe through the vegetated mat until it breaks through to the water layer beneath, then pull up, testing the resistance, to determine where the approximate bottom of the mat lies.
    c. Bottom depth: the bottom of the lake (sediment surface). Continue to push the probe through until you meet slight resistance, this is likely the beginning of sediment on the bottom of the lake.
    d. Maximum penetration: the maximum depth to which the probe can be pushed. Continue to push the probe through the sediment until you can no longer push without breaking the probe. If the maximum penetration is deeper than the 3 m length of the probe, enter 3 and make a note in the comments field.
6. Continue this procedure every 2 m along the transect until the end of the transect, or until it is no longer safe to sample.
7. Repeat the process on the other two transects, making sure to enter the transect number properly for each feature.
8. When you are finished collecting the monument feature, close the file.

Trimble Data Dictionaries

Data Dictionaries are standardized forms used for collecting data in Trimble GPS units. The Shallow Lakes project uses three different data dictionaries: Lake_Depth, Lake_Mon, and VegMat.

The Lake_Depth data dictionary is used for collecting data while out on the water, including bathymetery measurements, Secchi depth entries, vegetation patches, the location of water samples, and any comments noted while out on the water. The Lake_Mon data dictionary is used for reference markers, including the location of benchmarks, and reference points for specific photographs. The VegMat data dictionary is for the entry of data collected during vegetation profiles.

For details on the actual collection of data using these data dictionaries, refer to Instruction Sheet "Trimble Data Collection".

Creating and Editing Data Dictionaries

Data dictionaries can be created and edited either by using the Data Dictionary Editor included in Pathfinder Office, or in TerraSync on the GPS unit.

Pathfinder Office Data Dictionary Editor

It is generally easiest to create or edit data dictionaries before the start of the field season, using Pathfinder Office software.

1. Open Pathfinder Office and select *Data Dictionary Editor* from the *Utilities* menu.
2. To create a new dictionary:
   a. Fill in the Name field in the Untitled – Data Dictionary Editor window. This will be the name of the data dictionary, and should be short and informative. A comment may be added as well, but this is only for on-screen reference; it is not exported with the data.
   b. Save the file in the appropriate folder (by year) in:
      J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\Data Dictionaries
      *It is easiest if the Data Dictionary Editor name and the file name match
      *Save the dictionary often as features and attributes are added
   c. Click the *New Feature* button at the bottom of the screen
   d. Enter the feature Properties (in the Properties tab)
      i. Enter a name for the feature, using a maximum of 8 characters
      ii. Enter a comment if desired; this is for on-screen reference only; it is not exported with the data
      iii. Select the Feature Classification type (Point, Line, Polygon)
   e. Enter the Default Settings (in the Default Settings Tab)
      i. In general, the Time should be set to 1 second, unless creating large lines or polygons that don't require particularly high resolution.
      ii. In general, the Minimum Positions can be left at 5
   f. Enter Symbol settings (in the Symbol Tab) if desired
   g. When all settings have been entered, select *OK*; the feature will be added to the list of Features

h. Attributes can be added to each feature by highlighting the desired feature, and clicking the *New Atrribute* button.
    i. Select the attribute Type (one of the following list), and click *Add*
        1. Menu – letters, numbers, or other characters. Can select only one value (use only for fields where entries are limited to a set list of values and no others can be added)
        2. Numeric – numbers only, with decimals possible
        3. Text – letters, numbers, or other characters. Limited only by character limit settings (the maximum is 100 characters).
        4. Date – collects a date value
        5. Time – collects a time value
        6. File Name – collects a file name
        7. Separator –added to break up the list of attributes and increase readability; they are not attributes and do not contain attribute values.
    ii. Name the attribute, using a maximum of 10 characters
    iii. Enter a comment if desired; this is for on-screen reference only; it is not exported with the data
    iv. For menu attributes, create a list of options by clicking the *New* button to activate the New Attribute Value window. Add each desired value, limiting the Attribute Value field (the name displayed as the menu option) to 20 characters. Any characters may be used, including spaces.
    *It may be wise to include an "Other" option for unusual circumstances where none of the pre-defined options are appropriate.
    *To set a default menu value, select the *Default* check box when entering the attribute that will serve as a default.
    *To change any of the entered Attribute Values, or to change the default setting, double-click the value to be edited to open the Attribute Value window.
    v. For numeric attributes, be sure to set the appropriate number of decimal places, and the minimum and maximum values. Take care to set the minimum and maximum values to reasonable levels, allowing for the full range of plausible values.
i. Features and Attributes may be edited by clicking the appropriate *Edit* buttons.
j. When all features and attributes have been entered, be sure to Save the data dictionary file.

3. To edit an existing dictionary:
    a. Select *Open* from the *File* menu (or click the Open icon on the toolbar) in the Data Dictionary Editor window.
    b. New features or attributes can be added by clicking the *New Feature* or *New Attribute* buttons
    c. Existing feature or attributes can be edited by highlighting the feature or attribute to be edited and clicking the appropriate *Edit* button.

TerraSync

In some cases, changes will need to be made to data dictionaries while out in the field. In some cases, errors occur when data dictionaries are loaded onto Trimble GPS units; a common error is that range values for numeric fields are all changed to 0, which prevents any numeric data from being entered. If you are in the field, and find that a data dictionary requires editing, or if you need to create a new data dictionary, these functions can be performed in the field directly on the GPS unit.

1. Open TerraSync and select *Data* from the drop-down menu in the upper left corner.
2. Select *Manager* from the lower drop-down menu, and set the "Choose Field Type" field to *Dictionaries*.
3. To create a new dictionary:
    a. Select *New dictionary* from the *Options* drop-down menu
    b. Click the *Edit* menu at the bottom of the screen, and select *New Feature*
    c. Enter the feature Properties (in the Properties tab)
        i. Enter a name for the feature, using a maximum of 8 characters
        ii. Enter a comment if desired; this is for on-screen reference only; it is not exported with the data
        iii. Select the Feature Classification type (Point, Line, Polygon)
    d. Enter the Default Settings (in the Default Settings Tab)
        i. In general, the Time should be set to 1 second, unless creating large lines or polygons that don't require particularly high resolution.
        ii. In general, the Minimum Positions can be left at 5
    e. Enter Symbol settings (in the Symbol Tab) if desired
    f. When all settings have been entered, return to the Properties tab and select *OK*; the feature will be added to the Edit dictionary page.
    g. Attributes can be added to each feature by highlighting the desired feature, and selecting *New Atrribute* from the *Edit* menu.
        i. Select the attribute Type, and click *Add*
        ii. Name the attribute, using a maximum of 10 characters
        iii. Enter a comment if desired; this is for on-screen reference only; it is not exported with the data
        iv. For menu attributes, create a list of options
        v. For numeric attributes, be sure to set the appropriate number of decimal places, and the minimum and maximum values. Take care to set the minimum and maximum values to reasonable levels, allowing for the full range of plausible values.
    h. When all features and attributes have been entered, return to the main Edit dictionary page, and click the *Save* button
4. To edit an existing dictionary:
    a. Highlight the dictionary to be edited, and select *Edit dictionary* from the *Options* drop-down menu
    b. New features or attributes can be added, using the appropriate selection from the *Edit* menu
    c. Existing feature or attributes can be added by highlighting the feature or attribute to be edited (you may need to expand the list of features and attributes by clicking the +/- icons to the left of the list of features), and using the appropriate selection from the *Edit* menu

Data Dictionary Tips

1. While required fields may be a useful tool for standardizing data entry, use caution when setting fields to be required, as a value MUST be added for the feature to be collected.
2. Always add a comment field for each feature. It is sometimes difficult to foresee issues that may arise in data collection, and this ensures that there is always a place for notes to be recorded if the entry involves any peculiarities.

Loading Data Dictionaries

Data dictionaries must be loaded onto Trimble GPS units being used for data collection. It is very important to ensure that the most recent version of the data dictionaries being used are loaded onto each GPS unit before sending crews to the field to collect data. The master versions of data dictionaries are housed in J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\Data Dictionaries. Previous versions are moved to a folder labeled with the appropriate year.

To load data dictionaries, use the Data Transfer Utility in Pathfinder Office. Alternatively, if the GPS unit is already out in the field, and the required data dictionary has not been loaded, it can be extracted from another file on the unit that was collected with the desired data dictionary.

Pathfinder Office Data Transfer Utility

1. Connect the Trimble GPS unit to the computer
   a. Place the Trimble unit on its cradle, and connect the cradle to the PC with a USB cable
   b. Microsoft ActiveSync must be installed on the PC for recognition of the Trimble unit. Note that the ActiveSync need not be configured for use; cancel out of the Pocket PC Sync Setup Wizard when prompted.
2. Open Pathfinder Office and select *Data Transfer* from the *Utilities* menu.
3. Check that the Device field is set to GIS Datalogger on Windows Mobile
4. Select the *Send* tab, and click the *Add* button
5. Select *Data Dictionary*, and navigate to the desired data dictionary file
   a. Multiple data dictionary files can be selected for transfer
   b. Check that all of the desired data dictionaries are listed in the *Files to Send* window
6. Click the *Transfer All* button to load the data dictionary files onto the Trimble GPS unit

Extracting Data Dictionary from Datafile

1. Open TerraSync and select *Data* from the drop-down menu in the upper left corner
2. Select *Manager* from the lower drop-down menu, and set the *Choose Field Type* field to *Data Files*
3. Locate the datafile to serve as the source for the data dictionary (this should be a file collected using the data dictionary desired for extraction)
4. Under the *Options* drop-down menu, select *Read dictionary from data*
5. Enter a name for the extracted dictionary in the *Create dictionary file:* field (the default is the file name of the source file), and click the *OK* button
6. The extracted dictionary is now available for use for data entry. It also appears in the list of Data Dictionary files, and can be edited if necessary.

Trimble Data Processing

Because the Trimble software is frequently updated, and the procedures for processing data tend to change regularly, the most recent protocols developed for GPS: Trimble Pathfinder Systems (Course No. 1730-56) should be used. Contact the GIS program in the Alaska Regional Office of the National Park Service for course information and materials.

1. Download Data
    a. Place the GPS unit on the cradle, plug in power to cradle, and connect cradle to PC using USB cable. Note that Microsoft ActiveSync must be functional on the computer, along with GPS Pathfinder Office software, in order to transfer files properly. If ActiveSync does not recognize the unit, try popping the unit out of the cradle and replacing it.
    b. Open GPS Pathfinder Office software and select the project for working in. If the data will be part of a new project, click the New button to establish a new project, and add the appropriate project folder. The data should be housed in J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY\PARK (i.e. \2009\WRST) and the project name should be PARK_YYYY (i.e. WRST_2009)
    c. Open TerraSync on the Trimble unit and navigate to the Data screen (the upper drop-down box in the top left of the screen has a "Data" option)
    d. View the Existing Files on the Trimble unit (the lower drop-down box in the top left of the screen has an "Existing File" option). Verify that all the files to be transferred are properly named and populated (no extra spaces, no missing letter designators (m, d, v), no empty files). If there are errors to fix or changes to be made, navigate to the File Manager (the lower drop-down box in the top left of the screen has a "File Manager" option) and use the Options menu to rename or delete files as necessary.
    e. In GPS Pathfinder Office, click the Data Transfer icon or select Data Transfer from the Utilities menu to open the Data Transfer window (see Instruction Sheet "Trimble Data Transfer" for more information).
        i. Select the Receive tab
        ii. Click the Add button and select Data File
        iii. Select the desired files to transfer from the Open window (multiple files can be selected using the Ctrl and/or Shift keys) and click Open
        iv. In the Data Transfer window, select Transfer All
        v. When the Transfer Completed window opens, click the Close button, and close the Data Transfer window.
        vi. Check the project folder to verify that all files have been downloaded. Files may be viewed in GPS Pathfinder Office, but DO NOT make any edits to the uncorrected .ssf files. Edits should only be made to corrected versions of the data; the original downloads should remain unchanged for future reference.
2. Post-Process Data
    a. Open GPS Pathfinder Office, and select the Project folder you'll be working in.
    b. Under the Utilities menu, select Differential Correction to open the Differential Correction Wizard

c. Select the uncorrected SSF files to be corrected by clicking the + button (multiple files can be selected using the Ctrl and Shift keys), click Next
d. Processing type: Automatic Standard Carrier and Code Processing (if using our GeoXT)
e. Correct settings (if these do not match the following, click the Change button to edit):
    i. Standard rover processing
    ii. Rover filtering with data collection settings
    iii. Do not correct velocity records
    iv. Re-correct real-time code positions
    v. Standard audit files
    vi. Standard base processing
f. Base Data
    i. Select Base Provider Search, and click the Select button
    ii. Click the Update List button halfway down the window to get the newest data
    iii. Whenever possible, use a CORS station; highlight the base closest to the area with the highest integrity index.
    iv. Click the Properties button under Base Provider, and click the Go To button next to the web page listing. For CORS sites, this will open the National Geodetic Survey – CORS website.
    v. Enter the CORS Site ID (4 letter code found in brackets after station name) in the field before the Enter SiteID button, and click the button
    vi. In the sidebar, click the Coordinates link, and scroll down to the L1 Phase Center data. Verify the ITRF00 Position (Epoch 1997.0) latitude and longitude match the coordinates listed in the Base Provider Properties window under the Base Station tab. Click the OK button in the Base Provider Properties window. If the coordinates don't match, use a different base station and contact the AKRO GIS shop to report the problem.
    vii. Click OK in the Select Base Provider window
    viii. Under the Reference Position section, select Use reference position from base provider (it automatically enters the station selected above).
    ix. Check the box beside "Confirm base data and position before processing".
    x. Click the Next button to start the base file download.
g. For the Output folder, Use the project folder
h. For the Output filename, Create a unique filename based on the input filename
i. Click Start to begin differential correction
j. Once the base station files have been downloaded, check that the rover files each have 100% total coverage, and click Confirm to continue.
    i. If there is no coverage from the base station for any of the files, use the back button to re-select only the .ssf files that have coverage. For the .ssf files with no coverage, the differential correction will have to be done again using a different base station.
k. Examine the summary to check for adequate accuracy, and click the Close button.

3. Check corrected data files using GPS Pathfinder Office
    a. In the GPS Pathfinder Office screen, open the Map, the Feature Properties, and the Position Properties windows and arrange them so that all three are visible.
    b. Open a newly corrected .cor file

c. In the View menu, select Layers – Features and change the symbology of the Not In Feature feature to a bold color and greater thickness. Click OK and check to see if any Not In Feature points are visible on the map.
    i. If there are Not In Feature points visible, zoom in and use the erase tool to remove the position. This step is not particularly important, because you can set the Export Setup Properties so that Not In Feature Postions are not included in the files exported to ArcGIS (in the Data tab, make sure that the Include Not In Feature Positions box is unchecked).
d. In the Feature Properties window, click the First button, and then scroll through each of the features in the file. Take note of the Standard Deviation values; if they are more than 1.5 times the specified accuracy of the unit, there may be something wrong, and the differential correction should be re-done (note that for some measurements where drifting may have occurred during position collection, such as bathymetry, the Standard Deviations may naturally be higher than expected). If the Standard Deviation values are all 0, differential correction should be re-done using Code Only (rather than Carrier & Code).
e. If there are errors in any of the Attribute Values, they can be edited in the Feature Properties window under the Attributes tab.
f. If any changes are made to the file, save the file with a different name indicating that it's been edited.

4. Export data to ArcGIS
    a. Under the Utility Menu, select Export
    b. Select the files for Export using the Browse button
    c. The Output folder will default to the project's Export folder
    d. Choose an Export Setup (HK NPS Export Settings), or create a new setup
        i. Format: ESRI Shapefile
        ii. Type of Export: Features – Positions and Attributes
        iii. Output Option: Combine and output to Export folder
        iv. System: US Continental
        v. Zone: Alaska Albers 1983 (CORS96)
        vi. Datum: NAD 1983 (Conus) CORS96
        vii. Altitude Reference: Mean Sea Level (MSL) – GEOID03 (Alaska)
        viii. Coordinate Units: Meters
        ix. Altitude Units: Meters
    e. Click OK to Export the files
5. Open ArcCatalog and navigate to the Project Export folder to ensure Spatial Systems are correct
    a. View the contents of the Export folder so that the shapefiles are listed in the window on the right.
    b. Double-click the first new shapefile to open the Shapefile Properties window.
    c. Verify that the XY Coordinate System is set to NAD_1983_Alaska_Albers. If it is not, click the Select button and select Projected Coordinate Systems – Continental – North America – Alaska Albers Equal Area Conic.prj
    d. Click OK
    e. Repeat this process for all of the new shapefiles.
6. Add metadata for the new files in ArcCatalog

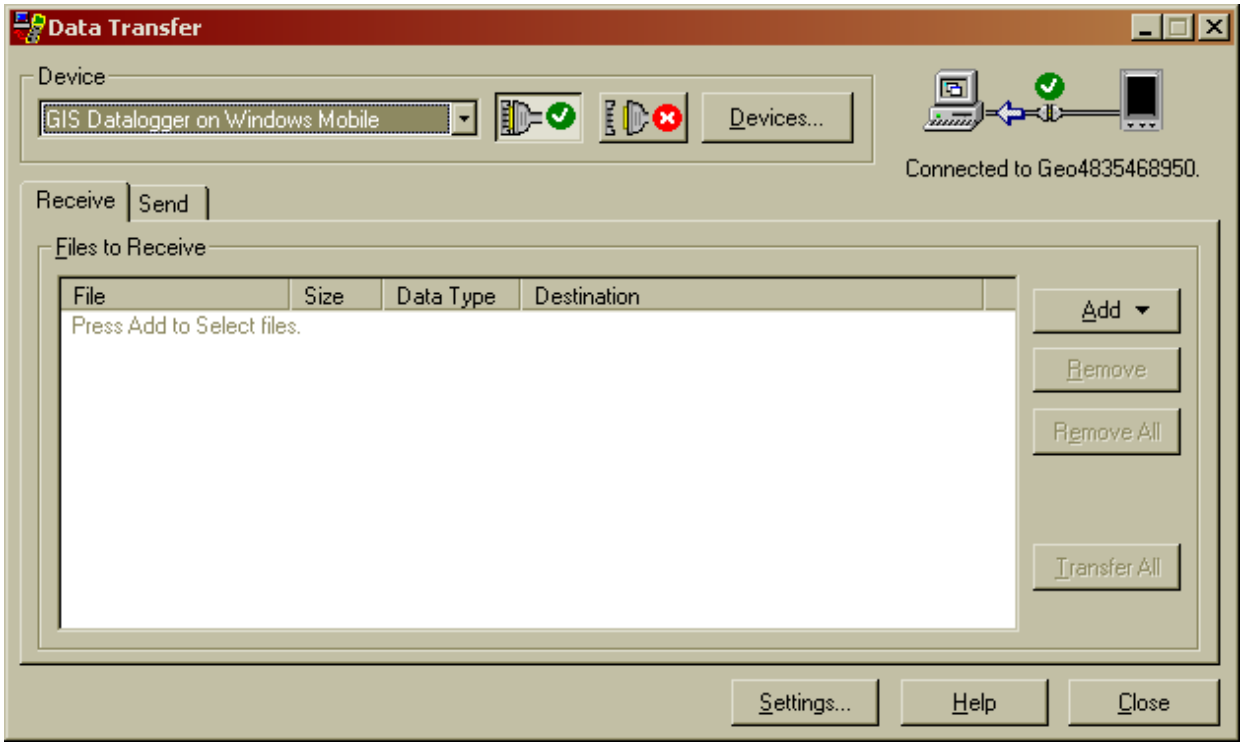
a. Select a shapefile and view the Metadata tab
b. Click the Import Metadata icon in the Stylesheet Toolbar
    i. Click the Browse button to locate the appropriate .xml file in J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\Metadata
    ii. Select DepthsMetadata, MonumentMetadata, or VegMatMetadata
    iii. Choose the FGDC CSDGM (XML) format
    iv. Click OK
c. Click the Edit Metadata icon in the Stylesheet Toolbar, and update the metadata as necessary (change keywords, park names, Trimble unit types, contact persons, base stations used, collection and processing dates, etc.). Make sure that all tabs are checked under all of the menus at the top of the Editing window.

7. Change the names of the new shapefiles to reflect the year and park
    a. In ArcCatalog, click twice on the file name to rename, or right click and select Rename
        i. PARK_YYYY_Depths
        ii. PARK_YYYY_Monuments
        iii. PARK_YYYY_VegMat
8. Add shapefiles to project
    a. Each Park should have an ArcMap project for each year work is done in the park. This project should contain the most helpful base imagery, the park outline, the GRTS sample file used for field sampling, the shapefiles for bathymetry, monuments, and veg points, and the GPS-Photo Link shapefiles for the park.
    b. Add the new shapefiles by clicking the Add Data icon or selecting Add Data from the File menu. Select the desired files from the appropriate folders in J:\Monitoring\Water_Quality_Macroinvert \TrimbleData\PARK\Export and click Add.
9. Check and edit the data in the Trimble Files
    a. See Data Processing Checklist
10. Create layer files for final versions of shapefiles
    a. Once all changes are made to each shapefile (symbology, labeling, QAQC, etc.), save as a layer file in J:\Monitoring\Water_Quality_Macroinvert\GIS***PARK***\FinalLayers
        i. Right click on the layer in the TOC and select Save As Layer File
        ii. Use the same naming convention as for the shapefiles
    b. Replace the shapefiles used in the project with the layer files
        i. Remove the shapefiles for Monuments, Depths and VegMat
        ii. Click the add data button and select the new layers
11. *This layer file is linked to the original shapefile used to create the layer.* It merely saves the formatting (such as symbology, labeling, appearance in TOC, etc.) in connection with the shapefile so that the shapefile has the same appearance every time it's added to a project. *Be aware that when data is changed in the attribute table of the layer, it will update immediately in the source shapefile as well. Similarly, any changes made to the data in the attribute table of the source shapefile are immediately reflected in the layer file in the project after refresh.*
12. Load data into geodatabase (J:\Monitoring\Water_Quality_Macroinvert\GIS\Geodatabase\AKShallowLakes.gdb)
    The protocol for storing data in the geodatabase has not yet been developed. This section will be updated as information becomes available.

Trimble Data Transfer

In order to properly transfer data between computers and Trimble GPS units, Microsoft ActiveSync and Pathfinder Office must be installed on the computer. It is also important to ensure that the versions of TerraSync on the Trimble GPS units and the version of Pathfinder Office on the computer are compatible. In some cases, certain functions become incompatible if one form of software is updated and the other is not.

1. Connect the Trimble GPS unit to the computer
   a. Place the Trimble unit on its cradle, and connect the cradle to the PC with a USB cable
   b. Microsoft ActiveSync must be installed on the PC for recognition of the Trimble unit. Note that the ActiveSync need not be configured for use; cancel out of the Pocket PC Sync Setup Wizard when prompted.
2. Open Pathfinder Office on the computer, select the appropriate Project, and select *Data Transfer* from the *Utilities* menu.
3. Check that the Device field is set to *GIS Datalogger on Windows Mobile*



Transferring Data from Computer to Receiver

1. Select the *Send* tab in the Data Transfer window, and click the *Add* button
2. Select the file type (Data File, Data Dictionary, Waypoint, Background, Configuration, Coordinate System, Coordinate System Export File, Other)
3. Navigate to the desired files and double-click individual files to add them.
    a. Many different files, even files of different types, can be added into the *Files to Send* list in the Data Transfer window.
    b. The *Add* button can be clicked repeatedly to add many different files from different folders or locations to the list.
    c. To add several files from one folder at once, the Ctrl button can be held down while each of the desired files are selected.
4. Once all files to be transferred have been added to the list, click the *Transfer All* button

Transferring Data from Receiver to Computer

1. Make sure that the Project settings in GPS Pathfinder Office are appropriate for the data to be transferred. Data should be transferred one park at a time, and the Project should match the Park and the Year of data collection. If there is not an appropriate project, take time to create a project, as described in Instruction Sheet "Trimble Data Processing".
2. Select the *Receive* tab in the Data Transfer window, and click the *Add* button
3. Select the file type (Data File, Waypoint, Almanac)
4. All of the files of the selected type that are currently on the Trimble unit will be displayed in the Open window (the program automatically looks in GIS Datalogger on Windows Mobile)
    a. The files that have never been transferred will be highlighted
5. Select the files to be transferred (the Ctrl button can be used to make multiple selections)
6. Once all files to be transferred have been added to the list, click the *Transfer All* button
7. The files (.ssf) will be transferred into the project folder selected in step 1, and uncompressed versions of the data will automatically be backed up in the Backup folder for the selected project. It is very important to keep these backup files secure in the proper location, as they allow for the data to be re-accessed in the case of any type of corruption caused during transfer or future processing.

Trimble Navigation

To navigate to a point, there must be a target coordinate. This can either be from a file captured by or loaded onto the Trimble GPS unit, or can be manually entered.

Navigating to a File Location

1. Turn on the Trimble GPS unit, and open TerraSync
2. Select *Data* from the drop-down menu in the top left corner of the screen, and select *Existing File* from the lower drop-down menu
3. Highlight the file that includes the desired location, and click the *Open* button
4. Confirm the antenna height, then highlight the feature that will be the navigation target
5. Click the *Options* button, and select *Set Nav Target*
6. Confirm the feature to be selected, which will then be marked with a navigation icon
7. In the upper drop-down menu, select *Navigation*
8. The navigation screen displays the bearing, heading, distance, and turn, allowing navigation to the feature
9. To de-select the navigation target, click the *Options* button and select *Clear Nav Target*

Entering a Navigation Target Manually

1. Turn on the Trimble GPS unit, and open TerraSync
2. Select *Navigation* from the drop-down menu in the top left corner of the screen, and select *Waypoints* from the lower drop-down menu
3. Click the *New* button, enter a file name, and click *OK*
4. Click the *Options* button, and select *New*
5. Enter a name, the latitude and longitude, and the approximate altitude, and click *OK*
6. Several waypoints may be entered into the same waypoint file, which can be convenient if entering multiple locations to be visited.
7. Select the desired waypoint, click the *Options* button, and select *Set Nav Target*
8. Select *Navigate* from the lower drop-down menu to display the bearing, heading, distance, and turn, allowing navigation to the waypoint.

Trimble Receiver Configuration

There are settings on the Trimble GPS units that can be customized, some of which are critical to the correct collection of data for this project, and others that only affect display and are mainly a function of user preference. It is essential that all Trimble GPS receivers are configured with the same critical settings before being used for this project. Receiver configuration files can be created to help with this; once the settings are determined, they can be exported as a configuration file, which can then be loaded onto any other Trimble GPS units being used for this project. Configuration files should be stored on the CAKN network drive: J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\Configuration Files.

Receiver Configuration

1. Open TerraSync on the Trimble GPS unit.
2. Select *Setup* from the drop-down menu in the upper left corner of the screen.
3. Set the Logging Settings
    a. Click the *Logging Settings* button
    b. The Accuracy Settings should be set as follows:
        i. Horizontal
        ii. Postprocessed
        iii. 200+ km
        iv. No accuracy-based logging
    c. The Point/Vertex Auto-pause Count should be set to *None*
    d. The Antenna Height can be set to whatever the most convenient default value would be (it is different for collecting data from the boat than for holding it at chest height when recording VegMat points), but it is essential that the Confirm setting be set to *Per File*. The default Type is GeoXT Internal, but if the Per File option is selected, both the Type and Height will be confirmed when each new file is created.
    e. The Allow Position Update option should be set to Confirm
    f. The Confirm End Feature can be set to No
    g. The Filename and Waypoint prefixes can be left as R and W; the filenames are manually entered, anyway.
    h. The Between Feature logging can be set with the Time Style and the Interval turned off. This project does not actively use data collected between features (“Not In Feature” positions).
4. Set the GPS Settings
    a. Click the *GPS Settings* button
    b. The GPS Receiver Port should never need to be changed from the Trimble default settings.
    c. Make sure that the box next to the Productivity-Precision slide bar is checked, and set the arrow as far left as it can go (maximize productivity). This is the most productive setting at which the precision specifications of the GPS receiver are met when using Pathfinder Office software for postprocessing. In the past, there were guidelines as to what the PDOP, SNR and Elevation values should be, but new software has allowed us to simply maximize productivity; unsuitable data is automatically filtered out during postprocessing.
    d. Set the Velocity Filter and NMEA Output options to Off
5. Set the Real-time Settings

a. Set Choice 1 to “Integrated SBAS” and Choice 2 to “Use Uncorrected GPS”
   *Never use two real-time sources for both choices. If SBAS is being used, the second choice should be “Use Uncorrected GPS”.
b. Set the Real-time age limit to 25 seconds
c. Click the Settings button next to the Integrated SBAS choice
   i. The corrected datum should be WGS1984.
   ii. The Tracking Mode should be customized for Alaska:
      1. Select Custom from the drop-down box
      2. PRN 135 should be set to *Enabled, Heed Health*
      3. PRN 138 should be set to *Disabled*
      4. The remaining PRN are for other geographic regions, and are irrelevant (leave default)
d. Click the Settings button next to the Integrated SBAS choice

6. Set the Coordinate System Settings
   *Note that these settings do not impact data collection; they only affect the display
   a. Set the System to *Latitude/Longitude*
   b. Set the Datum to NAD 1983 (Conus) CORS96. This is the datum used for post-processed location data, so is better for navigating to site locations listed in NAD83. It is also fine to change the datum to WGS 1984 if it better matches background imagery or other location data being used for navigation.
   c. The Altitude Reference can be set to Mean Sea Level (MSL), in Meters, using the DMA 10x10 (Global) Geoid, with the USNG Display set to Off. The altitude reference doesn’t generally make much difference during navigation.
   d. Set the Coordinate Order to North/East.
7. Set the Units Settings
   a. Set the Distance Units to Meters, the Area Units to Square Meters, the Velocity Units to Kilometers per Hour, the Angle Units to Degrees
   b. Set the Lat/Long Format to DD°MM.mmm’ (this can easily be changed to DD°MM’SS.ss or DD.ddd° if necessary for entering or navigating to locations in a different format)
   c. Set the Offset Format to Horizontal/Vertical (this can easily be changed to Slope/Inclination if necessary)
   d. Set the North Reference to True, with the Magnetic Declination set to Auto. This can be changed if navigation is required based on Magnetic North.
8. External Sensors are not used for this project, so these settings can be left blank.

Creating Receiver Configuration File

TerraSync Configuration files can be created in Pathfinder Office, and then transferred to Trimble GPS units, rather than entering all the settings directly on the unit itself.

1. Open Pathfinder Office software on a computer.
2. Select *Other* from the *Utilities* menu, and select *Configuration Manager*.
3. Select *New* from the *File* menu, or click the New File icon.
4. Select TerraSync Configuration and click *OK*
5. The tabs have the same groupings as the buttons used for configuration on the Trimble units. Set them to the values described for Receiver Configuration.
6. Save the file as a TerraSync Configuration file (.tcf)

Loading Configuration File to Trimble GPS Unit

File Transfer

1. Connect the Trimble GPS unit to the computer
   a. Place the Trimble unit on its cradle, and connect the cradle to the PC with a USB cable
   b. Microsoft ActiveSync must be installed on the PC for recognition of the Trimble unit. Note that the ActiveSync need not be configured for use; cancel out of the Pocket PC Sync Setup Wizard when prompted.
2. Open Pathfinder Office and select *Data Transfer* from the *Utilities* menu.
3. Check that the Device field is set to GIS Datalogger on Windows Mobile
4. Select the *Send* tab, and click the *Add* button
5. Select *Configuration*, and navigate to the desired configuration file
6. Click the *Transfer All* button to load the configuration file onto the Trimble GPS unit

Applying Configuration

1. Open TerraSync on the Trimble GPS unit
2. Select *Setup* from the drop-down menu in the upper left corner of the screen
3. Click the *Change* button in the *Current Configuration* section
4. Select the configuration file to be applied (the newly transferred file should appear as an option), and click the *Load* button
5. Click Yes to confirm the change in configuration settings

USGS Sample Collection

These samples are collected for laboratory analysis by the USGS. They are collected only once at each lake. The protocol for the collection of gases, DOC and ^{18}O was prepared by the USGS, and is summarized here:

Step 1: Serum bottles for C-gas

1. Label the bottles with the site and date. It helps to pre-label the bottles before they become wet. There are 2 serum bottles per site: a non-acidified bottle labeled with blue tape and used for CO_2 and CH_4 analysis, and an acidified bottle labeled with pink tape and used for DIC and ^{13}C analysis.
2. With a stopcock attached to a syringe, draw in about 10 mL of water from a few cm below the lake surface. Expel water from syringe to rinse it. For second rinse, draw water into syringe, hold it upright, and tap it to try to get the bubbles to rise to the tip of the syringe. Then expel the bubbles and most of the rinse water using the syringe plunger. Expel the final bit of rinse water below the water surface, so that when you draw sample water in, there are no bubbles in the syringe.
3. Carefully fill the syringe with **bubble-free** sample water, if possible. If bubbles do get in the syringe, try to remove the bubbles after filling. As above, do this by holding the syringe upright, and tapping it to try to get the bubbles to rise to the tip of the syringe. Then expel the bubbles using the syringe plunger.
4. Attach the 0.45 µm syringe filter to the luer tip on the 3-way stopcock on the syringe. Make sure the connection is tight by using the locking ring on the stopcock to secure the filter.
5. Attach a new needle to the tip of the syringe filter, and give it a twist to make sure it's tight.
6. While pointing the syringe up, push on the plunger to expel air from the filter and needle. Once 1-2 mL of water has passed through the filter and needle, insert the needle into the first serum bottle through the blue stopper, and inject 15 mL of water into the bottle. The amount does not have to be exact, but aim for 14-16 mL. When removing the syringe/needle from the bottle, maintain some pressure on the syringe plunger so that headspace gas from the bottle does not flow back into the syringe. Note that while injecting sample water into the bottles, it is best to have the syringe pointed up, because when removing the needle from the serum stopper, having the serum bottle upside down on top of the syringe needle means that gas cannot follow the needle as it is removed and escape to the atmosphere.

7. Change needles as repeat the procedure with the other serum bottle. It doesn't matter what order the bottles are filled, as long as a clean needle is used for each one. The syringes can be reused indefinitely, and don't have to be rinsed between the two bottles.
8. Save the filter to be used for DOC (Step 2).
9. Ideally the serum bottles should then be kept cool until they are shipped to Boulder for analysis, but this is not absolutely necessary if refrigerator/cooler space is lacking.
10. Pack the samples carefully and ship to:
11. Mark Dornblaser, USGS, 3215 Marine St., Suite E-127, Boulder, CO 80303
12. Return any unused bottles, filters, needles, etc. with the samples.

Step 2: DOC filtering

1. After collecting the C-gas samples, refill the syringe and use the same filter to fill the two 40 mL amber glass vials up to the neck for DOC. If it's difficult to get 80 mL through the filter, one vial is probably enough.
2. If filtering becomes difficult, change out the filter for a new one. Be sure to rinse the new filter with 30 mL of water before continuing to filter water into the DOC vial.
3. Throw away the syringe filter(s) after both C-gas and DOC samples have been filtered.
4. Vials should be stored and shipped in cool, dark conditions if possible.

Step 3: 18O/2H

1. Fill the clear glass 60 mL bottle completely (to overflowing) from 5-10 cm below the water surface. Make sure that there aren't any air bubbles trapped in the water, and cap beneath the surface so that the water is not exposed to ambient air.
2. These samples do not need to be kept cold or in the dark.

Using Extensis Portfolio

1. Launch Portfolio 8.5 and open the ShallowLakes catalog (J:\Monitoring\Water_Quality_Macroinvert\Photos\ShallowLakes.fdb)
2. Select Add Items from the Catalog menu, and navigate to the photo folder to be added.
3. If the entire folder needs to be cataloged, highlight the folder and click the Select Current Folder button at the bottom of the Add Items dialog window. If only some files from a folder need to be added, open the folder and select the desired items.
4. In the Cataloging Options dialog window, activate the option to Assign Properties, and set the options.
    a. In the Keywords tab, type Shallow Lakes into the Item Keywords field and click the Add button. If there are any other generic keywords you would like to add to all the photos being cataloged, enter them as well, clicking Add after each one.
    b. In the Fields tab, the values for each of the fields can be set. In most cases, the fields will differ from photo to photo, but if there are any fields that will be the same for all of the photos being cataloged, double-click the desired Field Name to bring up the Edit Text window. Selections can be made from the drop-down list, which has been customized for each field, or a different value can be typed in. In either case, the Add button must be clicked after each selection to add the value to the lower window of the dialog box. When all the selections have been made for that field, click the OK button. The value in the Cataloging options window is updated to your selection.
5. When all of the Fields and Keywords have been set, click the OK button to start the cataloging process. It takes some time for the cataloging process to complete, and if there are a large number of photos, it may work best to set it to catalog overnight. The process allegedly goes more quickly if the "Last Cataloged" gallery is being viewed, rather than the All Items gallery.
6. Add additional metadata to the newly-cataloged files.
    a. In the Galleries window, select Last Cataloged to view the most recently added files. Alternatively, use the Folders window to navigate to the folder containing the newly added files.
    b. Complete the metadata entries, particularly the ANPS fields, for each photograph. If some of the images will have the same entries for some fields, they can be selected together (using the Ctrl key while clicking the desired images), and processed together. Once the desired images are selected, choose either Edit Keywords or Edit Field Values from the Item menu, and select or enter the appropriate value.
    c. The Item menu can also be used for adding data to individual photos, but there are a couple of other, more convenient ways of adding the metadata:
        i. Click the Item icon to change the view, and select NPS Custom Field Display for the display style. Most of the ANPS fields are visible, and to edit them, simply click next to the desired field, and select or enter the value. Note that the + sign must be clicked after each entry to actually populate the field. Entries can also be deleted using this method.
        ii. Double-click the thumbnail or press Ctrl+Enter to view the properties. Double-click the Field Name to open the Edit Text window, and select or enter the desired value.
    d. Note that multiple entries can be added to any of the metadata fields.
    e. Add a description to the item if desired, either in Item view, or by opening the properties window and selecting the Description tab.

Using GPS-Photo Link

The following protocol details the process of geotagging photos with GPS location data.

1. Prepare photos for geotagging.
    a. Make sure that all photos to be linked to the same GPS dataset are housed together in one folder.
    b. Make any necessary edits to the photos (adjustments to settings, contrasts, cropping, etc).
2. Prepare the Garmin eTrex GPS dataset
    a. Download the Garmin eTrex units using MapSource.
        i. Save a copy of the project in .gdb format.
        ii. Once the original project is saved, keep the active logs from the days that sampling took place, or a saved log with the desired time frame included, and delete all unwanted tracklogs from the project.
        iii. Change the Datum to NAD 83
            1. Select Preferences from the Edit menu
            2. Select the Position tab and set the Grid to Lat/Lon hhddmm.mmm and the Datum to NAD 83
            3. Click OK to save change
    b. Save the edited project in the appropriate photo folder under the GIS folder, using either .txt or .gpx format for use with GPS-Photo Link. Name the file using the trip name and/or unit number and/or sampling date as appropriate.
    c. Once the data has been transferred from the eTrex receiver, delete the track logs and any saved tracks from the GPS unit to minimize download time for future trips.
    d. Select the “Clear” button in the Tracks menu to delete the active logs.
    e. To delete any saved tracks, navigate to the options in the Track menu (the button next to the close button) and select “Delete All Saved”.
3. Prepare the Trimble GPS dataset
    a. To geotag site photos, the Monuments feature class will be used for the reference GPS locations. If other photos were taken and marked using the PhotoPt feature class, this feature class will be used for the reference GPS locations. Both of these feature classes will be generated during the post-processing of the Trimble data. See SOP 24: Data Management for details on the protocols for production of features classes from the Trimble data.
    b. Use ArcCatalog to save a copy of the necessary Trimble shapefile or feature class Monuments or PhotoPt) in the appropriate photo folder under the GIS folder, along with all of the photos that will be tagged using this GPS dataset. Name the file using the trip name and/or sampling date as appropriate.
4. GPS-Photo Link Processing
    a. Open GPS-Photo Link GIS Pro
    b. Select the Photo Source
        i. Select “Existing Folder” in the Photo Source box

ii. For the Photo Root Folder, select the folder above the folder that includes the desired photographs.
iii. For the Existing Folder under Root Folder, select the folder that actually contains the photos to be tagged.
iv. Click the Next button; the program will read the photos.

c. Select the GPS Data source
   i. Select the "Use GPS data in file" option and browse for the desired .txt or .gpx file for Garmin tracklogs or corrected Trimble shapefile.
   ii. If using Garmin data, select "Track Logs" in the "For Garmin data use:" field.
   iii. Select the appropriate time zone (GMT-09:00) Alaska, and select the option to "Auto adjust for daylight saving time, if needed."
   iv. Under Datum/Position format, click the "Select Datum/Position Format" button, and Select Lat/Lon for Format, and NAD 83 for Datum (Note that the MapSource default for the Garmin tracklogs is WGS 84, so this must be changed to NAD 83 before saving the .gpx file for use with this program). Click OK.
   v. Click the Next button; the program will read the GPS data.

d. Match the digital photos to GPS location
   i. If a photo was taken of the GPS unit, select the option to "Use photo of the GPS receiver." If no photo was taken, you must manually enter the difference between the GPS unit and camera time (subtract the camera time from the GPS time).
   ii. For tagging aerial photos using a Garmin tracklog, select "Interpolate between closest GPS points" in the "Matching" field, and leave the "Use GPS position only if within" field selected. Generally 60 seconds would be appropriate, but it could be changed depending on the situation.
   iii. For tagging site photos using a Trimble shapefile, select "Match to closest point BEFORE photo" in the "Matching" field. **Unselect the "Use GPS position only if within" field.**
   iv. Click the Next button; the program will open all of the photos to allow the selection of the photo of the GPS unit for time synchronization.
   v. Find the photo of the GPS unit in the list, and check the box to "Use this photo for time entry". The time of the photo is automatically entered, and you must manually enter the time shown on the GPS in the picture.
   vi. Click OK to continue to the Data Entry/Photo Edit window.

e. Data Entry/Photo Edit
   i. In the All Photos section of the header, enter a Title for All Photos that indicates the sampling trip (i.e. WRST 2009), and a sub-title if desired (i.e. Nabesna)
   ii. Scroll through the photos to add information or edit the photo attributes.
      1. Use the photos in the Originals folder as a reference for determining the lake number, and in the Photo Comment field add the lake name (i.e. KOVA-002) when appropriate. For photos other than lake sites, other descriptive comments/labels may be added in this field. Note that once a Comment is added to one photo in the group, that comment becomes available in the drop-down box for future photos in the group.

a. Note that it is possible to add information to selected photos in batches. To add a comment to multiple photos, use the Shift and Ctrl keys to select the desired folders, and enter the comments to be applied to the selected photos.

2. Brightness and Contrast may be adjusted, and any photos needing rotation can be edited in this window; this will not edit the originals, but just the photos that will be visible in the output formats (shapefiles in ArcGIS, Google Earth files, etc.).
3. The photo of the GPS unit can be tagged for exclusion from output files by checking the box by "Do not include photo in output". Similarly, any other photos that lack coordinates, or which are deemed unworthy of being part of the output files can be excluded in this way.

iii. Click OK to continue on. The program will process, but does not display a message; the action buttons at the bottom are just greyed out until the processing is complete. When finished, the Output Options window will open.

f. Output Options

i. Select output formats:
   1. Watermarked Photo - YES
   2. Web Pages (maybe not?)
   3. Text File – YES
   4. GPS Exchange (maybe not?)
   5. Google Earth - YES
   6. Word Report (maybe not?)
   7. ESRI Shape File - YES

ii. Web/Word Output:
   1. Show Background Maps - YES
      a. Map Source: Google Maps – Hybrid
      b. Zoom Level: High
      c. Size of Maps: 300
   2. Show Overview Maps -YES
   3. Download map images to local file – YES
   4. Use Icon on Maps - NO
   5. Output Attributes Table – YES
   6. Web Page Options
      a. Link to Internet Map Sites: YES
      b. Link to Original Photo: NO
      c. Use web page file templates: NO

iii. Watermarks:
   1. Show Lat, Lon, Date, Time, Title, Sub Title (if applicable), Comment, and any other appropriate fields.
   2. Resize photo to 640
   3. JPEG Quality: Best
   4. Change Font Color to White for greater contrast (default is green).

iv. Google:
   1. Icon Options: Use photo, Size: medium, Label: Comment

2. View in Description Box: Comment, Photo (thumbnail), Attributes Table, Link to Watermarked.
3. Output Options: Leave all unchecked.

v. Misc:
1. Lat / Lon: DD MM.MMM
2. Grid: 1m
3. Elev: feet
4. Date: MM/DD/YYYY
5. Time: HH:MM:SS am
6. Time Zone: Local
7. Thumbnail photo size: 140 pixels
8. Rename output files using: Comment + MMDDYY_HHMMSS
9. Do not rename original photo

vi. Edit Heading/Distance fields if desired or if necessary, otherwise leave as default. We don't really keep a record of the direction the photo was taken, so the Heading is irrelevant.

vii. Click Finish to complete the processing.

5. ArcGIS

a. The shapefiles produced by GPS-Photo Link must remain in the same folder as the processed photo files in order for the linking feature to work in ArcGIS. This means that the shapefile cannot be added to a geodatabase or moved to a different location unless the entire folder of photos is also moved along with it.

b. Create a project for the park to include the photolink files if there is not already an appropriate project (i.e. KOVA_2009).

c. Add the photolink files

i. Click the Add Data button, and select the picture.shp file produced by GPS-Photo Link.

ii. Label the shapefile in the Display window as PARK_YEAR_AerialPhotos_GPSidentifier (i.e. KOVA_2009_AerialPhotos_eTrex14)



iii. Edit the symbology of the shapefile to the desired appearance. Use Circle 16 at size 10 for the icon, with different colors for different files.

iv. Save the edited shapefile as a layer (this saves all of the changes made, including the title in the Display window, along with the symbology).
1. Right-click on the file in the Display window
2. Select "Save as Layer File…"
3. Save in the same Aerial folder as the original shapefile, using the label from step ii as the file name (which is the default in the dialog box)

Using StreamlineENV

Using the Interactive Oceanographics software for YSI Sonde management

Adding Sondes to the Device Manager

1. Open the StreamlineENV program and select Device Manager from the Tools menu
2. Connect the Sonde to the computer and click the Test button on the Device Manager. This will test the connection, and read the basic information about the Sonde.
3. Enter a name for the Sonde (usually consisting of the code of the park where it will be deployed and the Sonde model number)

Calibrating Sondes

1. Open the StreamlineENV program and select Device Manager from the Tools menu
2. Connect the Sonde to the computer and click the Auto (YSI) button on the Device Manager. This will identify the Sonde (as long as it has been added as a device to the program).
3. Click on the Configuration Manager button, and click the Read Sonde Configuration button.
4. Click the Open Template button, and choose the calibration file for the appropriate YSI model (i.e. use the "600 XLM Configuration" file for any of the 600 XLM models). This configuration is set up for use during Calibration, as opposed to deployment; the main difference is that the Auto-Sleep function is turned off for calibration so that sensor readings can be monitored in real time to verify stability at the time of calibration.
5. Click the Write Configuration Settings to Sonde button.
6. Click the Read Configuration Settings button
7. Make necessary changes to the configuration
    a. Under the System tab, enter the GLP file to match the internal S/N listed below. Note that the template must have been written and read in order to display the correct S/N; if it has not been written and read, it will retain the S/N of the unit on which the template was created.
    b. Verify that the Sonde date/time is synchronized to the computer (the box should be checked under the System tab).
    c. Look through the remaining tabs to verify that they match the Calibration screen shots for the 6920v2.
    d. If any changes are made in the configuration, click the Write Configuration Settings to Sonde button again.
8. Click the Calibration button.
9. Click the New Calibration option in the Sensor Calibration panel.

10. Fill in the details for the Summary Report, especially the date and the technician fields. For calibrations performed before field deployment, identify the calibration as "In". For post-deployment calibrations, identify the calibration as "Out".
11. Select the desired probe for calibration, and continue with the specific instructions.

DO sensor

- When calibrating Rapid Pulse DO sensors, ensure that the probe has been kept in a moisture-saturated environment for 10 minutes before performing the calibration. To create this environment, add a small amount of water to the calibration cup, and set the probe into the cup. Do not tighten the calibration cup; it must be vented to the atmosphere. Ensure that the DO probe is not touching the water in the cup.
- Calibration of the ROX Optical DO sensor is essentially the same as the Rapid Pulse, but before beginning, dry off the temperature sensor and the Optical DO membrane so that there are no water droplets present. Allow the probe to stabilize in a moisture-saturated environment for 15 minutes before performing the calibration.

1. Click the Dissolved Oxy option in the Sensor Calibration panel
2. Refer to the directions in the information panel of the Streamline Window
3. Click the DO Sat % option in the Sensor Calibration panel
4. Enter the barometric pressure for the calibration location (it is convenient to use one of the 650 MDS units that have a barometer)
5. Wait for the sensor to stabilize
    - Streamline allows 40 seconds for stabilization before displaying the DO readings for Rapid Pulse sensors.
    - Once the readings are displayed in the graph, watch for the values to stabilize. The readings should be stable for at least 30 seconds before the calibration is performed. This may take several minutes, or even longer if the cell has not been used in some time.
    - If this is the first calibration since the membrane was changed on a Rapid Pulse probe, allow the measurements to run for 10 minutes before calibration.
6. Click the Calibrate button. Watch the measurements for a while after the calibration to make sure that they are stable.
7. Click the Continue button. Do not save the chart to file. Enter any comments about the calibration; this will be included in the Calibration Summary Report.
8. Click the Previous Menu option in the Sensor Calibration panel to calibrate the next probe.

Conductivity sensor

- Rinse and fill the calibration cup with 1500 uS standard solution. Rinse the probes with standard, as well. Expired or used solution can be used for the initial rinses. Make sure that the conductivity probe is fully immersed in standard; the conductivity cells must be completely filled for proper calibration.

1. Click the Conductivity option in the Sensor Calibration panel
2. Refer to the directions in the information panel of the Streamline Window
3. Click the SpCond option in the Sensor Calibration panel
4. Enter the conductivity of the standard in mS (1.5)
5. Watch the graph and wait for the sensor to return stable readings
6. Click the Calibrate button. Watch the measurements for a while after the calibration to make sure that they are stable.
7. Click the Continue button. Do not save the chart to file. Enter any comments about the calibration; this will be included in the Calibration Summary Report.
8. Click the Previous Menu option in the Sensor Calibration panel to calibrate the next probe.

pH sensor

1. Rinse and fill the calibration cup with pH 7 buffer. Rinse the probes with buffer, as well. The glass bulb on the pH probe must be completely submerged, with no air bubbles adhered to it.
1. Click the ISE1 pH option in the Sensor Calibration panel
2. Refer to the directions in the information panel of the Streamline Window
3. Click the 2 Point option in the Sensor Calibration panel
4. Enter the pH of the lower pH buffer (7)
5. Watch the graph and wait for the sensor to return stable readings
6. Click the Calibrate button. Watch the measurements for a while after the calibration to make sure that they are stable.
7. Click the Continue button. Do not save the chart to file. Enter any comments about the calibration (specify which standard is being referenced, if applicable, as all of the comments for both points are lumped together in the summary file); this will be included in the Calibration Summary Report.
8. Discard the lower pH buffer, rinse the calibration cup and probes with the higher buffer, and fill the calibration cup with the higher buffer.
9. Enter the pH of the higher pH buffer (10)
10. Watch the graph and wait for the sensor to return stable readings
11. Click the Calibrate button. Watch the measurements for a while after the calibration to make sure that they are stable.
12. Click the Continue button. Do not save the chart to file. Enter any comments about the calibration, referencing the standard.
13. Click the Previous Menu option in the Sensor Calibration panel, and click it again to return to the main calibration menu.

When finished with all calibrations, use the Deployment Wizard to set the Sonde to Idle mode (low battery use), to conserve batteries until the Sonde is prepared for deployment. See the Stop Logging portion of the Downloading Sondes section for detailed instructions on setting to Idle mode.

Review the Calibration Results

When you return to the main calibration menu, it triggers the generation of a Calibration Summary Report. The Calibration Summary is saved on the actual Sonde, for future reference. It can also be saved in a variety of formats in different locations. For long-term archiving of Calibration Records, the summary should be saved to a folder, so that it is not just on the Sonde.

1. Archive the Calibration Record
    a. Save the record as both a .pdf and .xls type
    b. Each instrument has a folder on the J drive in which calibration reports can be saved:

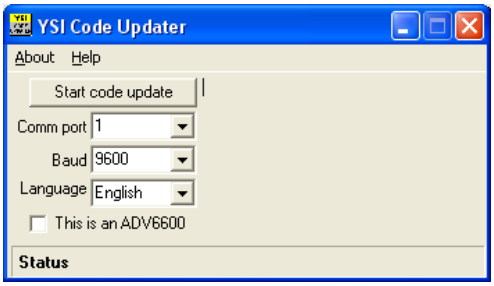
       J:\Monitoring\Water_Quality_Macroinvert\Field_Data\Streamline\CalibrationReports
    c. If the laptop is not connected to the network, calibration reports can be saved in the following folder on the C drive of the laptop, then transferred to the network later, either by connecting the laptop to the network or by using a thumb drive:

       C:\Documents and Settings\All Users\Streamline\CalibrationReports
2. Check the values for each probe
    a. DO – Rapid Pulse
        i. The DO Charge should be between 25 and 75 (35-50 is better, with 40 being optimal)
        ii. The DO Gain in the calibration constants section should be between -0.7 and +1.4.
    b. DO – ROX Optical
        i. Note that the Sonde will only read 100% saturation if the barometric pressure is 760 mmHg. To determine the actual DO is %, divide the barometer reading by 760 and then multiply that number by 100.
        ii. The ODO Gain in the calibration constants section should be between 0.85 and 1.15.
    c. Conductivity
        i. Check that the conductivity cell constant is 5 ± 0.45
    d. pH
        i. The mV values for pH7 should be 0 ± 50
        ii. The mV values for pH10 should be -180 ± 50
        iii. The pH slope should be between 165 and 180 (note that Streamline calculates the slope from pH7 to pH10 as negative; consider the absolute value of the calculation).

Updating Firmware

- Before preparing Sondes for deployment, ensure that the most recent firmware has been installed on the Sondes.
- Note that all files residing on the Sonde must be downloaded; they will be deleted in the process of the firmware update.

1. Download the YSI Code Updater from http://www.ysi.com/software.php, and install it in C:\Program Files\YSI Code Updater.
2. Open the Device Manager in Streamline, and press the Firmware Update button.
3. Click the Browse button and verify that the path is correct.
4. Click the Update button, and enter the settings shown in the window to the right.
5. Click the Start code update button.
6. When the update is complete, close the YSI Code Updater window.

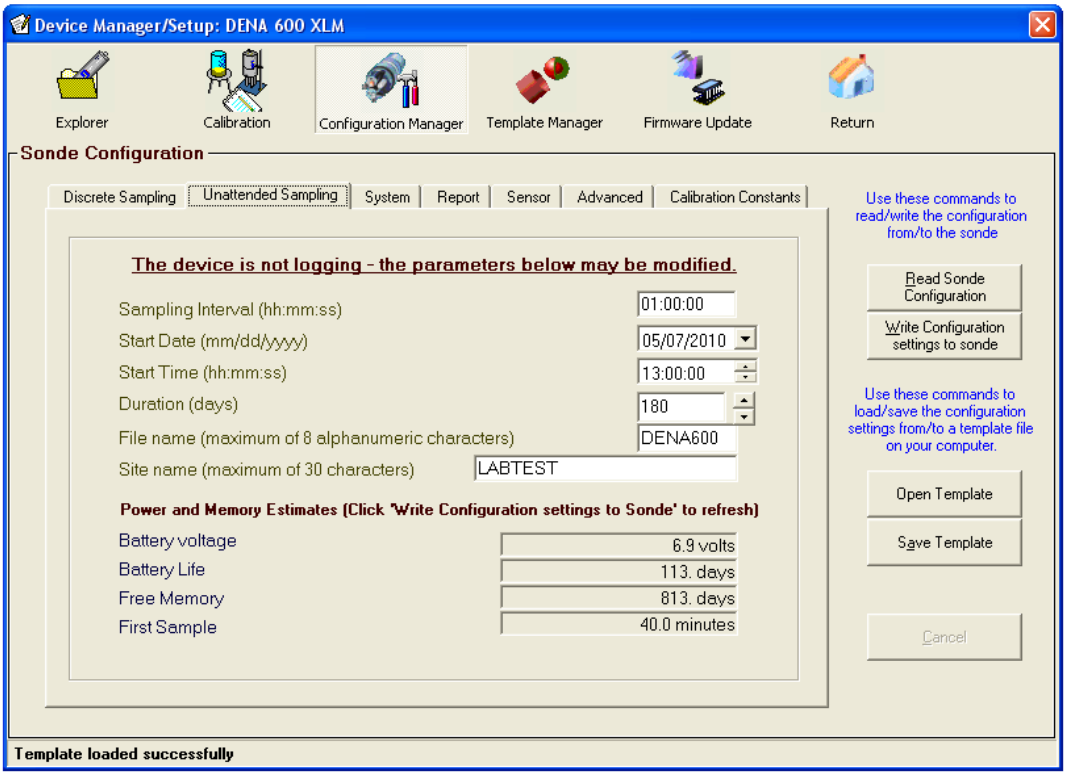


Configuring Sondes for Deployment

600 XLM

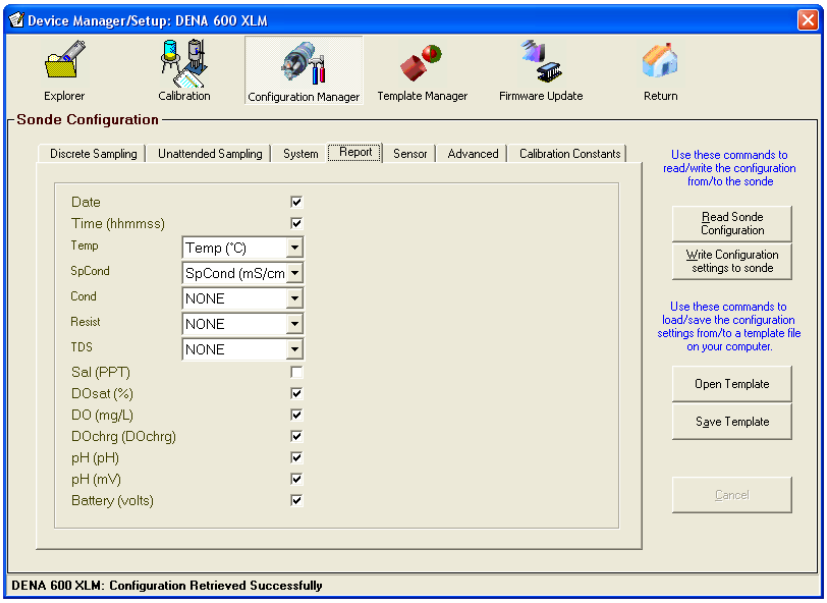
1. Open the Device Manager in Streamline, and use the Auto (YSI) button to recognize the Sonde
2. Click the Tools button and select the Configuration Manager button.
3. Read the Sonde Configuration, then click the Open Template button.
4. Select the appropriate template from the dropdown list, making sure that it is the Deployment template for the correct Sonde model (i.e. 600 XLM Deployment), and wait for the template to be applied.
5. Click the Write Configuration settings to Sonde button and wait for it to update, then again click the Read Sonde Configuration button before making changes to the template.
6. Make the following changes to the template, to customize it to the instrument and the new sampling event.
    a. In the Discrete Sampling tab, change the filename to be the park and the sonde model (i.e. DENA600), and change the sitename to be the lake number where the sonde will be deployed. If the specific lake numbers are not known at the time of configuration, the park code can be entered followed by 1 or 2. Be sure to keep good notes of the actual location for each Sonde at the time of deployment.

b. Verify the settings in the Unattended Sampling tab, making sure that the Sampling interval is set for 1 hour, and that the appropriate start date and time are entered. Make sure that the new filename and sitename entered in the Discrete Sampling tab carried over.



c. Under the System tab, select Synchronize Sonde date and time to computer. Change the GLP file to match the Circuit Board Serial Number listed below (note that if the template has not been written and then reread to the Sonde before this step, the Serial number from the template will be retained).

d. Verify the settings in the Report tab. All of the check boxes should be selected, except for Sal. Temp should be set to °C, SpCond should be set to mS/cm, and Cond, Resist, and TDS should be set to NONE.



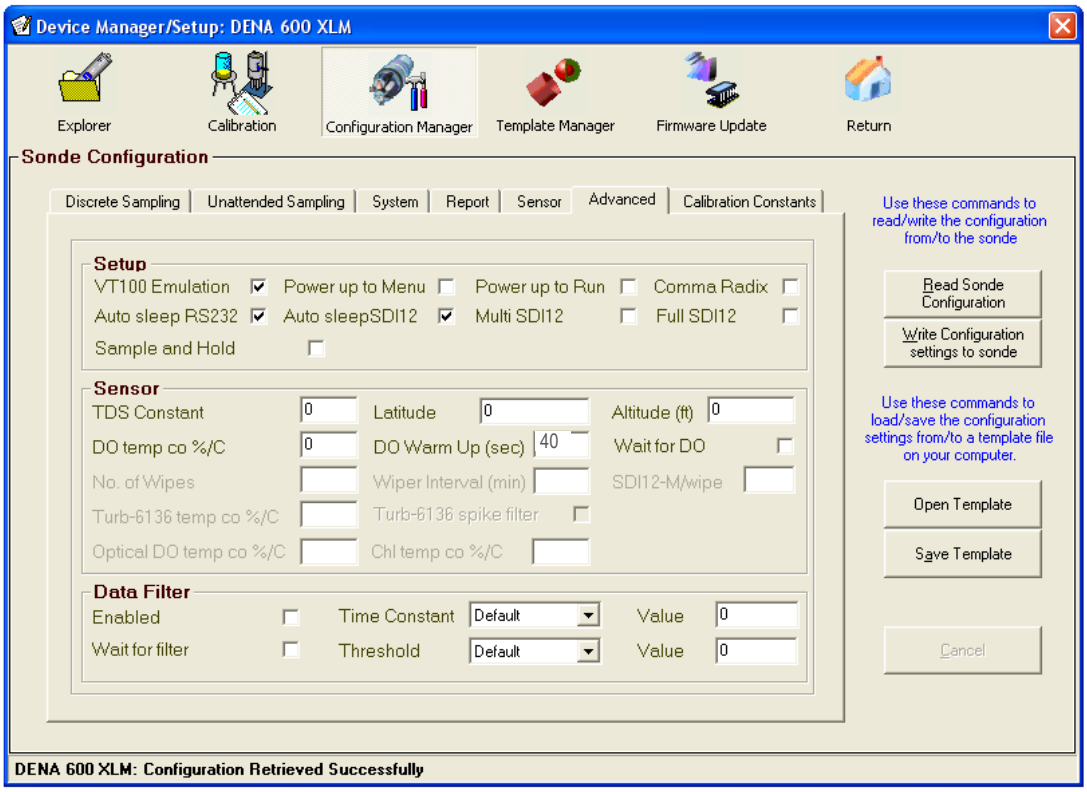
e. Under the Sensor tab, all of the sensors should be selected except for ISE2 Orp.

f. The Advanced tab should be set up as follows:

   i. Setup: check the boxes for VT100 Emulation, Auto Sleep RS232, Auto Sleep SDI12; leave all the other check boxes empty.

   ii. Sensor: The DO temp co % should be set to 1.1% for the Rapid Pulse sensors. The DO Warm Up time should be set to 40 seconds. All of the other values should be set to 0, as they are not applicable for the XLM units.

   iii. Data Filter: this should be left blank for the XLM units, because they do not have optical probes installed.



g. Nothing is changed in the Calibration Constants tab.

h. Check the start time and date again before finalizing the configuration. If the template was not written and reread to the sonde before the time/date was set, the start time will probably change to be an hour after the current time/date.

i. When everything has been set correctly, click Write Configuration settings to sonde.

6920

Follow the same process as for the 600 XLM, but choose the 6920v1 Deployment template. There are some significant differences in the settings for the 6920 units:

1. The DO temp co %/C should be set to 1.1 for the Rapid Pulse probes. If the probes are changed to optical probes, they should be adjusted accordingly. The current settings for the ROX probes

are 1.27%, unless they have the brass anti-fouling caps on the end of the sensor, in which case they should be set to 1.5%.

2. The data filters should be set for Time Constraints for all optical probes. Click the Enabled check-box next to Time Constraint, and enter a value of 30. Generally the only optical probes installed on the 6920 units are Turbidity.

3. The 6920 units are equipped with depth sensors, but because they are held at the surface, the depth data is of little value. If the depth is to be tracked, the latitude and altitude for the deployment site should be entered into the appropriate fields.

4. Check that the DO Warm Up is set to 40 for the Rapid Pulse sensors.

6920 V2

Follow the same process as for the 600 XLM, but choose the 6920v2 Deployment template. There are some significant differences in the settings for the 6920 v2 units:

1. The Optical DO temp co %/C should be set to 1.27%, unless they have the brass anti-fouling caps on the end of the sensor, in which case they should be set to 1.5%.

2. The data filters should be set for Time Constraints for all optical probes. Click the Enabled check-box next to Time Constraint, and enter a value of 30. Both Turbidity and Dissolved Oxygen optical probes should have this setting enabled. If both probes are present on a unit, either one can be chosen to serve as the Time Constraint probe.

3. For the Optical DO sensors, the warm up time should be set to 40 seconds.

Activating the Sondes for Deployment

1. Configure the Sonde with the appropriate deployment template as described, and click the Return button to clear the COM port. Keep the sonde connected to the computer.

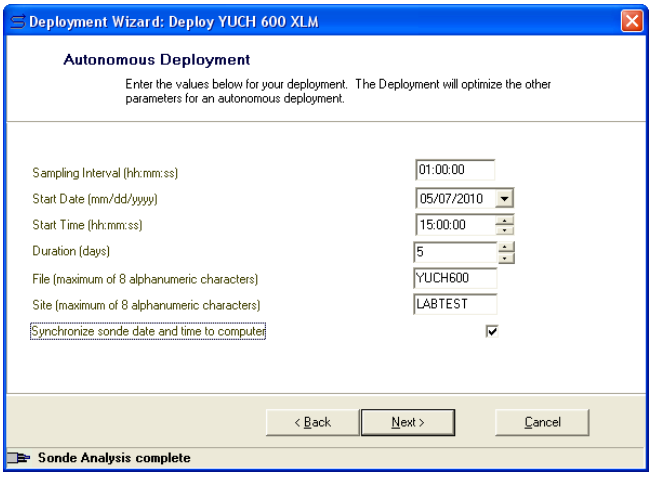
2. Open the Deployment Wizard under the Tool menu, and click Next to reach the device selection window.

3. Select the appropriate YSI unit, and click Next.

4. Make sure the sonde is connected to the computer, check the box for changing the parameters, and click Next.

5. In the Deployment Type window, select the Autonomous or unattended deployment option, and click Next.

6. Enter the sampling interval for 1 hour, and set the start date and time as applicable. For duration, select the longest possible length of deployment. Enter the park code and sonde type for the File, and enter the lake name (if known) for the Site. If the lake names are not known at the time of setup, just



enter 1 and 2 after the park code, and make sure that detailed notes are taken on the deployment location for each sonde. Set the option to synchronize the sonde date and time to computer. Click Next.

7. Verify the parameter list. Date and Time should be selected. Temp should be set to °C, SpCond should be set to µS/cm. Cond, Resist and TDS should all be set to NONE. All the rest of the items should be selected, except for Sal and Orp. Click Next.
8. When the Wizard has finished Optimizing the Sonde configuration, close the wizard and return to the Device Manager.
9. Open the Configuration Manager, and click the Read Sonde Configuration button.
10. Check the settings in all the tabs to make sure nothing was changed in the optimization process. Streamline tends to make some standard changes to the configuration, and one way to make sure that everything is OK is to again load the Deployment Template. It will come up with a message that it can't change some of the parameters while logging is activated, but it will apply all the rest of the settings. Be sure to check that the GLP file (System tab) reads correctly. The settings can also be changed manually. Some of the main things to look for include:
    a. In the System tab, check the box to synchronize the time and date of the Sonde to the computer.
    b. In the Advanced tab, make sure the DO Warm Up time is set to 40 seconds, and the Wait for DO box is checked.
    c. In the Data Filter section of the Advanced tab, make sure that the Enable filter check box is empty.
    d. For units with depth sensors, make sure the latitude and altitude are entered correctly.
11. After all necessary changes to the configuration have been made, click the Write Configuration Settings to Sonde button, then click the Return button to clear the COM port
12. Disconnect the Sonde, and screw the protective cap for the cable connection into place.

There are a couple of ways to activate logging on the Sonde. Once the configuration has been set up, the Deployment Wizard can be used to activate the sonde. Unfortunately, in order to start logging using the Wizard, the program runs an Optimizer, which changes some of the settings in the configuration. Once the sonde has been activated, however, it is possible to go back into the configuration and change these features. It may work to activate the Sonde first, and then apply a template to complete the configuration. The other option for activation is to use the 650 MDS. The sonde can be configured with Streamline, and when it's time to activate, it can be attached to the MDS and logging can be activated.

Downloading Sondes

The active logging by the Sonde can be stopped either before or after the download of the data. For mid-season downloads, it's easiest just to download the data while the unit is still logging. At the end of the season, however, the logging can be stopped as soon as is convenient, and then the data can be downloaded at any time.

Stop Logging

1. Open the Deployment Wizard
2. Select the appropriate Sonde from the list
3. Click Next to reach the Deployment Type window
4. Select the Cancel Deployments (Idle mode) from the options and click Next
5. Note that the Device Manager window cannot be open at the same time as the Deployment Wizard is being used to stop logging.

Download Data

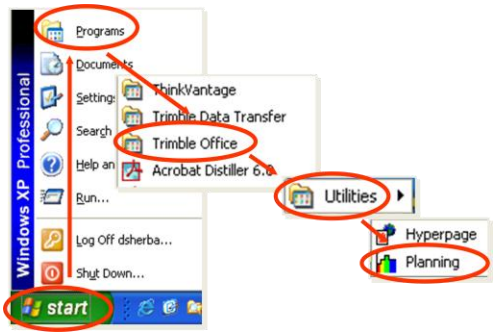
1. Open the Device Manager and click on the Explorer button if it is not already active.
2. Click the Refresh File icon beneath the file list. Note that if the logging has not been stopped, the last entry in the downloaded file will be the last entry before the file list was refreshed.
3. Check the box next to the data file/s to be downloaded (data files are designated with the .dat extension), highlight the DataDownloads folder in the Destination Window, and click the Upload Selected Files icon. Note that the DataDownloads shortcut leads to a folder on the CAKN drive:

   J:\Monitoring\Water_Quality_Macroinvert\Field_Data\Streamline\DataDownloads
4. After the data has been downloaded, it should be moved to the appropriate folder and named according to protocol (see Continuous Monitoring SOP for details).
   - J:\Monitoring\Water_Quality_Macroinvert\Field_Data\Continuous_Data\Sonde_data
   - Model_PARK-XXX_YEAR_Serial# ex: YSI600XLM_DENA-018_2009_09C101468.dat
5. The data files on the Sonde should be deleted once they are downloaded and archived. It is best to leave them on the unit for a while if possible, until the downloads are verified and secure. One good approach is to delete the Sonde files during the process of preparing the Sondes for long-term storage in the fall.
   a. In the Explorer window in the Device Manager, click the Delete icon to delete the files
   b. Note that when the Delete function is used, it will delete all of the files listed as being on the Sonde, not just the ones that are checked.
6. Click the Return button to clear the port before trying to stop the next logger.

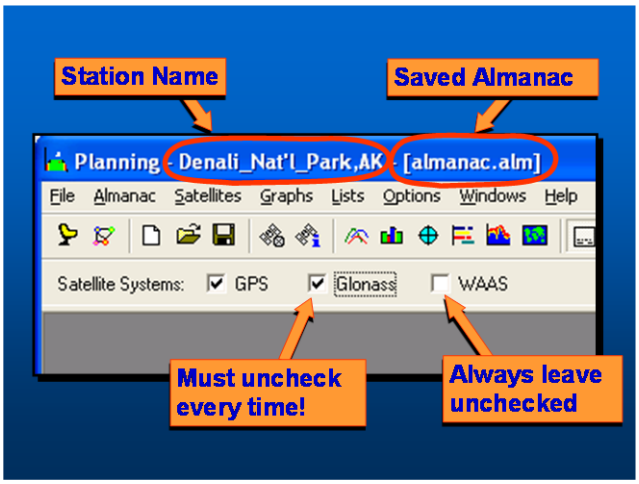
Using Trimble Planning

To check on projected satellite status during field data collection, use the Trimble Planning software included in the Trimble Office package (it installs along with Pathfinder Office).

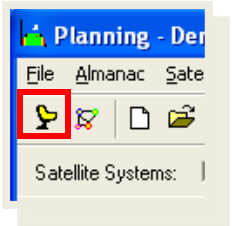
1. Acquire a recent Almanac, either from the Trimble Unit itself (if it has been used recently), or from the Trimble Website, and save it in the default Almanac location (C:\Program Files\Common Files\Trimble\Almanacs), replacing the existing current.ssf file.
2. Open the Trimble Planning software, and select only the GPS satellite system from the options listed.



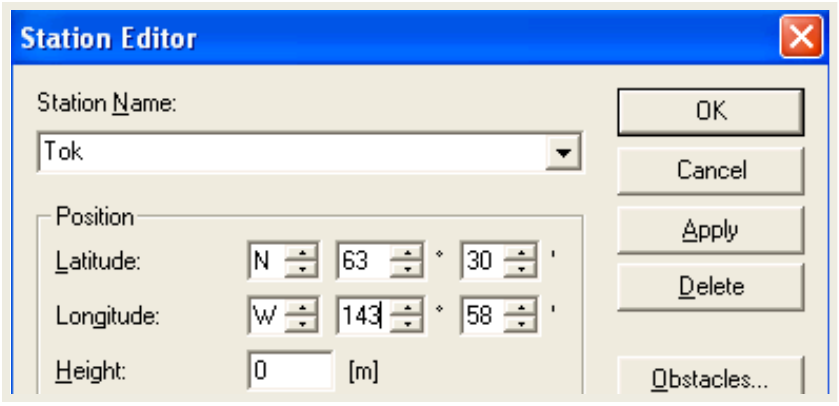
3. Check that only the GPS Satellite System is activated. The checkbox next to WAAS should be left blank, and the checkbox next to Glonass should be turned off.



4. Open the Station Editor

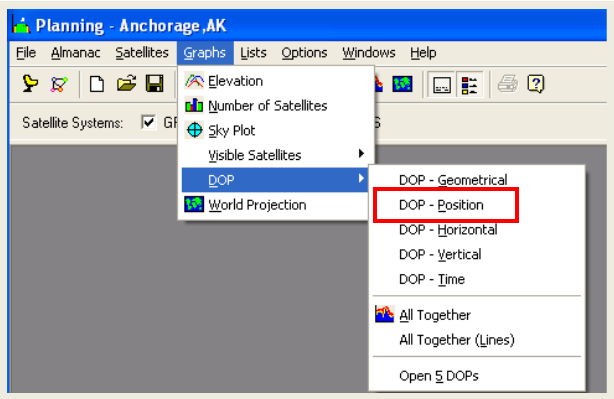


5. Select the desired Station from the drop-down menu. If it is not listed, click on the *City* button and choose the appropriate location from the drop-down menu.
6. If the desired location is not listed in the City drop-down menu, close the City window and manually enter a station name and the coordinates into the Station Editor window.



7. Set the desired date and time range for the data to be retrieved, and check that the time zone is correct.

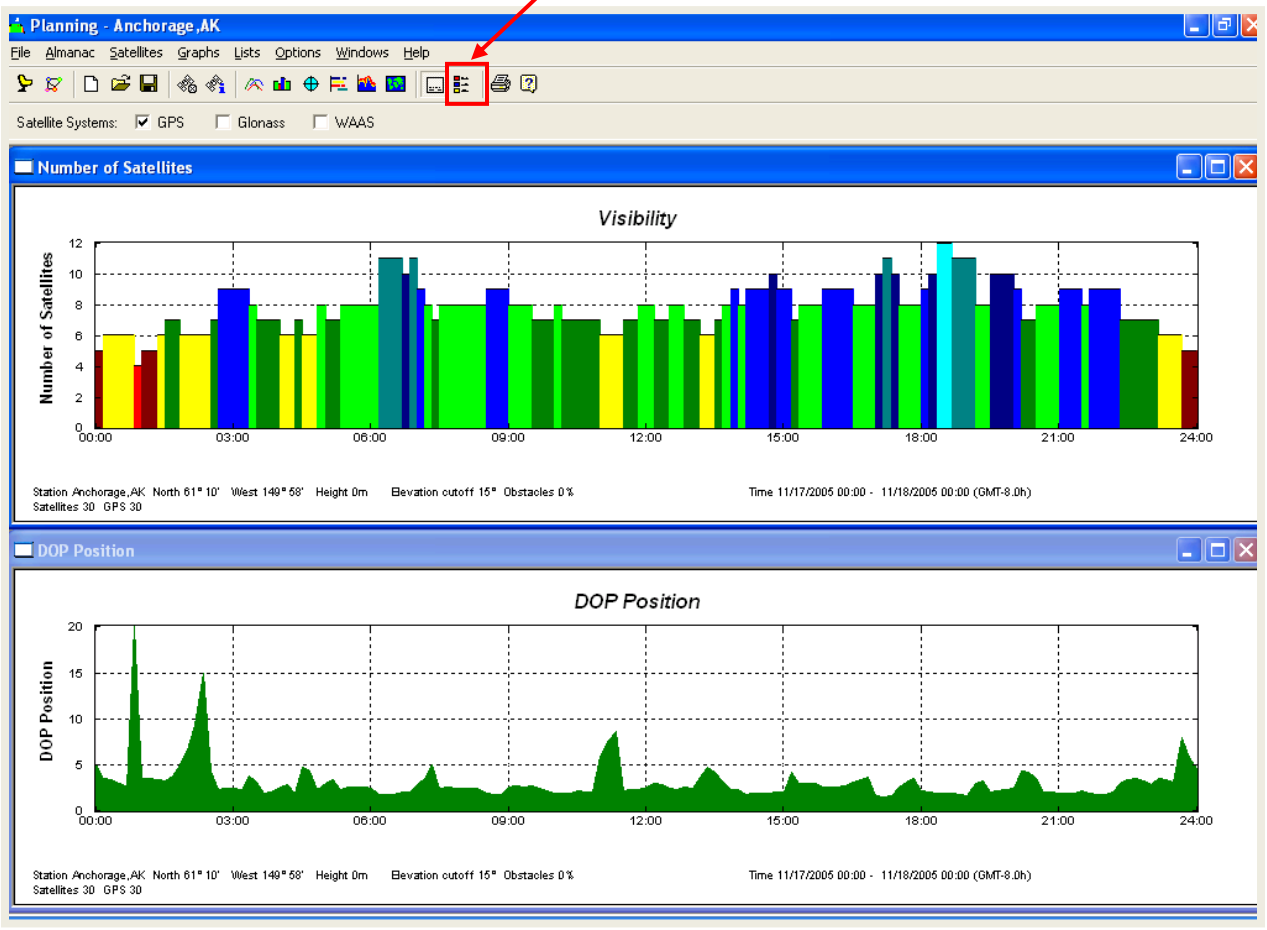
8. Open the DOP-Position graph by selecting *DOP* from the *Graphs* menu, and selecting *DOP – Position*



9. Open the Number of Satellites Graph by selecting *Number of Satellites* from the *Graph* menu

10. Under the *Window* menu, select *Tile Horizontally* to organize the graphs in the window.

11. Click the *Legend* button to remove the legend from the DOP Position graph, allowing the timeline of the graphs to line up



12. Examine the time range of interest, and check for time periods with poor PDOP (>6), or low satellite visibility. If possible, schedule field work to avoid these periods with poor conditions.

Continuous Monitoring Log - Deployments/Retrievals

Site Name:		
Deployment Retrieval		
Date:		
Time:		
Logger type	Serial #	Depth (cm)
Sonde		
Temp		
Temp		
Temp		
Temp		
Temp		
Water Level		
Bar. Pressure		

Reference measurements	
Temp	
SpCond	
DO%	
DO mg/L	
DO ch	
pH	
pH mV	

Notes:

Continuous Monitoring Log - Deployments/Retrievals

Site Name:		
Deployment Retrieval		
Date:		
Time:		
Logger type	Serial #	Depth (cm)
Sonde		
Temp		
Temp		
Temp		
Temp		
Temp		
Water Level		
Bar. Pressure		

Reference measurements	
Temp	
SpCond	
DO%	
DO mg/L	
DO ch	
pH	
pH mV	

Notes:

Continuous Monitoring Log - Deployments/Retrievals

Site Name:		
Deployment Retrieval		
Date:		
Time:		
Logger type	Serial #	Depth (cm)
Sonde		
Temp		
Temp		
Temp		
Temp		
Temp		
Water Level		
Bar. Pressure		

Reference measurements	
Temp	
SpCond	
DO%	
DO mg/L	
DO ch	
pH	
pH mV	

Notes:

Continuous Monitoring Log - Deployments/Retrievals

Site Name:		
Deployment Retrieval		
Date:		
Time:		
Logger type	Serial #	Depth (cm)
Sonde		
Temp		
Temp		
Temp		
Temp		
Temp		
Water Level		
Bar. Pressure		

Reference measurements	
Temp	
SpCond	
DO%	
DO mg/L	
DO ch	
pH	
pH mV	

Notes:

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Trimble Data

- Monument Data
  - ☐ Download data from Trimble Unit (see Trimble Data Management protocol)
  - ☐ Post-process data using GPS Pathfinder Office
  - ☐ Export data to ArcGIS, using the default file structure to save the shapefile in J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY\PARK\Export
  - ☐ Change the filename in ArcCatalog to ***PARK_YYYY_Monuments***
  - ☐ Add metadata for shapefile in ArcCatalog
  - ☐ Check the attributes table in ArcMap, ensuring that all data is entered correctly. Take particular note that the site name is entered correctly, without any extra spaces or small-case letters.
  - ☐ Add lat/lon fields (decimal degrees) to attributes table using AlaskaPak
  - ☐ Ensure that the Receiver Type field is filled in (if known); use Field Calculator if necessary
  - ☐ Change symbology and labeling properties as desired, and save as a layer file to: J:\Monitoring\Water_Quality_Macroinvert\GIS***PARK***\FinalLayers***PARK_YYYY_Monuments***
  - ☐ Add metadata for layer file in ArcCatalog
  - ☐ Import data into database (see Database Import Protocol)

Final Filename:

Date Completed:

Completed By:

Comments:

Park:_____ Year:_____ Revised 09/20/2010

Trimble Data

- Depth Data
  - ☐ Download data from Trimble Unit (see Trimble Data Management protocol)
  - ☐ Post-process data using GPS Pathfinder Office
  - ☐ Export data to ArcGIS, using the default file structure to save the shapefile in J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY\PARK\Export
  - ☐ Change the filename in ArcCatalog to ***PARK_YYYY_Depths***
  - ☐ Add metadata for shapefile in ArcCatalog
  - ☐ Add a 50 character text field called Lake_Num, and use the Field Calculator to populate it:
    Lake_Num = LEFT([Datafile],8)
  - ☐ Enter the secchi depths listed in the comments section into the database.
  - ☐ Search for any depths of 0 and delete the record(s)
    - Select by attributes: "Depth_m" = 0
  - ☐ Search for any depths greater than about 2m, and verify that they are in context
    - Select by attributes: "Depth" >2
  - ☐ Search for any depths less than 0.1 m and delete or correct if possible
    - Select by attributes: "Depth" < 0.1
  - ☐ Scroll through to look for errors such as double-tapped numbers (1.44) and correct them
  - ☐ Delete any records that are obviously incorrect and have more than one possible correction
  - ☐ Add lat/lon fields (decimal degrees) to attributes table using AlaskaPak
  - ☐ Ensure that the Receiver Type field is filled in (if known); use Field Calculator if necessary
  - ☐ Change symbology and labeling properties as desired, and save as a layer file to: J:\Monitoring\Water_Quality_Macroinvert\GIS***PARK***\FinalLayers***PARK_YYYY_Depths***
  - ☐ Add metadata for layer file in ArcCatalog
  - ☐ Import data into database (see Database Import protocol)

Final Filename:

Date Completed:

Completed By:

Comments:

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Trimble Data

- VegMat Data
  - ☐ Download data from Trimble Unit (see Trimble Data Management protocol)
  - ☐ Post-process data using GPS Pathfinder Office
  - ☐ Export data to ArcGIS, using the default file structure to save the shapefile in J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY\PARK\Export
  - ☐ Change the filename in ArcCatalog to ***PARK_YYYY_VegMat***
  - ☐ Add metadata for shapefile in ArcCatalog
  - ☐ Add a 50 character text field called Lake_Num, and use the Field Calculator to populate it:
    Lake_Num = LEFT([Datafile],8)
  - ☐ QAQC attributes table in ArcMap, ensuring that all data is entered correctly.
  - ☐ Ensure that the Receiver Type field is filled in (if known); use Field Calculator if necessary
  - ☐ Check that all values were entered as meters rather than cm (no values >3), and that each successive measurement is equal to or greater than the previous one using the following Select by Attributes:

"water_dept" > 3 OR "mat_depth" > 3 OR "bottom_dep" >3 OR "max_penetr" >3	"water_dept" > "mat_depth" OR "mat_depth" > "bottom_dep" OR "bottom_dep" > "max_penetr"

  - ☐ Visualize the records for each lake to determine if there are any outlying spatial points. If there are any points obviously in the wrong place, add "spatial location inaccurate" to the comment field for that point.
  - ☐ Check the transect numbers to make sure they are present and correct
    - Select all records for one lake, zoom to selected, then select each transect individually to verify that they are all in the same row
  - ☐ Add lat/lon fields (decimal degrees) to attributes table using AlaskaPak
  - ☐ Change symbology and labeling properties as desired, and save as a layer file: J:\Monitoring\Water_Quality_Macroinvert\GIS***PARK***\FinalLayers***PARK_YYYY_VegMat***
  - ☐ Add metadata for layer file in ArcCatalog
  - ☐ Import data into database (see Database Import protocol)

Final Filename:

Date Completed:

Completed By:

Comments:

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YSI Data

- ☐ Ensure that all in-situ YSI files collected with the MDS650 have been downloaded and saved in J:\Monitoring\Water_Quality_Macroinvert\Field_Data\YYYY\YSIProfiles
- ☐ Convert the CDF files (export format from EcoWatch) into Excel spreadsheets
- ☐ Edit the individual Excel files to prepare for import (see SOP for Importing Data into Database)
- ☐ Import the data into AK_ShallowLakes using SQL Server

Notes:

Paper Datasheets and Sketch Maps

- ☐ Check through all datasheets to ensure that all data and notes contained on sketch maps or individual data collection sheets have all been entered correctly into the AK_ShallowLakes database. This can be done either before or after concatenation.

Database

- ☐ Ensure that all Site Names and Sample Dates are correct in the database before concatenation process
- ☐ Concatenate data from field Tablet PCs into the AK_ShallowLakes database using SQL Server
- ☐ Verify the import of all data from Trimble files (Monuments, Depths, VegMat)
- ☐ Add the secchi depths and other notes from the comments field in the Trimble Depths shapefile into the appropriate fields in the AK_ShallowLakes database.
- ☐ Ensure that there are entries for each water sample location (generally A, B, C for each sample site, unless otherwise noted) in tblWaterSamples in the AK_ShallowLakes database.
- ☐ Enter the measured pond depth for each sample location (A,B,C) of every site into the DEPTH field of tblWaterSamples, using the values recorded in the Trimble Depths shapefile. Leave blank if unknown.

Photos

- ☐ Download photos to J:\Monitoring\Water_Quality_Macroinvert\Photos\Photos\YYYY\PARK
- ☐ Catalog photos in Portfolio
- ☐ Attribute keywords and custom fields in Portfolio

Notes:

Garmin Data

- ☐ Download tracklogs using MapSource, save in J:\Monitoring\Water_Quality_Macroinvert\Field_Data\YYYY\GarminTrackLogs
- ☐ Create different projects if necessary, including only the tracklogs relevant to the photos for each project
- ☐ Change the grid to Lat/Lon hhddmm.mmm and the Datum to NAD 83 (Preferences menu) in the projects
- ☐ Save the projects in .gdb format

GPS-Photo Link

- ☐ Create a folder in J:\Monitoring\Water_Quality_Macroinvert\GIS\PARK\GPS_Photo_Link\YYYY for each project
- ☐ Make copies of the photos to be geotagged for each project and paste them into the project folder
- ☐ Edit the copied photos as necessary
- ☐ Make a copy of the tracklog or other GPS data to be used for the project, and paste it into the project folder
- ☐ Run GPS-Photo Link (see SOP 15: Digital Photography)

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Physical Samples

- Water Chemistry (CCAL)
  - ☐ Create an inventory list using the dbo.vwSampleListWaterChem and editing the date range in the query
  - ☐ Check the samples against the inventory list, making sure all the samples are present and correctly labeled
  - ☐ Pack and ship the samples FedEx overnight, alerting the lab to their arrival time. Enclose inventory list
  - ☐ Email the inventory list to the lab
- Chlorophyll (Kielland)
  - ☐ Create an inventory list using the dbo.vwSampleListChlorophyll and editing the date range in the query
  - ☐ Check the samples against the inventory list, making sure all the samples are present and correctly labeled, and entering the filtered volume into the database if it has not already been entered.
  - ☐ Email the inventory list to the lab
- Invertebrates (ABR)
  - ☐ Create an inventory list using the dbo.vwSampleListInvertebrates and editing the date range in the query
  - ☐ Check the samples against the inventory list, making sure all the samples are present and correctly labeled
  - ☐ Pack the samples in bags inside Action Packers, and ship them cargo with Carlile

Lab Data

- Water Chemistry (CCAL)
  - ☐ Compile data from individual Excel files into one large Excel file for the season
  - ☐ Import data into tblWaterChemistry in the AK_ShallowLakes SQL Server database (see SOP 24)
  - ☐ Run the MDL (method detection limit) script to populate the MDL fields for the analyses
    - If the lab MDL has changed for any of the measurements, update the script as necessary
  - ☐ Print out the text comments, and enter them into the appropriate fields. Also check that each lab sample number matches up with the correct PondName and SampleDate.
- Chlorophyll (Kielland)
  - ☐ Import data into tblChlorophyll in the AK_ShallowLakes SQL Server database (see SOP 24)
- Invertebrates (ABR)
  - ☐ Import data into tblInvertebrates
  - ☐ Update tluInvertTaxa table

Continuous Monitoring Data

Deployments

- *Loggers*
  - ☐ Test Temperature loggers
  - ☐ Test Pressure loggers
  - ☐ Test Sondes
  - ☐ Launch Temperature loggers
  - ☐ Launch Pressure loggers
  - ☐ Launch Sondes
- *Trimble Data*
  - ☐ Download Trimble files
  - ☐ Post-process Trimble files
  - ☐ Export data to ArcGIS, using the default file structure to save the shapefile in J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY\PARK\Export
  - ☐ Change the filename in ArcCatalog to ***PARK_YYYY_Deployment***

- ☐ Add metadata for shapefile in ArcCatalog
- ☐ Add a 50 character text field called Lake_Num, and use the Field Calculator to populate it:
  Lake_Num = LEFT([Datafile],8)
- ☐ Enter the secchi depths from the Trimble file into the database.
- ☐ Search for any errors in depth entries (0 values, verify depths >2m, correct/delete depths <0.1m)
- ☐ Scroll through to look for errors such as double-tapped numbers (1.44) and correct them
- ☐ Delete any records that are obviously incorrect and have more than one possible correction
- ☐ Add lat/lon fields (decimal degrees) to attributes table using AlaskaPak
- ☐ Ensure that the Receiver Type field is filled in (if known); use Field Calculator if necessary
- ☐ Change symbology and labeling properties as desired, and save as a layer file to:
  J:\Monitoring\Water_Quality_Macroinvert\GIS***PARK***\FinalLayers***PARK_YYYY_Deployment***
- ☐ Add metadata for layer file in ArcCatalog
- ☐ Import data into database as for depths file

- *Field Sampling Data*
  - ☐ Download YSI profile data from MDS
  - ☐ Import YSI profile data into database
  - ☐ Download photos
  - ☐ Catalog photos in Portfolio
  - ☐ Attribute keywords and custom fields in Portfolio
- *Database Entries*
  - ☐ Enter deployment data into the database using continuous monitoring forms
  - ☐ Create an event in the database for the retrieval/deployment visit if necessary (i.e. if any profiles are taken, water chemistry samples collected, lake level measured, etc.)
- *Physical Samples*
  - ☐ Inventory and ship any samples that were collected during deployment

Retrievals

- *Logger Data*
  - ☐ Download Hobo Temperature Loggers and stop logging activity
  - ☐ Export Hobo Temperature data into comma delimited format
  - ☐ Download Hobo Pressure Transducers and stop logging activity
  - ☐ Calculate depths from pressure data
  - ☐ Export Pressure Transducer data INCLUDING depth calculations to comma delimited format (do not export to CDF until all of the calculations have been completed)
  - ☐ Download Sonde data and place sondes in low-power mode
  - ☐ Transfer Sonde data from Streamline folder into the appropriate location with appropriate filenames
- *Trimble Data*
  - ☐ Download Trimble files
  - ☐ Post-process Trimble files
  - ☐ Export data to ArcGIS, using the default file structure to save the shapefile in
    J:\Monitoring\Water_Quality_Macroinvert\TrimbleData\YYYY\PARK\Export
  - ☐ Change the filename in ArcCatalog to ***PARK_YYYY_Retrieval***
  - ☐ Add metadata for shapefile in ArcCatalog
  - ☐ Add a 50 character text field called Lake_Num, and use the Field Calculator to populate it:
    Lake_Num = LEFT([Datafile],8)
  - ☐ Enter the secchi depths from the Trimble file into the database.

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- ☐ Search for any errors in depth entries (0 values, verify depths >2m, correct/delete depths <0.1m)
- ☐ Scroll through to look for errors such as double-tapped numbers (1.44) and correct them
- ☐ Delete any records that are obviously incorrect and have more than one possible correction
- ☐ Add lat/lon fields (decimal degrees) to attributes table using AlaskaPak
- ☐ Ensure that the Receiver Type field is filled in (if known); use Field Calculator if necessary
- ☐ Change symbology and labeling properties as desired, and save as a layer file to: J:\Monitoring\Water_Quality_Macroinvert\GIS***PARK***\FinalLayers***PARK_YYYY_Retrieval***
- ☐ Add metadata for layer file in ArcCatalog
- ☐ Import data into database as for depths file

- *Field Sampling Data*
  - ☐ Download YSI profile data from MDS
  - ☐ Import YSI profile data into database
  - ☐ Download photos
  - ☐ Catalog photos in Portfolio
  - ☐ Attribute keywords and custom fields in Portfolio
- *Database Entries*
  - ☐ Enter retrieval data into the database using continuous monitoring forms
  - ☐ Create an event in the database for the retrieval/deployment visit if necessary (i.e. if any profiles are taken, water chemistry samples collected, lake level measured, etc.)
- *Physical Samples*
  - ☐ Inventory and ship any samples that were collected during retrieval

Notes:

Pond Data Sheet

Pond Name:	
Sample Date:	
Start Time:	
Observers:	

Latitude:	
Longitude:	
Elevation:	
GPS Type:	
Datum:	

Lake Description/Comments:

Continuously Monitored Site? **Y / N**

Hydro Regime:	
Hydro Class:	
Genesis:	
Shoreline:	
Salinity:	

Precipitation:	
Intensity:	
% Clouds:	
Wind:	

Emergents: **Y / N**

Islands: **Y / N**

Substrate Texture:

Weather Comments:

Secchi depth:	
Water Level:	
Field Turbidity:	

Site Condition Comments:

Fish present? **Y / N**

Wood Frogs present? **Y / N**

Shore Burned? **Y / N**

Burn Date:

Birds/Animals:

Thermokarst evidence? **Y / N**

Thermokarst location:

Map Lake Number:

Viereck Information:

	Type	Widths (m)
Upland		
Emergent		
Submergent		

Notes:

References

Precipitation	None
	Rain
	Sleet
	Snow

Intensity	N/A
(of precipitation)	Light
	Moderate
	Heavy

% Clouds	0-10%	Clear
	11-50%	Partly Cloudy (Scattered)
	51-90%	Cloudy (Broken)
	91-100%	Overcast

Wind	Calm
	Light
	Moderate
	Gusty

Hydro Regime	1	Connected, inlet stream only
	2	Connected, inlet and outlet stream
	3	Unconnected or isolated
	4	Connected to another pond/lake, otherwise isolated

Hydro Class	Ombotrophic	Receive water and nutrients from atmosphere
	Minerotrophic	Receive water and nutrients from ground water
	Lentic	Receive water and nutrients from rivers and streams

Genesis	Riverine	Related to river processes and includes deltaic, channel, oxbow, point bar and terrace flank ponds and lakes
	Thaw Lake	Related to melting of ice-rich deposits and impoundment of water
	Bedrock	Shoreline and water level controlled by bedrock
	Kettle Lake	Depressions in glacial deposits related to melting of glacial ice
	Dune	Depressions in dune fields
	Beaver	Formed by beaver activity

Shoreline	Smooth	Lacking peninsulas, bays, and indentations
	Undulating	Peninsulas, bays and indentations abundant
	Polygonized Margins	Highly irregular shoreline formed by rims of ice-wedge polygons

Salinity	Saline	>15,000 umhos/cm; subsaline and saline
	Brackish	500-15,000 umhos/cm
	Fresh	

Emergents	No	Emergent grasses, sedges or forbs do not form sufficiently large stands to map
	Yes	Emergent grasses, sedges or forbs form sufficiently large stands to map

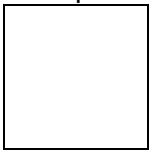
Islands	No	Isolated terrestrial patches or islands insufficiently large or numerous to map
	Yes	Islands greater than 0.5 m and more than 2 m from shore

Pond Water Samples

	Depth (m)	Temp (C)	pH	Spec. Cond.	Water Color	DO
Sample a						
Sample b						
Sample c						

Sketch Map Pond Name: _____ Date: _____

Compass



Artist: _____

Sonde Calibration Form

MC-__ __ __ __ __ __
Y Y M M D D

Serial Number: _____

Sonde Type: 600QS 600XLM 6920 6920V2

DO

Start % DO: _____ Ch:_____
mg/L: _____
Final % DO: _____ Ch:_____
mg/L: _____
Barometric Pressure: _____

Specific Conductivity

Standard (µS/cm): _____

Start Value: _____

End Value: _____

pH

First Standard: 4 7 10

Start pH: _____

End pH: _____

End mV (EM1): _____

Second Standard: 4 7 10

Start pH: _____

End pH: _____

End mV (EM2): _____

EM1-EM2 = _____

NOTES

Technician: _____

Sonde Calibration Form

MC-__ __ __ __ __ __
Y Y M M D D

Serial Number: _____

Sonde Type: 600QS 600XLM 6920 6920V2

DO

Start % DO: _____ Ch:_____
mg/L: _____
Final % DO: _____ Ch:_____
mg/L: _____
Barometric Pressure: _____

Specific Conductivity

Standard (µS/cm): _____

Start Value: _____

End Value: _____

pH

First Standard: 4 7 10

Start pH: _____

End pH: _____

End mV (EM1): _____

Second Standard: 4 7 10

Start pH: _____

End pH: _____

End mV (EM2): _____

EM1-EM2 = _____

NOTES

Technician: _____

Sonde Calibration Form

MC-__ __ __ __ __ __
Y Y M M D D

Serial Number: _____

Sonde Type: 600QS 600XLM 6920 6920V2

DO

Start % DO: _____ Ch:_____
mg/L: _____
Final % DO: _____ Ch:_____
mg/L: _____
Barometric Pressure: _____

Specific Conductivity

Standard (µS/cm): _____

Start Value: _____

End Value: _____

pH

First Standard: 4 7 10

Start pH: _____

End pH: _____

End mV (EM1): _____

Second Standard: 4 7 10

Start pH: _____

End pH: _____

End mV (EM2): _____

EM1-EM2 = _____

NOTES

Technician: _____

Sonde Calibration Form

MC-__ __ __ __ __ __
Y Y M M D D

Serial Number: _____

Sonde Type: 600QS 600XLM 6920 6920V2

DO

Start % DO: _____ Ch:_____
mg/L: _____
Final % DO: _____ Ch:_____
mg/L: _____
Barometric Pressure: _____

Specific Conductivity

Standard (µS/cm): _____

Start Value: _____

End Value: _____

pH

First Standard: 4 7 10

Start pH: _____

End pH: _____

End mV (EM1): _____

Second Standard: 4 7 10

Start pH: _____

End pH: _____

End mV (EM2): _____

EM1-EM2 = _____

NOTES

Technician: _____

Log Page # _____

Sonde Log

Sonde Type: _____ Sonde Serial #: _____

Date	Description	Reference Document	Initials

Log Page # _____

Sonde Log

Sonde Type: _____ Sonde Serial #: _____

Date	Description	Reference Document	Initials

Log Page # _____

Sonde Log

Sonde Type: _____ Sonde Serial #: _____

Date	Description	Reference Document	Initials

Log Page # _____

Sonde Log

Sonde Type: _____ Sonde Serial #: _____

Date	Description	Reference Document	Initials

Long-term Storage ***LTS-*** __ __ __ __ __ __
Y Y M M D D

Serial #: _____ Sonde Type:
pH SN: _____ 600QS 600XLM
Turb SN: _____ 6920 6920 v2
Comments:

Tech: _____

- ☐ Wash exterior casing
- ☐ Check for debris in cable connector socket
- ☐ Clean outside of sensor probes
- ☐ Clean conductivity probe
- ☐ Clean pH probe
- ☐ Ensure the logger is Inactive (stop logging)
- ☐ Clean optics on optical probes
- ☐ Test pH Buffer: 4 7 10 Value: _____
- ☐ Test Conductivity uS/cm: _____ Value: _____
- ☐ Remove pH probe and prepare for storage
- ☐ Remove turbidity probe and prepare for storage
- ☐ Check that remaining probes are clean
- ☐ Check rapid pulse DO membrane
- ☐ Plug dry sockets in bulkhead
- ☐ Test DO
- ☐ Fill cap with water and close tightly
- ☐ Remove batteries

% Sat: _____
mg/L: _____
Ch: _____
BP: _____

Long-term Storage ***LTS-*** __ __ __ __ __ __
Y Y M M D D

Serial #: _____ Sonde Type:
pH SN: _____ 600QS 600XLM
Turb SN: _____ 6920 6920 v2
Comments:

Tech: _____

- ☐ Wash exterior casing
- ☐ Check for debris in cable connector socket
- ☐ Clean outside of sensor probes
- ☐ Clean conductivity probe
- ☐ Clean pH probe
- ☐ Ensure the logger is Inactive (stop logging)
- ☐ Clean optics on optical probes
- ☐ Test pH Buffer: 4 7 10 Value: _____
- ☐ Test Conductivity uS/cm: _____ Value: _____
- ☐ Remove pH probe and prepare for storage
- ☐ Remove turbidity probe and prepare for storage
- ☐ Check that remaining probes are clean
- ☐ Check rapid pulse DO membrane
- ☐ Plug dry sockets in bulkhead
- ☐ Test DO
- ☐ Fill cap with water and close tightly
- ☐ Remove batteries

% Sat: _____
mg/L: _____
Ch: _____
BP: _____

Long-term Storage ***LTS-*** __ __ __ __ __ __
Y Y M M D D

Serial #: _____ Sonde Type:
pH SN: _____ 600QS 600XLM
Turb SN: _____ 6920 6920 v2
Comments:

Tech: _____

- ☐ Wash exterior casing
- ☐ Check for debris in cable connector socket
- ☐ Clean outside of sensor probes
- ☐ Clean conductivity probe
- ☐ Clean pH probe
- ☐ Ensure the logger is Inactive (stop logging)
- ☐ Clean optics on optical probes
- ☐ Test pH Buffer: 4 7 10 Value: _____
- ☐ Test Conductivity uS/cm: _____ Value: _____
- ☐ Remove pH probe and prepare for storage
- ☐ Remove turbidity probe and prepare for storage
- ☐ Check that remaining probes are clean
- ☐ Check rapid pulse DO membrane
- ☐ Plug dry sockets in bulkhead
- ☐ Test DO
- ☐ Fill cap with water and close tightly
- ☐ Remove batteries

% Sat: _____
mg/L: _____
Ch: _____
BP: _____

Long-term Storage ***LTS-*** __ __ __ __ __ __
Y Y M M D D

Serial #: _____ Sonde Type:
pH SN: _____ 600QS 600XLM
Turb SN: _____ 6920 6920 v2
Comments:

Tech: _____

- ☐ Wash exterior casing
- ☐ Check for debris in cable connector socket
- ☐ Clean outside of sensor probes
- ☐ Clean conductivity probe
- ☐ Clean pH probe
- ☐ Ensure the logger is Inactive (stop logging)
- ☐ Clean optics on optical probes
- ☐ Test pH Buffer: 4 7 10 Value: _____
- ☐ Test Conductivity uS/cm: _____ Value: _____
- ☐ Remove pH probe and prepare for storage
- ☐ Remove turbidity probe and prepare for storage
- ☐ Check that remaining probes are clean
- ☐ Check rapid pulse DO membrane
- ☐ Plug dry sockets in bulkhead
- ☐ Test DO
- ☐ Fill cap with water and close tightly
- ☐ Remove batteries

% Sat: _____
mg/L: _____
Ch: _____
BP: _____

Sonde Notes

Sonde type/name: _____

N- __ __ __ __ __ __
Y Y M M D D

N- __ __ __ __ __ __
Y Y M M D D

N- __ __ __ __ __ __
Y Y M M D D

Sonde Notes

Sonde type/name: _____

N- __ __ __ __ __ __
Y Y M M D D

N- __ __ __ __ __ __
Y Y M M D D

N- __ __ __ __ __ __
Y Y M M D D

Sonde Notes

Sonde type/name: _____

N- __ __ __ __ __ __
Y Y M M D D

N- __ __ __ __ __ __
Y Y M M D D

N- __ __ __ __ __ __
Y Y M M D D

Sonde Notes

Sonde type/name: _____

N- __ __ __ __ __ __
Y Y M M D D

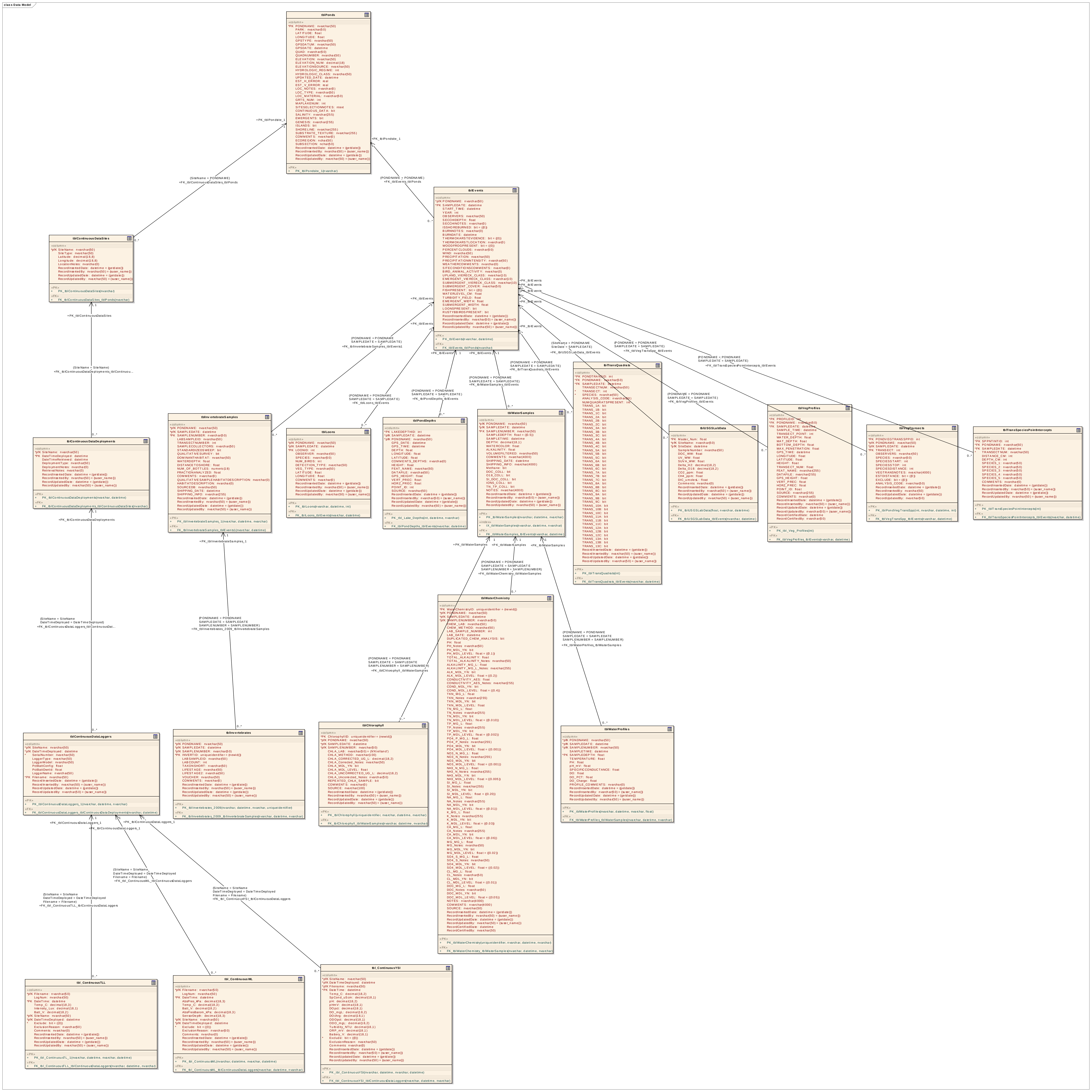
N- __ __ __ __ __ __
Y Y M M D D

N- __ __ __ __ __ __
Y Y M M D D

Vegetation Transect

Pond Name / Date: _____ Observer/Recorder: _____

Trans #	Species		Distance on Transect									
		Start										
		Stop										
		Start										
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		Stop										


class Data Model
tblPonds
«column»
*PK PONDNAME: nvarchar(50)
PARK: nvarchar(50)
LATITUDE: float
LONGITUDE: float
GPSTYPE: nvarchar(50)
GPSDATUM: nvarchar(50)
GPSDATE: datetime
QUAD: nvarchar(50)
QUADNUMBER: nvarchar(50)
ELEVATION: nvarchar(50)
ELEVATION_NUM: decimal(18)
ELEVATIONSOURCE: nvarchar(50)
HYDROLOGIC_REGIME: int
HYDROLOGIC_CLASS: nvarchar(50)
UPDATED_DATE: datetime
EST_H_ERROR: real
EST_V_ERROR: real
LOC_NOTES: nvarchar(0)
LOC_TYPE: nvarchar(50)
LOC_MATERIAL: nvarchar(50)
GRTS_NUM: int
MAPLAKENUM: int
SITESELECTIONNOTES: ntext
CONTINUOUS_DATA: bit
SALINITY: nvarchar(255)
EMERGENTS: bit
GENESIS: nvarchar(255)
ISLANDS: bit
SHORELINE: nvarchar(255)
SUBSTRATE_TEXTURE: nvarchar(255)
COMMENTS: nvarchar(0)
ECOREGION: nchar(50)
SUBSECTION: nchar(50)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblPondsite_1(nvarchar)
+PK_tblPondsite_1
1
(SiteName = PONDNAME)
+FK_tblContinuousDataSites_tblPonds
0..*
+PK_tblPondsite_1
1
(PONDNAME = PONDNAME)
+FK_tblEvents_tblPonds
0..*
tblEvents
«column»
*pfK PONDNAME: nvarchar(50)
*PK SAMPLEDATE: datetime
START_TIME: datetime
YEAR: int
OBSERVERS: nvarchar(50)
SECCHIDEPTH: float
SECCHINOTES: nvarchar(0)
ISSHOREBURNED: bit = ((0))
BURNNOTES: nvarchar(0)
BURNDATE: datetime
THERMOKARSTEVIDENCE: bit = ((0))
THERMOKARSTLOCATION: nvarchar(0)
WOODFROGPRESENT: bit = ((0))
PERCENTCLOUDS: nvarchar(50)
WIND: nvarchar(50)
PRECIPITATION: nvarchar(50)
PRECIPITATIONINTENSITY: nvarchar(50)
WEATHERCOMMENTS: nvarchar(0)
SITECONDITIONSCOMMENTS: nvarchar(0)
BIRD_ANIMAL_ACTIVITY: nvarchar(0)
UPLAND_VIERECK_CLASS: nvarchar(10)
EMERGENT_VIERECK_CLASS: nvarchar(10)
SUBMERGENT_VIERECK_CLASS: nvarchar(10)
SUBMERGENT_COVER: nvarchar(50)
FISHPRESENT: bit = ((0))
WATERLEVEL_CM: float
TURBIDITY_FIELD: float
EMERGENT_WIDTH: float
SUBMERGENT_WIDTH: float
LOONSPRESENT: bit
RUSTYBBIRDSPRESENT: bit
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblEvents(nvarchar, datetime)
«FK»
+ FK_tblEvents_tblPonds(nvarchar)
tblContinuousDataSites
«column»
*pfK SiteName: nvarchar(50)
SiteType: nvarchar(50)
Latitude: decimal(18,8)
Longitude: decimal(18,8)
LocationNotes: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblContinuousDataSites(nvarchar)
«FK»
+ FK_tblContinuousDataSites_tblPonds(nvarchar)
1
+PK_tblContinuousDataSites
(SiteName = SiteName)
+FK_tblContinuousDataDeployments_tblContinuou...
0..*
tblContinuousDataDeployments
«column»
*pfK SiteName: nvarchar(50)
*PK DateTimeDeployed: datetime
DateTimeRetrieved: datetime
DeploymentType: nvarchar(50)
DeploymentNotes: nvarchar(0)
RetrievalNotes: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblContinuousDataDeployments(nvarchar, datetime)
«FK»
+ FK_tblContinuousDataDeployments_tblContinuousDataSites(nvarchar)
1
+PK_tblContinuousDataDeployments
(SiteName = SiteName
DateTimeDeployed = DateTimeDeployed)
+FK_tblContinuousDataLoggers_tblContinuousDat...
0..*
+PK_tblEvents
1
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE)
+FK_tblInvertebrateSamples_tblEvents1
0..*
+PK_tblEvents
1
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE)
+FK_tblLoons_tblEvents
0..*
+PK_tblEvents 1
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE)
+FK_tblPondDepths_tblEvents
0..*
+PK_tblEvents 1
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE)
+FK_tblWaterSamples_tblEvents
0..*
+PK_tblEvents
1
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE)
+FK_tblTransQuadrats_tblEvents
0..*
+PK_tblEvents
1
(SiteName = PONDNAME
SiteDate = SAMPLEDATE)
+FK_tblUSGSLabData_tblEvents
0..*
+PK_tblEvents
1
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE)
+FK_tblVegTransSpp_tblEvents
0..*
+PK_tblEvents
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE)
+FK_tblVegProfiles_tblEvents
0..*
+PK_tblEvents
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE)
+FK_tblTransSpeciesPointIntercepts_tblEvents
0..*
tblInvertebrateSamples
«column»
*pfK PONDNAME: nvarchar(50)
*pfK SAMPLEDATE: datetime
*PK SAMPLENUMBER: nvarchar(50)
LABSAMPLEID: nvarchar(50)
TRANSECTNUMBER: int
SAMPLECOLLECTORS: nvarchar(50)
STANDARDIZEDSWEEP: bit
QUALITATIVESURVEY: bit
DOMINANTHABITAT: nvarchar(50)
WATERDEPTH: float
DISTANCETOSHORE: float
NUM_OF_BOTTLES: numeric(18)
FRACTIONANALYZED: float
COMMENTS: nvarchar(0)
QUALITATIVESAMPLEHABITATDESCRIPTION: nvarchar(0)
HABITATDESCRIPTION: nvarchar(0)
SOURCEDB: nvarchar(50)
SHIPPING_DATE: datetime
SHIPPING_INFO: nvarchar(255)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblInvertebrateSamples_1(nvarchar, datetime, nvarchar)
«FK»
+ FK_tblInvertebrateSamples_tblEvents1(nvarchar, datetime)
1
+PK_tblInvertebrateSamples_1
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE
SAMPLENUMBER = SAMPLENUMBER)
+FK_tblInvertebrates_2009_tblInvertebrateSamples
0..*
tblLoons
«column»
*pfK PONDNAME: nvarchar(50)
*pfK SAMPLEDATE: datetime
*PK LOONID: int
OBSERVER: nvarchar(50)
SPECIES: nvarchar(50)
NUM_BIRDS: int
DETECTION_TYPE: nvarchar(50)
VEG_TYPE: nvarchar(50)
LATITUDE: float
LONGITUDE: float
COMMENTS: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblLoons(nvarchar, datetime, int)
«FK»
+ FK_tblLoons_tblEvents(nvarchar, datetime)
tblPondDepths
«column»
*PK LAKEDEPTHID: int
*pfK SAMPLEDATE: datetime
*pfK PONDNAME: nvarchar(50)
GPS_DATE: datetime
GPS_TIME: datetime
DEPTH: float
LONGITUDE: float
LATITUDE: float
COMMENTS_DEPTHS: nvarchar(0)
HEIGHT: float
FEAT_NAME: nvarchar(50)
DATAFILE: nvarchar(50)
GPS_HEIGHT: float
VERT_PREC: float
HORZ_PREC: float
POINT_ID: int
SOURCE: nvarchar(50)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tbl_Lake_Depths(int, datetime, nvarchar)
«FK»
+ FK_tblPondDepths_tblEvents(nvarchar, datetime)
tblWaterSamples
«column»
*pfK PONDNAME: nvarchar(50)
*pfK SAMPLEDATE: datetime
*PK SAMPLENUMBER: nvarchar(50)
SAMPLEDEPTH: float = ((0.5))
SAMPLETIME: datetime
DEPTH: decimal(18,1)
WATERCOLOR: float
ALKALINITY: float
VOLUMEFILTERED: nvarchar(50)
COMMENTS: nvarchar(4000)
SHIPPING_DATE: datetime
SHIPPING_INFO: nvarchar(4000)
Methane: bit
DOC_COLL: bit
O18_COLL: bit
SI_DOC_COLL: bit
IONS_COLL: bit
TN_TP_COLL: bit
NOTES: nvarchar(4000)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblWaterSamples(nvarchar, datetime, nvarchar)
«index»
+ IX_tblWaterSamples(nvarchar, datetime, nvarchar)
«FK»
+ FK_tblWaterSamples_tblEvents(nvarchar, datetime)
+PK_tblWaterSamples 1
+PK_tblWaterSamples 1
+PK_tblWaterSamples 1
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE
SAMPLENUMBER = SAMPLENUMBER)
+FK_tblWaterChemistry_tblWaterSamples
0..*
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE
SAMPLENUMBER = SAMPLENUMBER)
+FK_tblChlorophyll_tblWaterSamples
0..*
(PONDNAME = PONDNAME
SAMPLEDATE = SAMPLEDATE
SAMPLENUMBER = SAMPLENUMBER)
+FK_tblWaterProfiles_tblWaterSamples
0..*
tblTransQuadrats
«column»
*PK PONDTRANSID: int
*FK PONDNAME: nvarchar(50)
*FK SAMPLEDATE: datetime
TRANSECTNUM: nvarchar(50)
* TRANSECT: int
* SPECIES: nvarchar(50)
ANALYSIS_CODE: nvarchar(50)
NUMQUADRATSPRESENT: int
TRANS_1A: bit
TRANS_1B: bit
TRANS_1C: bit
TRANS_2A: bit
TRANS_2B: bit
TRANS_2C: bit
TRANS_3A: bit
TRANS_3B: bit
TRANS_3C: bit
TRANS_4A: bit
TRANS_4B: bit
TRANS_4C: bit
TRANS_5A: bit
TRANS_5B: bit
TRANS_5C: bit
TRANS_6A: bit
TRANS_6B: bit
TRANS_6C: bit
TRANS_7A: bit
TRANS_7B: bit
TRANS_7C: bit
TRANS_8A: bit
TRANS_8B: bit
TRANS_8C: bit
TRANS_9A: bit
TRANS_9B: bit
TRANS_9C: bit
TRANS_10A: bit
TRANS_10B: bit
TRANS_10C: bit
TRANS_11A: bit
TRANS_11B: bit
TRANS_11C: bit
TRANS_12A: bit
TRANS_12B: bit
TRANS_12C: bit
TRANS_13A: bit
TRANS_13B: bit
TRANS_13C: bit
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblTransQuadrats(int)
«FK»
+ FK_tblTransQuadrats_tblEvents(nvarchar, datetime)
tblUSGSLabData
«column»
*PK Master_Num: float
*pfK SiteName: nvarchar(50)
*pfK SiteDate: datetime
SampleNumber: nvarchar(50)
DOC_WW: float
UV_WW: float
SUVA_WW: float
Delta_H2: decimal(18,2)
Delta_O18: decimal(18,2)
CO2_ppm: float
CH4_ppm: float
DIC_umolesL: float
Comments: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblUSGSLabData(float, nvarchar, datetime)
«FK»
+ FK_tblUSGSLabData_tblEvents(nvarchar, datetime)
tblVegProfiles
«column»
*PK PROFILEID: int
*FK PONDNAME: nvarchar(50)
*FK SAMPLEDATE: datetime
SAMPLE_TIME: datetime
TRANSECT_POINT: int
WATER_DEPTH: float
MAT_DEPTH: float
BOTTOM_DEPTH: float
MAX_PENETRATION: float
GPS_TIME: datetime
LONGITUDE: float
LATITUDE: float
HEIGHT: float
TRANSECT_NUM: float
FEAT_NAME: nvarchar(255)
DATAFILE: nvarchar(255)
GPS_HEIGHT: float
VERT_PREC: float
HORZ_PREC: float
POINT_ID: float
SOURCE: nvarchar(255)
COMMENTS: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
RecordCertifiedDate: datetime
RecordCertifiedBy: nvarchar(50)
«PK»
+ PK_tbl_Veg_Profiles(int)
«FK»
+ FK_tblVegProfiles_tblEvents(nvarchar, datetime)
tblVegTransects
«column»
*PK PONDVEGTRANSSPPID: int
*pfK PONDNAME: nvarchar(50)
*pfK SAMPLEDATE: datetime
*PK TRANSECT: int
OBSERVERS: nvarchar(50)
SPECIES: nvarchar(50)
SPECIESSTART: int
SPECIESSTOP: int
SPECIESDISTANCE: int
VEGTRANSNOTES: nvarchar(4000)
ESTDISTANCE: bit = ((0))
EXCLUDE: bit = ((0))
ANALYSIS_CODE: nvarchar(50)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50)
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50)
«PK»
+ PK_tblPondVegTransSpp(int, nvarchar, datetime, int)
«FK»
+ FK_tblVegTransSpp_tblEvents(nvarchar, datetime)
tblTransSpeciesPointIntercepts
«column»
*PK SPPNTINTID: int
*FK PONDNAME: nvarchar(50)
*FK SAMPLEDATE: datetime
* TRANSECTNUM: nvarchar(50)
DISTANCE_CM: int
DEPTH_CM: int
SPECIES_1: nvarchar(50)
SPECIES_2: nvarchar(50)
SPECIES_3: nvarchar(50)
SPECIES_4: nvarchar(50)
SPECIES_5: nvarchar(50)
COMMENTS: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblTransSpeciesPointIntercepts(int)
«FK»
+ FK_tblTransSpeciesPointIntercepts_tblEvents(nvarchar, datetime)
tblWaterChemistry
«column»
*PK WaterChemistryID: uniqueidentifier = (newid())
*pfK PONDNAME: nvarchar(50)
*pfK SAMPLEDATE: datetime
*pfK SAMPLENUMBER: nvarchar(50)
CHEM_LAB: nvarchar(50)
CHEM_METHOD: nvarchar(50)
LAB_SAMPLE_NUMBER: int
LAB_DATE: datetime
DUPLICATED_CHEM_ANALYSIS: bit
PH: float
PH_Notes: nvarchar(50)
PH_MDL_YN: bit
PH_MDL_LEVEL: float = ((0.1))
TOTAL_ALKALINITY: float
TOTAL_ALKALINITY_Notes: nvarchar(50)
ALKALINITY_MG_L: float
ALKALINITY_MG_L_Notes: nvarchar(255)
ALK_MDL_YN: bit
ALK_MDL_LEVEL: float = ((0.2))
CONDUCTIVITY_AES: float
CONDUCTIVITY_AES_Notes: nvarchar(255)
COND_MDL_YN: bit
COND_MDL_LEVEL: float = ((0.4))
TKN_MG_L: float
TKN_Notes: nvarchar(255)
TKN_MDL_YN: bit
TKN_MDL_LEVEL: float
TN_MG_L: float
TN_Notes: nvarchar(255)
TN_MDL_YN: bit
TN_MDL_LEVEL: float = ((0.010))
TP_MG_L: float
TP_Notes: nvarchar(255)
TP_MDL_YN: bit
TP_MDL_LEVEL: float = ((0.002))
PO4_P_MG_L: float
PO4_P_Notes: nvarchar(255)
PO4_MDL_YN: bit
PO4_MDL_LEVEL: float = ((0.001))
NO3_N_MG_L: float
NO3_N_Notes: nvarchar(255)
NO3_MDL_YN: bit
NO3_MDL_LEVEL: float = ((0.001))
NH3_N_MG_L: float
NH3_N_Notes: nvarchar(255)
NH3_MDL_YN: bit
NH3_MDL_LEVEL: float = ((0.005))
SI_MG_L: float
SI_Notes: nvarchar(255)
SI_MDL_YN: bit
SI_MDL_LEVEL: float = ((0.20))
NA_MG_L: float
NA_Notes: nvarchar(255)
NA_MDL_YN: bit
NA_MDL_LEVEL: float = ((0.01))
K_MG_L: float
K_Notes: nvarchar(255)
K_MDL_YN: bit
K_MDL_LEVEL: float = ((0.03))
CA_MG_L: float
CA_Notes: nvarchar(255)
CA_MDL_YN: bit
CA_MDL_LEVEL: float = ((0.06))
MG_MG_L: float
MG_Notes: nvarchar(50)
MG_MDL_YN: bit
MG_MDL_LEVEL: float = ((0.02))
SO4_S_MG_L: float
SO4_S_Notes: nvarchar(50)
SO4_MDL_YN: bit
SO4_MDL_LEVEL: float = ((0.02))
CL_MG_L: float
CL_Notes: nvarchar(50)
CL_MDL_YN: bit
CL_MDL_LEVEL: float = ((0.01))
DOC_MG_L: float
DOC_Notes: nvarchar(50)
DOC_MDL_YN: bit
DOC_MDL_LEVEL: float = ((0.05))
NOTES: nvarchar(4000)
COMMENTS: nvarchar(4000)
SOURCE: nvarchar(50)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
RecordCertifiedDate: datetime
RecordCertifiedBy: nvarchar(50)
«PK»
+ PK_tblWaterChemistry(uniqueidentifier, nvarchar, datetime, nvarchar)
«FK»
+ FK_tblWaterChemistry_tblWaterSamples(nvarchar, datetime, nvarchar)
tblWaterProfiles
«column»
*pfK PONDNAME: nvarchar(50)
*pfK SAMPLEDATE: datetime
*pfK SAMPLENUMBER: nvarchar(50)
SAMPLETIME: datetime
*PK SAMPLEDEPTH: float
TEMPERATURE: float
PH: float
pH_mV: float
SPECIFICCONDUCTANCE: float
DO: float
DO_PCT: float
DO_Charge: float
PROFILE_COMMENTS: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblWaterProfiles(nvarchar, datetime, nvarchar, float)
«FK»
+ FK_tblWaterProfiles_tblWaterSamples(nvarchar, datetime, nvarchar)
tblChlorophyll
«column»
*PK ChlorophyllID: uniqueidentifier = (newid())
*pfK PONDNAME: nvarchar(50)
*pfK SAMPLEDATE: datetime
*pfK SAMPLENUMBER: nvarchar(50)
CHLA_LAB: nvarchar(50) = (N'Kielland')
CHLA_METHOD: nvarchar(100)
CHLA_CORRECTED_UG_L: decimal(18,2)
CHLA_Corrected_Notes: nvarchar(50)
CHLA_MDL_YN: bit
CHLA_MDL_LEVEL: float
CHLA_UNCORRECTED_UG_L: decimal(18,2)
CHLA_Uncorrected_Notes: nvarchar(50)
REPEATED_CHLA_SAMPLE: bit
COMMENTS: nvarchar(0)
SOURCE: nvarchar(100)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblChlorophyll(uniqueidentifier, nvarchar, datetime, nvarchar)
«FK»
+ FK_tblChlorophyll_tblWaterSamples(nvarchar, datetime, nvarchar)
tblInvertebrates
«column»
*pfK PONDNAME: nvarchar(50)
*pfK SAMPLEDATE: datetime
*pfK SAMPLENUMBER: nvarchar(50)
*PK INVERTID: uniqueidentifier = (newid())
LABSAMPLEID: nvarchar(50)
LABCOUNT: int
TAXONSHORT: nvarchar(50)
LIFESTAGE: nvarchar(50)
LIFESTAGE2: nvarchar(50)
VOUCHER: nvarchar(50)
COMMENTS: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblInvertebrates_2009(nvarchar, datetime, nvarchar, uniqueidentifier)
«FK»
+ FK_tblInvertebrates_2009_tblInvertebrateSamples(nvarchar, datetime, nvarchar)
tblContinuousDataLoggers
«column»
*pfK SiteName: nvarchar(50)
*pfK DateTimeDeployed: datetime
* SerialNumber: nvarchar(50)
LoggerType: nvarchar(50)
LoggerModel: nvarchar(50)
PctBattConfig: float
PctBattDwnld: float
LoggerName: nvarchar(50)
*PK Filename: nvarchar(50)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tblContinuousDataLoggers_1(nvarchar, datetime, nvarchar)
«FK»
+ FK_tblContinuousDataLoggers_tblContinuousDataDeployments(nvarchar, datetime)
1
+PK_tblContinuousDataLoggers_1
1
+PK_tblContinuousDataLoggers_1
1
+PK_tblContinuousDataLoggers_1
(SiteName = SiteName
DateTimeDeployed = DateTimeDeployed
Filename = Filename)
+FK_tbl_ContinuousTLL_tblContinuousDataLoggers
0..*
(SiteName = SiteName
DateTimeDeployed = DateTimeDeployed
Filename = Filename)
+FK_tbl_ContinuousWL_tblContinuousDataLoggers
0..*
(SiteName = SiteName
DateTimeDeployed = DateTimeDeployed
Filename = Filename)
+FK_tbl_ContinuousYSI_tblContinuousDataLoggers
0..*
tbl_ContinuousTLL
«column»
*pfK Filename: nvarchar(50)
LogNum: nvarchar(50)
*PK DateTime: datetime
Temp_C: decimal(18,3)
Intensity_Lux: decimal(18,1)
Batt_V: decimal(18,2)
*pfK SiteName: nvarchar(50)
*pfK DateTimeDeployed: datetime
* Exclude: bit = ((0))
ExclusionReason: nvarchar(50)
Comments: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tbl_ContinuousTL_1(nvarchar, datetime, nvarchar, datetime)
«FK»
+ FK_tbl_ContinuousTLL_tblContinuousDataLoggers(nvarchar, datetime, nvarchar)
tbl_ContinuousWL
«column»
*pfK Filename: nvarchar(50)
LogNum: nvarchar(50)
*PK DateTime: datetime
AbsPres_kPa: decimal(18,3)
Temp_C: decimal(18,3)
Batt_V: decimal(18,2)
AbsPresBarom_kPa: decimal(18,3)
SensorDepth: decimal(18,3)
*pfK SiteName: nvarchar(50)
*pfK DateTimeDeployed: datetime
* Exclude: bit = ((0))
ExclusionReason: nvarchar(50)
Comments: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tbl_ContinuousWL(nvarchar, datetime, nvarchar, datetime)
«FK»
+ FK_tbl_ContinuousWL_tblContinuousDataLoggers(nvarchar, datetime, nvarchar)
tbl_ContinuousYSI
«column»
*pfK SiteName: nvarchar(50)
*pfK DateTimeDeployed: datetime
*pfK Filename: nvarchar(50)
*PK DateTime: datetime
Temp_C: decimal(18,2)
SpCond_uScm: decimal(18,1)
pH: decimal(18,2)
pHmV: decimal(18,1)
DOpct: decimal(18,1)
DO_mgL: decimal(18,2)
DOchrg: decimal(18,1)
ODOpct: decimal(18,1)
ODO_mgL: decimal(18,2)
Turbidity_NTU: decimal(18,1)
ORP_mV: decimal(18,1)
Battery_V: decimal(18,1)
* Exclude: bit = ((0))
ExclusionReason: nvarchar(50)
Comments: nvarchar(0)
RecordInsertedDate: datetime = (getdate())
RecordInsertedBy: nvarchar(50) = (suser_name())
RecordUpdatedDate: datetime = (getdate())
RecordUpdatedBy: nvarchar(50) = (suser_name())
«PK»
+ PK_tbl_ContinuousYSI(nvarchar, datetime, nvarchar, datetime)
«FK»
+ FK_tbl_ContinuousYSI_tblContinuousDataLoggers(nvarchar, datetime, nvarchar)

Shallow Lakes

AK_ShallowLakes

Server	inpyugams08\sqlexpress
Author	
Created	01 November 2010 15:46
File Path	J:\Monitoring\Water_Quality_Macroinvert\Database\Data Model\AK_ShallowLakesDataModel_ 2010-11-01 15-46-39.doc

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AK_ShallowLakes Database

inpyugams08\sqlexpress > AK_ShallowLakes

Project Information

Author	
Created	01 November 2010 15:46

Properties

Property	Value
SQL Server Version	SQL Server 2005
Compatibility Level	SQL Server 2005

Files

Name	Type	Size	File Name
AK_ShallowLakes	Data	124.00 MB	C:\Program Files\Microsoft SQL Server\MSSQL.1\MSSQL\Data\AK_ShallowLakes.mdf
AK_ShallowLakes_log	Log	61.94 MB	C:\Program Files\Microsoft SQL Server\MSSQL.1\MSSQL\Data\AK_ShallowLakes_log.ldf

Tables

inpyugams08\sqlexpress > AK_ShallowLakes > Tables

Name
dbo.tbl_ContinuousTLL *This table has been developed for housing all of the Temperature data from data loggers deployed as part of the Continuous Monitoring protocol. Software options are being explored for Continuous Monitoring data management, making this table unneccessary.*
dbo.tbl_ContinuousWL *This table has been developed for housing all of the Water Level data from data loggers deployed as part of the Continuous Monitoring protocol. Software options are being explored for Continuous Monitoring data management, making this table unneccessary.*
dbo.tbl_ContinuousYSI *This table has been developed for housing all of the Sonde data from YSI data loggers deployed as part of the Continuous Monitoring protocol. Software options are being explored for Continuous Monitoring data management, making this table unneccessary.*
dbo.tblChlorophyll *This table contains the laboratory data for Chlorophyll-a analysis of water samples.*
dbo.tblContinuousDataDeployments *This table contains the deployment and retrieval information for continuous monitoring data collection. It relates to tbl-ContinuousDataSites by SiteName.*
dbo.tblContinuousDataLoggers *This table includes the details of instruments deployed for continuous monitoring data collection. It relates to tbl-ContinuousDataDeployments by SiteName and DateTimeDeployed.*
dbo.tblContinuousDataSites *Table for storing information about sites where data is continuously collected, usually using data loggers. These sites may or may not be the same as ponds in tblPonds. When SiteName=PONDNAME, this table links to tblPonds.*
dbo.tblDBIssues *This table provides a location to make note of any problems with the database, or issues that need to be addressed. When an issue is addressed, it can be marked as resolved. It is an independent table, not necessary for database function.*
dbo.tblEvents *This table contains all of the general data regarding a sampling event at a sampling site. All additional protocols (surveys, samples, etc.) are linked to the sampling event, including data collected in the field and laboratory results.*
dbo.tblInvertebrates *This table contains all of the laboratory results for invertebrate samples. It has been updated from the previous tbl-Invertebrates to streamline the primary key format, and unused fields have been marked for deletion.*
dbo.tblInvertebrateSamples *This table contains the information about samples collected for invertebrate analysis. It relates to tblEvents by PONDNAME and SAMPLEDATE.*
dbo.tblLoons *This table contains information about Loon sightings in the field, collected on behalf of Mel Flamme.*
dbo.tblPhotos *This table is not currently functioning. It appears to have been started, but minimally populated. It is not currently part of the sampling protocol.*
dbo.tblPondDepths *This table contains bathymetry data for sampled lakes. Most of the data is imported from Trimble GPS units, but data can be manually entered if the Trimble is unavailable.*
dbo.tblPonds *This table contains all of the sampling sites included in the Shallow Lakes project. This data is the stable, long-term information recorded for each site, and is referenced each time a Sampling Event is entered.*
dbo.tblTransQuadrats

This table contains the Nested Frequency Quadrat data collected as part of the Vegetation survey at each site.
dbo.tblTransSpeciesPointIntercepts *This table contains point intercept data, which was collected in an earlier protocol for vegetation surveys. Data is not being actively appended to this table, as the survey protocols have changed.*
dbo.tblUSGSLabData *This table contains the laboratory data returned from the USGS. Samples for gases, dissolved carbon and isotopes are collected on behalf of the USGS, and they share the results with the Shallow Lakes project.*
dbo.tblVegProfiles *This table contains the data from the Vegetation Profile protocol (VegMat). The depth of the various layers of the lake margin are profiled using an avalanche probe. Data is generally imported from a Trimble GPS unit, but can also be manually entered.*
dbo.tblVegTransects *This table contains the data for the line intercept vegetation transects performed at each lake as part of the vegetation survey protocol.*
dbo.tblWaterChemistry *This table contains the data received from the lab, detailing the results of water chemistry analyses. Data is imported from spreadsheets received from the lab.*
dbo.tblWaterProfiles *This table includes the data collected using Sonde multi-meters. The current protocol calls for profiles of measurements taken through the water column, while earlier methods included only a surface measurement. All in-situ Sonde data is included here.*
dbo.tblWaterSamples *This table includes the data collected about the water samples taken at lake sites. It links to tblEvents, and includes the results of analyses and processes performed in the field.*
dbo.tluCloudCover *This look-up table is used to select cloud cover codes when recording Sampling Event data.*
dbo.tluDatum *This look-up table is used to select the datum of the geographic coordinates contained in tblPonds.*
dbo.tluExclusionReason *This look-up table is used to select the reason for exclusion when flagging data in the continuous monitoring log tables for exclusion.*
dbo.tluFFGCodes *This look-up table contains the list of Functional Feeding Groups, referenced in tluInvertTaxa.*
dbo.tluGPS *This look-up table is used to select the code for the type of GPS unit used to collect geographic coordinates entered in tblPonds.*
dbo.tluHydrologicClass *This look-up table is used to select the Hydrologic Class code when entering data into tblPonds.*
dbo.tluHydrologicRegime *This look-up table is used to select the Hydrologic Regime code when entering data into tblPonds.*
dbo.tluInvertTaxa *This look-up table contains the taxonomic information for every invertebrate species that has been identified for this project. It is included in the Invertebrate database sent to the lab each year, and must be updated annually with any new additions.*
dbo.tluLifeStageCodes *This look-up table is used by the lab analyzing invertebrate samples to select the life stage of the specimens present in the sample. It can be updated if additional life stages are identified by the lab.*
dbo.tluLittoralHabitat *This look-up table contains the list of choices that can be used in the Dominant Habitat field of tblInvertebrateSamples or frmInvertCollection.*
dbo.tluLoggerModel *This look-up table can be used to select logger type in the continuous monitoring tables and forms. It includes temperature and pressure loggers, as well as all types of Sonde multi-probes.*
dbo.tluLoggerType *This look-up table contains the different types of dataloggers, and can be used to select the appropriate logger type in the Continuous Monitoring tables and forms.*

dbo.tluLoonDetection *This look-up table lists the different methods of identifying a loon species. It is referenced in tblLoon and frmLoon.*
dbo.tluLoonSpecies *This look-up table lists the loon species present in Alaska, and is referenced in tblLoons and frmLoons.*
dbo.tluLoonVeg *This look-up table lists the different veg codes that can be referenced to select the appropriate entry in tblLoons and frm-Loons.*
dbo.tluObserver *This look-up table lists all the personnel who have participated in data collection for this project. This table can be referenced by any table or form where a drop-down box for observer would be beneficial, or it can just serve as a reference.*
dbo.tluParkCode *This look-up table lists the park codes for the units covered by the scope of this project. It can be referenced by any table or form where it would be convenient to have a drop-down box for park code.*
dbo.tluPondClassGenesis *This look-up table is used to select the Genesis code when entering data into tblPonds.*
dbo.tluPondClassSalinity *This look-up table is used to select the Salinity code when entering data into tblPonds.*
dbo.tluPondClassShoreline *This look-up table is used to select the Shoreline code when entering data into tblPonds.*
dbo.tluSubmergedVeg *This look-up table is used to select the Submerged Vegetation Coverage code when entering data into tblEvents.*
dbo.tluVegTaxa *This look-up table is a list of plant species, as generated by Carl Roland in the mid-2000s. It contains extensive information for many species. When a species is encountered in this project, a 1 is entered in the SHALLOW_LAKES field to generate lists.*
dbo.tluVerticalStrata
dbo.tluViereckClass *This look-up table contains the Viereck Vegetation Class codes, and is referenced when entering the Viereck classification codes in tblEvents.*

[dbo].[tbl_ContinuousTLL]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tbl_ContinuousTLL

This table has been developed for housing all of the Temperature data from data loggers deployed as part of the Continuous Monitoring protocol. Software options are being explored for Continuous Monitoring data management, making this table unneccessary.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	0
Created	12:04:34 PM Friday, April 02, 2010
Last Modified	3:04:09 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	Filename *The name of the file downloaded from the datalogger.*	nvarchar(50)	100	✗	
	LogNum *Record identifier assigned by datalogger during data collection*	nvarchar(50)	100	✓	
	DateTime *Date and Time each record was recorded by datalogger*	datetime	8	✗	
	Temp_C *Temperature in C*	decimal(18,3)	9	✓	
	Intensity_Lux *Light Intensity reading in Lux*	decimal(18,1)	9	✓	
	Batt_V *Battery reading in Volts*	decimal(18,2)	9	✓	
	SiteName *Official site name. For lakes that are part of the monitoring program, this is the Pond-Name, which includes the park code and three-digit number. For sites outside of the Shallow Lake Monitoring program, a location name is assigned.*	nvarchar(50)	100	✗	
	DateTimeDeployed *Date and Time the logger was put in the water at the continuous monitoring site.*	datetime	8	✗	
	Exclude *Check this box if the data should be excluded from analysis for any reason*	bit	1	✗	((0))
	ExclusionReason *Reason for excluding the data (select from drop-down box)*	nvarchar(50)	100	✓	
	Comments *Comments regarding the exclusion of data or other general comments.*	nvarchar(max)	max	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tbl_ContinuousTL_1	Filename, DateTime, SiteName, Date-TimeDeployed	✓

Foreign Keys

Name	No Check	Columns
FK_tbl_ContinuousTLL_tblContinuousDataLoggers	✓	SiteName->[dbo].[tblContinuousData-Loggers].[SiteName] DateTimeDeployed->[dbo].[tblContinuous-DataLoggers].[DateTimeDeployed] Filename->[dbo].[tblContinuousData-Loggers].[Filename]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	Batt_V	-1
MS_ColumnHidden	COLUMN	Batt_V	False
MS_ColumnOrder	COLUMN	Batt_V	0
MS_ColumnWidth	COLUMN	Batt_V	-1
MS_DisplayControl	COLUMN	Batt_V	109
MS_Format	COLUMN	Batt_V	
MS_IMEMode	COLUMN	Batt_V	0
MS_TextAlign	COLUMN	Batt_V	0
MS_AggregateType	COLUMN	Comments	-1
MS_ColumnHidden	COLUMN	Comments	False
MS_ColumnOrder	COLUMN	Comments	0
MS_ColumnWidth	COLUMN	Comments	-1
MS_DisplayControl	COLUMN	Comments	109
MS_Format	COLUMN	Comments	
MS_IMEMode	COLUMN	Comments	0
MS_TextAlign	COLUMN	Comments	0
MS_AggregateType	COLUMN	DateTime	-1
MS_ColumnHidden	COLUMN	DateTime	False
MS_ColumnOrder	COLUMN	DateTime	0
MS_ColumnWidth	COLUMN	DateTime	-1
MS_DisplayControl	COLUMN	DateTime	
MS_Format	COLUMN	DateTime	
MS_IMEMode	COLUMN	DateTime	0
MS_TextAlign	COLUMN	DateTime	0
MS_AggregateType	COLUMN	DateTimeDeployed	-1
MS_ColumnHidden	COLUMN	DateTimeDeployed	False
MS_ColumnOrder	COLUMN	DateTimeDeployed	0
MS_ColumnWidth	COLUMN	DateTimeDeployed	-1
MS_DisplayControl	COLUMN	DateTimeDeployed	

MS_Format	COLUMN	DateTimeDeployed	
MS_IMEMode	COLUMN	DateTimeDeployed	0
MS_TextAlign	COLUMN	DateTimeDeployed	0
MS_AggregateType	COLUMN	Exclude	-1
MS_ColumnHidden	COLUMN	Exclude	False
MS_ColumnOrder	COLUMN	Exclude	0
MS_ColumnWidth	COLUMN	Exclude	-1
MS_DisplayControl	COLUMN	Exclude	109
MS_Format	COLUMN	Exclude	
MS_IMEMode	COLUMN	Exclude	0
MS_TextAlign	COLUMN	Exclude	0
MS_AggregateType	COLUMN	ExclusionReason	-1
MS_AllowValueListEdits	COLUMN	ExclusionReason	False
MS_ColumnHidden	COLUMN	ExclusionReason	False
MS_ColumnOrder	COLUMN	ExclusionReason	0
MS_ColumnWidth	COLUMN	ExclusionReason	2430
MS_DisplayControl	COLUMN	ExclusionReason	109
MS_Format	COLUMN	ExclusionReason	
MS_IMEMode	COLUMN	ExclusionReason	0
MS_ListItemsEditForm	COLUMN	ExclusionReason	
MS_RowSource	COLUMN	ExclusionReason	
MS_ShowOnlyRowSourceValues	COLUMN	ExclusionReason	False
MS_TextAlign	COLUMN	ExclusionReason	0
MS_AggregateType	COLUMN	Filename	-1
MS_ColumnHidden	COLUMN	Filename	False
MS_ColumnOrder	COLUMN	Filename	0
MS_ColumnWidth	COLUMN	Filename	-1
MS_DisplayControl	COLUMN	Filename	109
MS_Format	COLUMN	Filename	
MS_IMEMode	COLUMN	Filename	0
MS_TextAlign	COLUMN	Filename	0
MS_AggregateType	COLUMN	Intensity_Lux	-1
MS_ColumnHidden	COLUMN	Intensity_Lux	False
MS_ColumnOrder	COLUMN	Intensity_Lux	0
MS_ColumnWidth	COLUMN	Intensity_Lux	-1
MS_DisplayControl	COLUMN	Intensity_Lux	109
MS_Format	COLUMN	Intensity_Lux	
MS_IMEMode	COLUMN	Intensity_Lux	0
MS_TextAlign	COLUMN	Intensity_Lux	0
MS_AggregateType	COLUMN	LogNum	-1
MS_ColumnHidden	COLUMN	LogNum	False
MS_ColumnOrder	COLUMN	LogNum	0

MS_ColumnWidth	COLUMN	LogNum	-1
MS_DisplayControl	COLUMN	LogNum	109
MS_Format	COLUMN	LogNum	
MS_IMEMode	COLUMN	LogNum	0
MS_TextAlign	COLUMN	LogNum	0
MS_AggregateType	COLUMN	SiteName	-1
MS_ColumnHidden	COLUMN	SiteName	False
MS_ColumnOrder	COLUMN	SiteName	0
MS_ColumnWidth	COLUMN	SiteName	-1
MS_DisplayControl	COLUMN	SiteName	109
MS_Format	COLUMN	SiteName	
MS_IMEMode	COLUMN	SiteName	0
MS_TextAlign	COLUMN	SiteName	0
MS_AggregateType	COLUMN	Temp_C	-1
MS_ColumnHidden	COLUMN	Temp_C	False
MS_ColumnOrder	COLUMN	Temp_C	0
MS_ColumnWidth	COLUMN	Temp_C	-1
MS_DisplayControl	COLUMN	Temp_C	109
MS_Format	COLUMN	Temp_C	
MS_IMEMode	COLUMN	Temp_C	0
MS_TextAlign	COLUMN	Temp_C	0

Uses

[dbo].[tblContinuousDataLoggers]
dbo

[dbo].[tbl_ContinuousWL]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tbl_ContinuousWL

This table has been developed for housing all of the Water Level data from data loggers deployed as part of the Continuous Monitoring protocol. Software options are being explored for Continuous Monitoring data management, making this table unneccessary.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	0
Created	12:19:14 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	Filename *The name of the file downloaded from the datalogger.*	nvarchar(50)	100	✗	
	LogNum *Record identifier assigned by datalogger during data collection*	nvarchar(50)	100	✓	
	DateTime *Date and Time each record was recorded by datalogger*	datetime	8	✗	
	AbsPres_kPa *Absolute Pressure in kPa*	decimal(18,3)	9	✓	
	Temp_C *Temperature in C*	decimal(18,3)	9	✓	
	Batt_V *Battery reading in Volts*	decimal(18,2)	9	✓	
	AbsPresBarom_kPa *Absolute Pressure of the reference on-shore logger*	decimal(18,3)	9	✓	
	SensorDepth *Sensor Depth as calculated by HOBOware*	decimal(18,3)	9	✓	
	SiteName *Official site name. For lakes that are part of the monitoring program, this is the Pond-Name, which includes the park code and three-digit number. For sites outside of the Shallow Lake Monitoring program, a location name is assigned.*	nvarchar(50)	100	✗	
	DateTimeDeployed *Date and Time the logger was put in the water at the continuous monitoring site.*	datetime	8	✗	
	Exclude *Check this box if the data should be excluded from analysis for any reason*	bit	1	✗	((0))
	ExclusionReason *Reason for excluding the data (select from drop-down box)*	nvarchar(50)	100	✓	
	Comments *Comments regarding the exclusion of data or other general comments.*	nvarchar(max)	max	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tbl_ContinuousWL	Filename, DateTime, SiteName, DateTimeDeployed	✓

Foreign Keys

Name	No Check	Columns
FK_tbl_ContinuousWL_tblContinuousDataLoggers	✓	SiteName->[dbo].[tblContinuousDataLoggers].[SiteName] DateTimeDeployed->[dbo].[tblContinuousDataLoggers].[DateTimeDeployed] Filename->[dbo].[tblContinuousDataLoggers].[Filename]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	AbsPres_kPa	-1
MS_ColumnHidden	COLUMN	AbsPres_kPa	False
MS_ColumnOrder	COLUMN	AbsPres_kPa	0
MS_ColumnWidth	COLUMN	AbsPres_kPa	-1
MS_DisplayControl	COLUMN	AbsPres_kPa	109
MS_Format	COLUMN	AbsPres_kPa	
MS_IMEMode	COLUMN	AbsPres_kPa	0
MS_TextAlign	COLUMN	AbsPres_kPa	0
MS_AggregateType	COLUMN	AbsPresBarom_kPa	-1
MS_ColumnHidden	COLUMN	AbsPresBarom_kPa	False
MS_ColumnOrder	COLUMN	AbsPresBarom_kPa	0
MS_ColumnWidth	COLUMN	AbsPresBarom_kPa	-1
MS_DisplayControl	COLUMN	AbsPresBarom_kPa	109
MS_Format	COLUMN	AbsPresBarom_kPa	
MS_IMEMode	COLUMN	AbsPresBarom_kPa	0
MS_TextAlign	COLUMN	AbsPresBarom_kPa	0
MS_AggregateType	COLUMN	Batt_V	-1
MS_ColumnHidden	COLUMN	Batt_V	False
MS_ColumnOrder	COLUMN	Batt_V	0
MS_ColumnWidth	COLUMN	Batt_V	-1
MS_DisplayControl	COLUMN	Batt_V	109
MS_Format	COLUMN	Batt_V	
MS_IMEMode	COLUMN	Batt_V	0
MS_TextAlign	COLUMN	Batt_V	0
MS_AggregateType	COLUMN	Comments	-1
MS_ColumnHidden	COLUMN	Comments	False
MS_ColumnOrder	COLUMN	Comments	0
MS_ColumnWidth	COLUMN	Comments	-1
MS_TextAlign	COLUMN	Comments	0

MS_AggregateType	COLUMN	DateTime	-1
MS_ColumnHidden	COLUMN	DateTime	False
MS_ColumnOrder	COLUMN	DateTime	0
MS_ColumnWidth	COLUMN	DateTime	-1
MS_DisplayControl	COLUMN	DateTime	
MS_Format	COLUMN	DateTime	
MS_IMEMode	COLUMN	DateTime	0
MS_TextAlign	COLUMN	DateTime	0
MS_AggregateType	COLUMN	DateTimeDeployed	-1
MS_ColumnHidden	COLUMN	DateTimeDeployed	False
MS_ColumnOrder	COLUMN	DateTimeDeployed	0
MS_ColumnWidth	COLUMN	DateTimeDeployed	-1
MS_TextAlign	COLUMN	DateTimeDeployed	0
MS_AggregateType	COLUMN	Exclude	-1
MS_ColumnHidden	COLUMN	Exclude	False
MS_ColumnOrder	COLUMN	Exclude	0
MS_ColumnWidth	COLUMN	Exclude	-1
MS_TextAlign	COLUMN	Exclude	0
MS_AggregateType	COLUMN	ExclusionReason	-1
MS_AllowValueListEdits	COLUMN	ExclusionReason	False
MS_ColumnHidden	COLUMN	ExclusionReason	False
MS_ColumnOrder	COLUMN	ExclusionReason	0
MS_ColumnWidth	COLUMN	ExclusionReason	2685
MS_DisplayControl	COLUMN	ExclusionReason	111
MS_ListItemsEditForm	COLUMN	ExclusionReason	
MS_RowSource	COLUMN	ExclusionReason	SELECT ExclusionReason FROM dbo.tluExclusionReason ORDER BY SortOrder
MS_ShowOnlyRowSourceValues	COLUMN	ExclusionReason	False
MS_TextAlign	COLUMN	ExclusionReason	0
MS_AggregateType	COLUMN	Filename	-1
MS_ColumnHidden	COLUMN	Filename	False
MS_ColumnOrder	COLUMN	Filename	0
MS_ColumnWidth	COLUMN	Filename	-1
MS_DisplayControl	COLUMN	Filename	109
MS_Format	COLUMN	Filename	
MS_IMEMode	COLUMN	Filename	0
MS_TextAlign	COLUMN	Filename	0
MS_AggregateType	COLUMN	LogNum	-1
MS_ColumnHidden	COLUMN	LogNum	False
MS_ColumnOrder	COLUMN	LogNum	0
MS_ColumnWidth	COLUMN	LogNum	-1

MS_DisplayControl	COLUMN	LogNum	109
MS_Format	COLUMN	LogNum	
MS_IMEMode	COLUMN	LogNum	0
MS_TextAlign	COLUMN	LogNum	0
MS_AggregateType	COLUMN	SensorDepth	-1
MS_ColumnHidden	COLUMN	SensorDepth	False
MS_ColumnOrder	COLUMN	SensorDepth	0
MS_ColumnWidth	COLUMN	SensorDepth	-1
MS_DisplayControl	COLUMN	SensorDepth	109
MS_Format	COLUMN	SensorDepth	
MS_IMEMode	COLUMN	SensorDepth	0
MS_TextAlign	COLUMN	SensorDepth	0
MS_AggregateType	COLUMN	SiteName	-1
MS_ColumnHidden	COLUMN	SiteName	False
MS_ColumnOrder	COLUMN	SiteName	0
MS_ColumnWidth	COLUMN	SiteName	-1
MS_TextAlign	COLUMN	SiteName	0
MS_AggregateType	COLUMN	Temp_C	-1
MS_ColumnHidden	COLUMN	Temp_C	False
MS_ColumnOrder	COLUMN	Temp_C	0
MS_ColumnWidth	COLUMN	Temp_C	-1
MS_DisplayControl	COLUMN	Temp_C	109
MS_Format	COLUMN	Temp_C	
MS_IMEMode	COLUMN	Temp_C	0
MS_TextAlign	COLUMN	Temp_C	0

Uses

[dbo].[tblContinuousDataLoggers]
dbo

[dbo].[tbl_ContinuousYSI]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tbl_ContinuousYSI

This table has been developed for housing all of the Sonde data from YSI data loggers deployed as part of the Continuous Monitoring protocol. Software options are being explored for Continuous Monitoring data management, making this table unneccessary.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	0
Created	12:19:48 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
🔑🔑	SiteName *Official site name. For lakes that are part of the monitoring program, this is the Pond-Name, which includes the park code and three-digit number. For sites outside of the Shallow Lake Monitoring program, a location name is assigned.*	nvarchar(50)	100	✘	
🔑🔑	DateTimeDeployed *Date and Time the logger was put in the water at the continuous monitoring site.*	datetime	8	✘	
🔑🔑	Filename *The name of the file downloaded from the datalogger.*	nvarchar(50)	100	✘	
🔑	DateTime *Date and Time each record was recorded by datalogger*	datetime	8	✘	
	Temp_C *Temperature in C*	decimal(18,2)	9	✓	
	SpCond_uScm *Specific Conductivity in uS/cm*	decimal(18,1)	9	✓	
	pH *pH*	decimal(18,2)	9	✓	
	pHmV *pH charge in mV (used to diagnose problems)*	decimal(18,1)	9	✓	
	DOpct *Dissolved oxygen in percent saturation, collected with a rapid pulse probe.*	decimal(18,1)	9	✓	
	DO_mgL *Dissolved oxygen in mg/L, collected with a rapid pulse probe.*	decimal(18,2)	9	✓	
	DOchrg *Dissolved oxygen charge reading from rapid pulse probe (used to diagnose problems)*	decimal(18,1)	9	✓	
	ODOpct *Dissolved oxygen in percent saturation, collected with an optical probe.*	decimal(18,1)	9	✓	
	ODO_mgL *Dissolved oxygen in mg/L, collected with an optical probe.*	decimal(18,2)	9	✓	
	Turbidity_NTU *Turbidity in NTU*	decimal(18,1)	9	✓	
	ORP_mV *Oxidation Reduction Potential in mV*	decimal(18,1)	9	✓	
	Battery_V *Battery reading in Volts*	decimal(18,1)	9	✓	
	Exclude *Check this box if the data should be excluded from analysis for any reason*	bit	1	✘	((0))
	ExclusionReason *Reason for excluding the data (select from*	nvarchar(50)	100	✓	

	drop-down box)				
	Comments *Comments regarding the exclusion of data or other general comments.*	nvarchar(max)	max	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tbl_ContinuousYSI	SiteName, DateTimeDeployed, Filename, DateTime	✓

Foreign Keys

Name	No Check	Columns
FK_tbl_ContinuousYSI_tblContinuousDataLoggers	✓	SiteName->[dbo].[tblContinuousData-Loggers].[SiteName] DateTimeDeployed->[dbo].[tblContinuous-DataLoggers].[DateTimeDeployed] Filename->[dbo].[tblContinuousData-Loggers].[Filename]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	Battery_V	-1
MS_ColumnHidden	COLUMN	Battery_V	False
MS_ColumnOrder	COLUMN	Battery_V	0
MS_ColumnWidth	COLUMN	Battery_V	-1
MS_DisplayControl	COLUMN	Battery_V	109
MS_Format	COLUMN	Battery_V	
MS_IMEMode	COLUMN	Battery_V	0
MS_TextAlign	COLUMN	Battery_V	0
MS_AggregateType	COLUMN	Comments	-1
MS_ColumnHidden	COLUMN	Comments	False
MS_ColumnOrder	COLUMN	Comments	0
MS_ColumnWidth	COLUMN	Comments	-1
MS_DisplayControl	COLUMN	Comments	109
MS_Format	COLUMN	Comments	
MS_IMEMode	COLUMN	Comments	0
MS_TextAlign	COLUMN	Comments	0
MS_AggregateType	COLUMN	DateTime	-1
MS_ColumnHidden	COLUMN	DateTime	False
MS_ColumnOrder	COLUMN	DateTime	0
MS_ColumnWidth	COLUMN	DateTime	-1
MS_DisplayControl	COLUMN	DateTime	
MS_Format	COLUMN	DateTime	
MS_IMEMode	COLUMN	DateTime	0
MS_TextAlign	COLUMN	DateTime	0
MS_AggregateType	COLUMN	DateTimeDeployed	-1
MS_ColumnHidden	COLUMN	DateTimeDeployed	False
MS_ColumnOrder	COLUMN	DateTimeDeployed	0
MS_ColumnWidth	COLUMN	DateTimeDeployed	-1
MS_DisplayControl	COLUMN	DateTimeDeployed	

MS_Format	COLUMN	DateTimeDeployed	
MS_IMEMode	COLUMN	DateTimeDeployed	0
MS_TextAlign	COLUMN	DateTimeDeployed	0
MS_AggregateType	COLUMN	DO_mgL	-1
MS_ColumnHidden	COLUMN	DO_mgL	False
MS_ColumnOrder	COLUMN	DO_mgL	0
MS_ColumnWidth	COLUMN	DO_mgL	-1
MS_DisplayControl	COLUMN	DO_mgL	109
MS_Format	COLUMN	DO_mgL	
MS_IMEMode	COLUMN	DO_mgL	0
MS_TextAlign	COLUMN	DO_mgL	0
MS_AggregateType	COLUMN	DOchrg	-1
MS_ColumnHidden	COLUMN	DOchrg	False
MS_ColumnOrder	COLUMN	DOchrg	0
MS_ColumnWidth	COLUMN	DOchrg	-1
MS_DisplayControl	COLUMN	DOchrg	109
MS_Format	COLUMN	DOchrg	
MS_IMEMode	COLUMN	DOchrg	0
MS_TextAlign	COLUMN	DOchrg	0
MS_AggregateType	COLUMN	DOpct	-1
MS_ColumnHidden	COLUMN	DOpct	False
MS_ColumnOrder	COLUMN	DOpct	0
MS_ColumnWidth	COLUMN	DOpct	-1
MS_DisplayControl	COLUMN	DOpct	109
MS_Format	COLUMN	DOpct	
MS_IMEMode	COLUMN	DOpct	0
MS_TextAlign	COLUMN	DOpct	0
MS_AggregateType	COLUMN	Exclude	-1
MS_ColumnHidden	COLUMN	Exclude	False
MS_ColumnOrder	COLUMN	Exclude	0
MS_ColumnWidth	COLUMN	Exclude	-1
MS_DisplayControl	COLUMN	Exclude	109
MS_Format	COLUMN	Exclude	
MS_IMEMode	COLUMN	Exclude	0
MS_TextAlign	COLUMN	Exclude	0
MS_AggregateType	COLUMN	ExclusionReason	-1
MS_AllowValueListEdits	COLUMN	ExclusionReason	False
MS_ColumnHidden	COLUMN	ExclusionReason	False
MS_ColumnOrder	COLUMN	ExclusionReason	0
MS_ColumnWidth	COLUMN	ExclusionReason	2610
MS_DisplayControl	COLUMN	ExclusionReason	111
MS_Format	COLUMN	ExclusionReason	

MS_IMEMode	COLUMN	ExclusionReason	0
MS_ListItemsEditForm	COLUMN	ExclusionReason	
MS_RowSource	COLUMN	ExclusionReason	SELECT ExclusionReason FROM dbo.tluExclusionReason ORDER BY SortOrder
MS_ShowOnlyRowSourceValues	COLUMN	ExclusionReason	False
MS_TextAlign	COLUMN	ExclusionReason	0
MS_AggregateType	COLUMN	Filename	-1
MS_ColumnHidden	COLUMN	Filename	False
MS_ColumnOrder	COLUMN	Filename	0
MS_ColumnWidth	COLUMN	Filename	-1
MS_DisplayControl	COLUMN	Filename	109
MS_Format	COLUMN	Filename	
MS_IMEMode	COLUMN	Filename	0
MS_TextAlign	COLUMN	Filename	0
MS_AggregateType	COLUMN	ODO_mgL	-1
MS_ColumnHidden	COLUMN	ODO_mgL	False
MS_ColumnOrder	COLUMN	ODO_mgL	0
MS_ColumnWidth	COLUMN	ODO_mgL	-1
MS_DisplayControl	COLUMN	ODO_mgL	109
MS_Format	COLUMN	ODO_mgL	
MS_IMEMode	COLUMN	ODO_mgL	0
MS_TextAlign	COLUMN	ODO_mgL	0
MS_AggregateType	COLUMN	ODOpct	-1
MS_ColumnHidden	COLUMN	ODOpct	False
MS_ColumnOrder	COLUMN	ODOpct	0
MS_ColumnWidth	COLUMN	ODOpct	-1
MS_DisplayControl	COLUMN	ODOpct	109
MS_Format	COLUMN	ODOpct	
MS_IMEMode	COLUMN	ODOpct	0
MS_TextAlign	COLUMN	ODOpct	0
MS_AggregateType	COLUMN	ORP_mV	-1
MS_ColumnHidden	COLUMN	ORP_mV	False
MS_ColumnOrder	COLUMN	ORP_mV	0
MS_ColumnWidth	COLUMN	ORP_mV	-1
MS_DisplayControl	COLUMN	ORP_mV	109
MS_Format	COLUMN	ORP_mV	
MS_IMEMode	COLUMN	ORP_mV	0
MS_TextAlign	COLUMN	ORP_mV	0
MS_AggregateType	COLUMN	pH	-1
MS_ColumnHidden	COLUMN	pH	False
MS_ColumnOrder	COLUMN	pH	0

MS_ColumnWidth	COLUMN	pH	-1
MS_DisplayControl	COLUMN	pH	109
MS_Format	COLUMN	pH	
MS_IMEMode	COLUMN	pH	0
MS_TextAlign	COLUMN	pH	0
MS_AggregateType	COLUMN	pHmV	-1
MS_ColumnHidden	COLUMN	pHmV	False
MS_ColumnOrder	COLUMN	pHmV	0
MS_ColumnWidth	COLUMN	pHmV	-1
MS_DisplayControl	COLUMN	pHmV	109
MS_Format	COLUMN	pHmV	
MS_IMEMode	COLUMN	pHmV	0
MS_TextAlign	COLUMN	pHmV	0
MS_AggregateType	COLUMN	SiteName	-1
MS_ColumnHidden	COLUMN	SiteName	False
MS_ColumnOrder	COLUMN	SiteName	0
MS_ColumnWidth	COLUMN	SiteName	-1
MS_DisplayControl	COLUMN	SiteName	109
MS_Format	COLUMN	SiteName	
MS_IMEMode	COLUMN	SiteName	0
MS_TextAlign	COLUMN	SiteName	0
MS_AggregateType	COLUMN	SpCond_uScm	-1
MS_ColumnHidden	COLUMN	SpCond_uScm	False
MS_ColumnOrder	COLUMN	SpCond_uScm	0
MS_ColumnWidth	COLUMN	SpCond_uScm	-1
MS_DisplayControl	COLUMN	SpCond_uScm	109
MS_Format	COLUMN	SpCond_uScm	
MS_IMEMode	COLUMN	SpCond_uScm	0
MS_TextAlign	COLUMN	SpCond_uScm	0
MS_AggregateType	COLUMN	Temp_C	-1
MS_ColumnHidden	COLUMN	Temp_C	False
MS_ColumnOrder	COLUMN	Temp_C	0
MS_ColumnWidth	COLUMN	Temp_C	-1
MS_DisplayControl	COLUMN	Temp_C	109
MS_Format	COLUMN	Temp_C	
MS_IMEMode	COLUMN	Temp_C	0
MS_TextAlign	COLUMN	Temp_C	0
MS_AggregateType	COLUMN	Turbidity_NTU	-1
MS_ColumnHidden	COLUMN	Turbidity_NTU	False
MS_ColumnOrder	COLUMN	Turbidity_NTU	0
MS_ColumnWidth	COLUMN	Turbidity_NTU	-1
MS_DisplayControl	COLUMN	Turbidity_NTU	109

MS_Format	COLUMN	Turbidity_NTU	
MS_IMEMode	COLUMN	Turbidity_NTU	0
MS_TextAlign	COLUMN	Turbidity_NTU	0

Uses

[dbo].[tblContinuousDataLoggers]
dbo

[dbo].[tblChlorophyll]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblChlorophyll

This table contains the laboratory data for Chlorophyll-a analysis of water samples.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	643
Created	12:20:42 PM Friday, April 02, 2010
Last Modified	10:59:59 AM Wednesday, April 28, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	ChlorophyllID *Unique identifier automatically assigned to each chlorophyll record*	uniqueidentifier	16	✗	(newid())
	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗	
	SAMPLEDATE *The date and time of the sample; automatically populated when a new form is opened*	datetime	8	✗	
	SAMPLENUMBER *Alphabetic designation given when the sample is collected; start with "a" for the first sample taken, and label each sample consecutively*	nvarchar(50)	100	✗	
	CHLA_LAB *The lab in which the samples were analyzed*	nvarchar(50)	100	✓	(N'Kielland')
	CHLA_METHOD *The specific method used for analyzing the samples*	nvarchar(100)	200	✓	
	CHLA_CORRECTED_UG_L *Chlorophyll in ug/L after correction for phaeophytin*	decimal(18,2)	9	✓	
	CHLA_Corrected_Notes *Notes regarding the corrected chlorophyll measurement*	nvarchar(50)	100	✓	
	CHLA_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	CHLA_MDL_LEVEL *Minimum Detection Level of lab analysis for chlorophyll*	float	8	✓	
	CHLA_UNCORRECTED_UG_L *Chlorophyll in ug/L before correction for phaeophytin*	decimal(18,2)	9	✓	
	CHLA_Uncorrected_Notes *Notes regarding the uncorrected chlorophyll measurement*	nvarchar(50)	100	✓	
	REPEATED_CHLA_SAMPLE *Enter True if the data is a duplicate sample*	bit	1	✓	
	COMMENTS *General comments regarding the lab analysis of chlorophyll*	nvarchar(max)	max	✓	
	SOURCE *The source file (usually Excel spreadsheet) of the data.*	nvarchar(100)	200	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name( ))

	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name( ))

Indexes

	Name	Columns	Unique
	PK_tblChlorophyll	ChlorophyllID, PONDNAME, SAMPLEDATE, SAMPLENUMBER	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblChlorophyll_tblWaterSamples	✓	Cascade	Cascade	PONDNAME->[dbo].[tblWater-Samples].[PONDNAME] SAMPLEDATE->[dbo].[tblWater-Samples].[SAMPLEDATE] SAMPLENUMBER->[dbo].[tbl-Water-Samples].[SAMPLENUMBER]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			(CHLA_Corrected_- Notes="<MRL ")
MS_FilterOnLoad			False
MS_FrozenColumns			4
MS_HideNewField			False
MS_OrderBy			[tbl- Chlorophyll].[PONDNAME], [tbl- Chlorophyll].[SAMPLEDATE], [tbl- Chlorophyll].[SAMPLENUMB ER]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	CHLA_Corrected_Notes	-1
MS_ColumnHidden	COLUMN	CHLA_Corrected_Notes	False
MS_ColumnOrder	COLUMN	CHLA_Corrected_Notes	0
MS_ColumnWidth	COLUMN	CHLA_Corrected_Notes	885
MS_TextAlign	COLUMN	CHLA_Corrected_Notes	0
MS_AggregateType	COLUMN	CHLA_CORRECTED_UG_L	-1
MS_AllowValueListEdits	COLUMN	CHLA_CORRECTED_UG_L	False
MS_ColumnHidden	COLUMN	CHLA_CORRECTED_UG_L	False
MS_ColumnOrder	COLUMN	CHLA_CORRECTED_UG_L	0
MS_ColumnWidth	COLUMN	CHLA_CORRECTED_UG_L	1185
MS_DisplayControl	COLUMN	CHLA_CORRECTED_UG_L	110
MS_Format	COLUMN	CHLA_CORRECTED_UG_L	
MS_ListItemsEditForm	COLUMN	CHLA_CORRECTED_UG_L	
MS_RowSource	COLUMN	CHLA_CORRECTED_UG_L	-99999
MS_RowSourceType	COLUMN	CHLA_CORRECTED_UG_L	Value List
MS_ShowOnlyRowSourceValues	COLUMN	CHLA_CORRECTED_UG_L	False
MS_TextAlign	COLUMN	CHLA_CORRECTED_UG_L	0
MS_AggregateType	COLUMN	CHLA_LAB	-1
MS_ColumnHidden	COLUMN	CHLA_LAB	False
MS_ColumnOrder	COLUMN	CHLA_LAB	0
MS_ColumnWidth	COLUMN	CHLA_LAB	1245
MS_TextAlign	COLUMN	CHLA_LAB	0
MS_AggregateType	COLUMN	CHLA_MDL_LEVEL	-1

MS_ColumnHidden	COLUMN	CHLA_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	CHLA_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	CHLA_MDL_LEVEL	570
MS_DisplayControl	COLUMN	CHLA_MDL_LEVEL	109
MS_Format	COLUMN	CHLA_MDL_LEVEL	
MS_IMEMode	COLUMN	CHLA_MDL_LEVEL	0
MS_TextAlign	COLUMN	CHLA_MDL_LEVEL	0
MS_AggregateType	COLUMN	CHLA_MDL_YN	-1
MS_ColumnHidden	COLUMN	CHLA_MDL_YN	False
MS_ColumnOrder	COLUMN	CHLA_MDL_YN	0
MS_ColumnWidth	COLUMN	CHLA_MDL_YN	600
MS_DisplayControl	COLUMN	CHLA_MDL_YN	109
MS_Format	COLUMN	CHLA_MDL_YN	True/False
MS_IMEMode	COLUMN	CHLA_MDL_YN	0
MS_TextAlign	COLUMN	CHLA_MDL_YN	0
MS_AggregateType	COLUMN	CHLA_METHOD	-1
MS_ColumnHidden	COLUMN	CHLA_METHOD	False
MS_ColumnOrder	COLUMN	CHLA_METHOD	0
MS_ColumnWidth	COLUMN	CHLA_METHOD	2430
MS_TextAlign	COLUMN	CHLA_METHOD	0
MS_AggregateType	COLUMN	CHLA_Uncorrected_Notes	-1
MS_ColumnHidden	COLUMN	CHLA_Uncorrected_Notes	False
MS_ColumnOrder	COLUMN	CHLA_Uncorrected_Notes	0
MS_ColumnWidth	COLUMN	CHLA_Uncorrected_Notes	690
MS_TextAlign	COLUMN	CHLA_Uncorrected_Notes	0
MS_AggregateType	COLUMN	CHLA_UNCORRECTED_-UG_L	-1
MS_ColumnHidden	COLUMN	CHLA_UNCORRECTED_-UG_L	False
MS_ColumnOrder	COLUMN	CHLA_UNCORRECTED_-UG_L	0
MS_ColumnWidth	COLUMN	CHLA_UNCORRECTED_-UG_L	1200
MS_DisplayControl	COLUMN	CHLA_UNCORRECTED_-UG_L	109
MS_Format	COLUMN	CHLA_UNCORRECTED_-UG_L	
MS_TextAlign	COLUMN	CHLA_UNCORRECTED_-UG_L	0
MS_AggregateType	COLUMN	ChlorophyllID	-1
MS_ColumnHidden	COLUMN	ChlorophyllID	False
MS_ColumnOrder	COLUMN	ChlorophyllID	4
MS_ColumnWidth	COLUMN	ChlorophyllID	1650
MS_TextAlign	COLUMN	ChlorophyllID	0

MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	0
MS_ColumnWidth	COLUMN	COMMENTS	4620
MS_DisplayControl	COLUMN	COMMENTS	109
MS_Format	COLUMN	COMMENTS	
MS_IMEMode	COLUMN	COMMENTS	0
MS_TextAlign	COLUMN	COMMENTS	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	1
MS_ColumnWidth	COLUMN	PONDNAME	2895
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	REPEATED_CHLA_SAMPLE	-1
MS_ColumnHidden	COLUMN	REPEATED_CHLA_SAMPLE	False
MS_ColumnOrder	COLUMN	REPEATED_CHLA_SAMPLE	0
MS_ColumnWidth	COLUMN	REPEATED_CHLA_SAMPLE	1065
MS_TextAlign	COLUMN	REPEATED_CHLA_SAMPLE	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	2
MS_ColumnWidth	COLUMN	SAMPLEDATE	1635
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SAMPLENUMBER	-1
MS_ColumnHidden	COLUMN	SAMPLENUMBER	False
MS_ColumnOrder	COLUMN	SAMPLENUMBER	3
MS_ColumnWidth	COLUMN	SAMPLENUMBER	2520
MS_Format	COLUMN	SAMPLENUMBER	>
MS_TextAlign	COLUMN	SAMPLENUMBER	0
MS_AggregateType	COLUMN	SOURCE	-1
MS_ColumnHidden	COLUMN	SOURCE	False
MS_ColumnOrder	COLUMN	SOURCE	0
MS_ColumnWidth	COLUMN	SOURCE	3300
MS_DisplayControl	COLUMN	SOURCE	109
MS_Format	COLUMN	SOURCE	
MS_IMEMode	COLUMN	SOURCE	0
MS_TextAlign	COLUMN	SOURCE	0

Uses

[dbo].[tblWaterSamples]
dbo

[dbo].[tblContinuousDataDeployments]

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This table contains the deployment and retrieval information for continuous monitoring data collection. It relates to tbl-ContinuousDataSites by SiteName.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	11
Created	12:21:04 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	SiteName *Official site name. For lakes that are part of the monitoring program, this is the Pond-Name, which includes the park code and three-digit number. For sites outside of the Shallow Lake Monitoring program, a location name is assigned.*	nvarchar(50)	100	✘	
	DateTimeDeployed *Date and Time the logger was put in the water at the continuous monitoring site.*	datetime	8	✘	
	DateTimeRetrieved *Date and Time the logger was taken out of the water at the continuous monitoring site.*	datetime	8	✓	
	DeploymentType *Indicate the type of sensor assembly that was deployed*	nvarchar(50)	100	✓	
	DeploymentNotes *Notes regarding the deployment of the sensor(s)*	nvarchar(max)	max	✓	
	RetrievalNotes *Notes regarding the retrieval of the sensor(s)*	nvarchar(max)	max	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblContinuousDataDeployments	SiteName, DateTimeDeployed	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblContinuousDataDeployments_tbl-ContinuousDataSites	✓	Cascade	Cascade	SiteName->[dbo].[tbl-ContinuousDataSites].[Site-Name]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	DateTimeDeployed	-1
MS_ColumnHidden	COLUMN	DateTimeDeployed	False
MS_ColumnOrder	COLUMN	DateTimeDeployed	0
MS_ColumnWidth	COLUMN	DateTimeDeployed	1995
MS_TextAlign	COLUMN	DateTimeDeployed	0
MS_AggregateType	COLUMN	DateTimeRetrieved	-1
MS_ColumnHidden	COLUMN	DateTimeRetrieved	False
MS_ColumnOrder	COLUMN	DateTimeRetrieved	0
MS_ColumnWidth	COLUMN	DateTimeRetrieved	1995
MS_TextAlign	COLUMN	DateTimeRetrieved	0
MS_AggregateType	COLUMN	DeploymentNotes	-1
MS_ColumnHidden	COLUMN	DeploymentNotes	False
MS_ColumnOrder	COLUMN	DeploymentNotes	0
MS_ColumnWidth	COLUMN	DeploymentNotes	8895
MS_TextAlign	COLUMN	DeploymentNotes	0
MS_AggregateType	COLUMN	DeploymentType	-1
MS_ColumnHidden	COLUMN	DeploymentType	False
MS_ColumnOrder	COLUMN	DeploymentType	0
MS_ColumnWidth	COLUMN	DeploymentType	3150
MS_TextAlign	COLUMN	DeploymentType	0
MS_AggregateType	COLUMN	RecordInsertedBy	-1
MS_ColumnHidden	COLUMN	RecordInsertedBy	False
MS_ColumnOrder	COLUMN	RecordInsertedBy	0
MS_ColumnWidth	COLUMN	RecordInsertedBy	-1
MS_TextAlign	COLUMN	RecordInsertedBy	0
MS_AggregateType	COLUMN	RecordInsertedDate	-1
MS_ColumnHidden	COLUMN	RecordInsertedDate	False
MS_ColumnOrder	COLUMN	RecordInsertedDate	0
MS_ColumnWidth	COLUMN	RecordInsertedDate	-1

MS_TextAlign	COLUMN	RecordInsertedDate	0
MS_AggregateType	COLUMN	RecordUpdatedBy	-1
MS_ColumnHidden	COLUMN	RecordUpdatedBy	False
MS_ColumnOrder	COLUMN	RecordUpdatedBy	0
MS_ColumnWidth	COLUMN	RecordUpdatedBy	-1
MS_TextAlign	COLUMN	RecordUpdatedBy	0
MS_AggregateType	COLUMN	RecordUpdatedDate	-1
MS_ColumnHidden	COLUMN	RecordUpdatedDate	False
MS_ColumnOrder	COLUMN	RecordUpdatedDate	0
MS_ColumnWidth	COLUMN	RecordUpdatedDate	-1
MS_TextAlign	COLUMN	RecordUpdatedDate	0
MS_AggregateType	COLUMN	RetrievalNotes	-1
MS_ColumnHidden	COLUMN	RetrievalNotes	False
MS_ColumnOrder	COLUMN	RetrievalNotes	0
MS_ColumnWidth	COLUMN	RetrievalNotes	-1
MS_TextAlign	COLUMN	RetrievalNotes	0
MS_AggregateType	COLUMN	SiteName	-1
MS_ColumnHidden	COLUMN	SiteName	False
MS_ColumnOrder	COLUMN	SiteName	1
MS_ColumnWidth	COLUMN	SiteName	2850
MS_TextAlign	COLUMN	SiteName	0

Uses

[dbo].[tblContinuousDataSites]
dbo

Used By

[dbo].[tblContinuousDataLoggers]

[dbo].[tblContinuousDataLoggers]

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This table includes the details of instruments deployed for continuous monitoring data collection. It relates to tbl-ContinuousDataDeployments by SiteName and DateTimeDeployed.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	54
Created	12:21:30 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	SiteName *Official site name. For lakes that are part of the monitoring program, this is the Pond-Name, which includes the park code and three-digit number. For sites outside of the Shallow Lake Monitoring program, a location name is assigned.*	nvarchar(50)	100	✘	
	DateTimeDeployed *Date and Time the logger was put in the water at the continuous monitoring site.*	datetime	8	✘	
	SerialNumber *Serial number of the logger*	nvarchar(50)	100	✘	
	LoggerType *Logger type, selected from drop-down list*	nvarchar(50)	100	✓	
	LoggerModel *Logger model, selected from drop-down list*	nvarchar(50)	100	✓	
	PctBattConfig *% Battery reading at configuration*	float	8	✓	
	PctBattDwnld *% Battery reading at download*	float	8	✓	
	LoggerName *Internal digital name of the logger*	nvarchar(50)	100	✓	
	Filename *Filename for the downloaded data file*	nvarchar(50)	100	✘	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblContinuousDataLoggers_1	SiteName, DateTimeDeployed, Filename	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblContinuousDataLoggers_tblContinuous-DataDeployments	✓	Cascade	Cascade	SiteName->[dbo].[tbl-ContinuousData-Deployments].[SiteName] DateTimeDeployed->[dbo].[tblContinuousData-Deployments].[DateTime-Deployed]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			([tblContinuousData-Loggers].[LoggerType] Is Not Null AND [tblContinuousData-Loggers].[LoggerType]<>"")
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	DateTimeDeployed	-1
MS_ColumnHidden	COLUMN	DateTimeDeployed	False
MS_ColumnOrder	COLUMN	DateTimeDeployed	0
MS_ColumnWidth	COLUMN	DateTimeDeployed	2220
MS_DisplayControl	COLUMN	DateTimeDeployed	
MS_Format	COLUMN	DateTimeDeployed	
MS_IMEMode	COLUMN	DateTimeDeployed	0
MS_TextAlign	COLUMN	DateTimeDeployed	0
MS_AggregateType	COLUMN	Filename	-1
MS_ColumnHidden	COLUMN	Filename	False
MS_ColumnOrder	COLUMN	Filename	0
MS_ColumnWidth	COLUMN	Filename	2865
MS_DisplayControl	COLUMN	Filename	109
MS_Format	COLUMN	Filename	
MS_IMEMode	COLUMN	Filename	0
MS_TextAlign	COLUMN	Filename	0
MS_AggregateType	COLUMN	LoggerModel	-1
MS_AllowValueListEdits	COLUMN	LoggerModel	False
MS_ColumnCount	COLUMN	LoggerModel	2
MS_ColumnHidden	COLUMN	LoggerModel	False
MS_ColumnOrder	COLUMN	LoggerModel	0
MS_ColumnWidth	COLUMN	LoggerModel	1635
MS_ColumnWidths	COLUMN	LoggerModel	1440.000;2880.000
MS_DisplayControl	COLUMN	LoggerModel	111
MS_Format	COLUMN	LoggerModel	
MS_IMEMode	COLUMN	LoggerModel	0
MS_ListItemsEditForm	COLUMN	LoggerModel	

MS_ListWidth	COLUMN	LoggerModel	4320.000
MS_RowSource	COLUMN	LoggerModel	dbo.tluLoggerModel
MS_ShowOnlyRowSourceValues	COLUMN	LoggerModel	False
MS_TextAlign	COLUMN	LoggerModel	0
MS_AggregateType	COLUMN	LoggerName	-1
MS_ColumnHidden	COLUMN	LoggerName	False
MS_ColumnOrder	COLUMN	LoggerName	0
MS_ColumnWidth	COLUMN	LoggerName	1590
MS_DisplayControl	COLUMN	LoggerName	109
MS_Format	COLUMN	LoggerName	
MS_IMEMode	COLUMN	LoggerName	0
MS_TextAlign	COLUMN	LoggerName	0
MS_AggregateType	COLUMN	LoggerType	-1
MS_AllowValueListEdits	COLUMN	LoggerType	False
MS_ColumnCount	COLUMN	LoggerType	2
MS_ColumnHidden	COLUMN	LoggerType	False
MS_ColumnOrder	COLUMN	LoggerType	0
MS_ColumnWidth	COLUMN	LoggerType	-1
MS_ColumnWidths	COLUMN	LoggerType	720.000;2160.000
MS_DisplayControl	COLUMN	LoggerType	111
MS_Format	COLUMN	LoggerType	
MS_IMEMode	COLUMN	LoggerType	0
MS_ListItemsEditForm	COLUMN	LoggerType	
MS_ListWidth	COLUMN	LoggerType	2880.000
MS_RowSource	COLUMN	LoggerType	dbo.tluLoggerType
MS_RowSourceType	COLUMN	LoggerType	Tables/Views/Functions
MS_ShowOnlyRowSourceValues	COLUMN	LoggerType	False
MS_TextAlign	COLUMN	LoggerType	0
MS_AggregateType	COLUMN	PctBattConfig	-1
MS_ColumnHidden	COLUMN	PctBattConfig	False
MS_ColumnOrder	COLUMN	PctBattConfig	0
MS_ColumnWidth	COLUMN	PctBattConfig	1680
MS_DisplayControl	COLUMN	PctBattConfig	109
MS_Format	COLUMN	PctBattConfig	
MS_IMEMode	COLUMN	PctBattConfig	0
MS_TextAlign	COLUMN	PctBattConfig	0
MS_AggregateType	COLUMN	PctBattDwnld	-1
MS_ColumnHidden	COLUMN	PctBattDwnld	False
MS_ColumnOrder	COLUMN	PctBattDwnld	0
MS_ColumnWidth	COLUMN	PctBattDwnld	1680
MS_DisplayControl	COLUMN	PctBattDwnld	109
MS_Format	COLUMN	PctBattDwnld	

MS_IMEMode	COLUMN	PctBattDwnld	0
MS_TextAlign	COLUMN	PctBattDwnld	0
MS_AggregateType	COLUMN	RecordInsertedBy	-1
MS_ColumnHidden	COLUMN	RecordInsertedBy	False
MS_ColumnOrder	COLUMN	RecordInsertedBy	0
MS_ColumnWidth	COLUMN	RecordInsertedBy	-1
MS_TextAlign	COLUMN	RecordInsertedBy	0
MS_AggregateType	COLUMN	RecordInsertedDate	-1
MS_ColumnHidden	COLUMN	RecordInsertedDate	False
MS_ColumnOrder	COLUMN	RecordInsertedDate	0
MS_ColumnWidth	COLUMN	RecordInsertedDate	-1
MS_TextAlign	COLUMN	RecordInsertedDate	0
MS_AggregateType	COLUMN	RecordUpdatedBy	-1
MS_ColumnHidden	COLUMN	RecordUpdatedBy	False
MS_ColumnOrder	COLUMN	RecordUpdatedBy	0
MS_ColumnWidth	COLUMN	RecordUpdatedBy	-1
MS_TextAlign	COLUMN	RecordUpdatedBy	0
MS_AggregateType	COLUMN	RecordUpdatedDate	-1
MS_ColumnHidden	COLUMN	RecordUpdatedDate	False
MS_ColumnOrder	COLUMN	RecordUpdatedDate	0
MS_ColumnWidth	COLUMN	RecordUpdatedDate	-1
MS_TextAlign	COLUMN	RecordUpdatedDate	0
MS_AggregateType	COLUMN	SerialNumber	-1
MS_ColumnHidden	COLUMN	SerialNumber	False
MS_ColumnOrder	COLUMN	SerialNumber	0
MS_ColumnWidth	COLUMN	SerialNumber	1710
MS_DisplayControl	COLUMN	SerialNumber	109
MS_Format	COLUMN	SerialNumber	
MS_IMEMode	COLUMN	SerialNumber	0
MS_TextAlign	COLUMN	SerialNumber	0
MS_AggregateType	COLUMN	SiteName	-1
MS_ColumnHidden	COLUMN	SiteName	False
MS_ColumnOrder	COLUMN	SiteName	1
MS_ColumnWidth	COLUMN	SiteName	-1
MS_DisplayControl	COLUMN	SiteName	109
MS_Format	COLUMN	SiteName	
MS_IMEMode	COLUMN	SiteName	0
MS_TextAlign	COLUMN	SiteName	0

Uses

[dbo].[tblContinuousDataDeployments]

dbo

Used By

[dbo].[tbl_ContinuousTLL]
[dbo].[tbl_ContinuousWL]
[dbo].[tbl_ContinuousYSI]

[dbo].[tblContinuousDataSites]

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Table for storing information about sites where data is continuously collected, usually using data loggers. These sites may or may not be the same as ponds in tblPonds. When SiteName=PONDNAME, this table links to tblPonds.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	14
Created	12:21:46 PM Friday, April 02, 2010
Last Modified	11:26:04 AM Wednesday, April 14, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	SiteName *Official site name. For lakes that are part of the monitoring program, this is the Pond-Name, which includes the park code and three-digit number. For sites outside of the Shallow Lake Monitoring program, a location name is assigned.*	nvarchar(50)	100	✘	
	SiteType *Indicate if the site is a monitoring lake, a lake outside of the monitoring program, a river or stream, etc.*	nvarchar(50)	100	✓	
	Latitude *Latitude of the deployment*	decimal(18,8)	9	✓	
	Longitude *Longitude of the deployment*	decimal(18,8)	9	✓	
	LocationNotes *Notes regarding the location of the deployed sensor(s)*	nvarchar(max)	max	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblContinuousDataSites	SiteName	✓

Foreign Keys

Name	No Check	Replication	Columns
FK_tblContinuousDataSites_tblPonds	✓	✗	SiteName->[dbo].[tblPonds].[PONDNAME]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	Latitude	-1
MS_ColumnHidden	COLUMN	Latitude	False
MS_ColumnOrder	COLUMN	Latitude	0
MS_ColumnWidth	COLUMN	Latitude	-1
MS_TextAlign	COLUMN	Latitude	0
MS_AggregateType	COLUMN	LocationNotes	-1
MS_ColumnHidden	COLUMN	LocationNotes	False
MS_ColumnOrder	COLUMN	LocationNotes	0
MS_ColumnWidth	COLUMN	LocationNotes	5115
MS_TextAlign	COLUMN	LocationNotes	0
MS_AggregateType	COLUMN	Longitude	-1
MS_ColumnHidden	COLUMN	Longitude	False
MS_ColumnOrder	COLUMN	Longitude	0
MS_ColumnWidth	COLUMN	Longitude	-1
MS_TextAlign	COLUMN	Longitude	0
MS_AggregateType	COLUMN	RecordInsertedBy	-1
MS_ColumnHidden	COLUMN	RecordInsertedBy	False
MS_ColumnOrder	COLUMN	RecordInsertedBy	0
MS_ColumnWidth	COLUMN	RecordInsertedBy	-1
MS_TextAlign	COLUMN	RecordInsertedBy	0
MS_AggregateType	COLUMN	RecordInsertedDate	-1
MS_ColumnHidden	COLUMN	RecordInsertedDate	False
MS_ColumnOrder	COLUMN	RecordInsertedDate	0
MS_ColumnWidth	COLUMN	RecordInsertedDate	2280
MS_TextAlign	COLUMN	RecordInsertedDate	0
MS_AggregateType	COLUMN	RecordUpdatedBy	-1
MS_ColumnHidden	COLUMN	RecordUpdatedBy	False
MS_ColumnOrder	COLUMN	RecordUpdatedBy	0
MS_ColumnWidth	COLUMN	RecordUpdatedBy	-1

MS_TextAlign	COLUMN	RecordUpdatedBy	0
MS_AggregateType	COLUMN	RecordUpdatedDate	-1
MS_ColumnHidden	COLUMN	RecordUpdatedDate	False
MS_ColumnOrder	COLUMN	RecordUpdatedDate	0
MS_ColumnWidth	COLUMN	RecordUpdatedDate	-1
MS_TextAlign	COLUMN	RecordUpdatedDate	0
MS_AggregateType	COLUMN	SiteName	-1
MS_ColumnHidden	COLUMN	SiteName	False
MS_ColumnOrder	COLUMN	SiteName	0
MS_ColumnWidth	COLUMN	SiteName	-1
MS_TextAlign	COLUMN	SiteName	0
MS_AggregateType	COLUMN	SiteType	-1
MS_ColumnHidden	COLUMN	SiteType	False
MS_ColumnOrder	COLUMN	SiteType	0
MS_ColumnWidth	COLUMN	SiteType	-1
MS_TextAlign	COLUMN	SiteType	0

Uses

[dbo].[tblPonds]
dbo

Used By

[dbo].[tblContinuousDataDeployments]

[dbo].[tblDBIssues]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblDBIssues

This table provides a location to make note of any problems with the database, or issues that need to be addressed. When an issue is addressed, it can be marked as resolved. It is an independent table, not necessary for database function.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	7
Created	12:22:06 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	IssueID	uniqueidentifier	16	✗	
	Issue	nvarchar(max)	max	✓	
	IsResolved	bit	1	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblDBIssues	IssueID	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DisplayControl	COLUMN	IsResolved	109
MS_Format	COLUMN	IsResolved	
MS_IMEMode	COLUMN	IsResolved	0
MS_DisplayControl	COLUMN	Issue	109
MS_Format	COLUMN	Issue	
MS_IMEMode	COLUMN	Issue	0
MS_DisplayControl	COLUMN	IssueID	
MS_Format	COLUMN	IssueID	
MS_IMEMode	COLUMN	IssueID	0

Uses

dbo

[dbo].[tblEvents]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblEvents

This table contains all of the general data regarding a sampling event at a sampling site. All additional protocols (surveys, samples, etc.) are linked to the sampling event, including data collected in the field and laboratory results.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	329
Created	12:23:28 PM Friday, April 02, 2010
Last Modified	10:59:59 AM Wednesday, April 28, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗	
	SAMPLEDATE *The date and time of the sample; automatically populated when a new form is opened*	datetime	8	✗	
	START_TIME *The start time for a sampling event. In the old version of the database, date and time were separated. This field is retained for reference, but not populated with new data.*	datetime	8	✓	
	YEAR	int	4	✓	
	OBSERVERS *Initials of personnel participating in data collection*	nvarchar(50)	100	✓	
	SECCHIDEPTH *Secchi depth measured in meters*	float	8	✓	
	SECCHINOTES *Notes regarding the secchi measurement, including if the disk is still visible on the pond bottom*	nvarchar(max)	max	✓	
	ISSHOREBURNED *Is there evidence of any area of the shore having been burned?*	bit	1	✓	((0))
	BURNNOTES *Approximate date or timing of any burns.*	nvarchar(max)	max	✓	
	BURNDATE *Specific date of burn, if known.*	datetime	8	✓	
	THERMOKARSTEVIDENCE *Is there any evidence of thermokarst activity?*	bit	1	✓	((0))
	THERMOKARSTLOCATION *If there is evidence of thermokarst, where is it occurring?*	nvarchar(max)	max	✓	
	WOODFROGPRESENT *Indicates if wood frogs, including tadpoles, are observed.*	bit	1	✓	((0))
	PERCENTCLOUDS *Percent cloud cover; select from drop-down list*	nvarchar(50)	100	✓	
	WIND *Wind intensity; select from drop-down list*	nvarchar(50)	100	✓	
	PRECIPITATION *Precipitation type; select from drop-down list*	nvarchar(50)	100	✓	
	PRECIPITATIONINTENSITY *Precipitation intensity; select from drop-down list*	nvarchar(50)	100	✓	
	WEATHERCOMMENTS	nvarchar(max)	max	✓	

	Additional comments about the weather				
	SITECONDITIONSCOMMENTS *Comments about the condition of the site, specific to the sampling event (not permanent features).*	nvarchar(max)	max	✓	
	BIRD_ANIMAL_ACTIVITY *Comments about any birds, animals, or other wildlife seen, including notes about their activity.*	nvarchar(max)	max	✓	
	UPLAND_VIERECK_CLASS *The Viereck class code for upland vegetation, as selected using the tool.*	nvarchar(10)	20	✓	
	EMERGENT_VIERECK_CLASS *The Viereck class code for emergent vegetation, as selected using the tool.*	nvarchar(10)	20	✓	
	SUBMERGENT_VIERECK_CLASS *The Viereck class code for submergent vegetation, as selected using the tool.*	nvarchar(10)	20	✓	
	SUBMERGENT_COVER *Percent of lake containing submerged vegetation; select % cover from the drop-down list*	nvarchar(50)	100	✓	
	FISHPRESENT *Are there fish present in the lake?*	bit	1	✓	((0))
	WATERLEVEL_CM *Level of lake water in centimeters (measured using scope)*	float	8	✓	
	TURBIDITY_FIELD *Turbidity measurement (NTU) taken in the field using probe*	float	8	✓	
	EMERGENT_WIDTH *Width of the emergent zone in meters*	float	8	✓	
	SUBMERGENT_WIDTH *Width of submergent zone in meters*	float	8	✓	
	LOONSPRESENT *Are there loons present?*	bit	1	✓	
	RUSTYBBIRDSPRESENT *Are there rusty blackbirds present?*	bit	1	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblEvents	PONDNAME, SAMPLEDATE	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblEvents_tblPonds	✓	Cascade	Cascade	PONDNAME->[dbo].[tblPonds].[PONDNAME]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			((tblPond-Events.PONDNAME="YUCH-004 "))
MS_FilterOnLoad			False
MS_FrozenColumns			3
MS_HideNewField			False
MS_OrderBy			tblPondEvents.PONDNAME, tblPond-Events.SAMPLEDATE
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	BIRD_ANIMAL_ACTIVITY	-1
MS_ColumnHidden	COLUMN	BIRD_ANIMAL_ACTIVITY	False
MS_ColumnOrder	COLUMN	BIRD_ANIMAL_ACTIVITY	0
MS_ColumnWidth	COLUMN	BIRD_ANIMAL_ACTIVITY	-1
MS_TextAlign	COLUMN	BIRD_ANIMAL_ACTIVITY	0
MS_AggregateType	COLUMN	BURNDATE	-1
MS_ColumnHidden	COLUMN	BURNDATE	False
MS_ColumnOrder	COLUMN	BURNDATE	0
MS_ColumnWidth	COLUMN	BURNDATE	-1
MS_TextAlign	COLUMN	BURNDATE	0
MS_AggregateType	COLUMN	BURNNOTES	-1
MS_ColumnHidden	COLUMN	BURNNOTES	False
MS_ColumnOrder	COLUMN	BURNNOTES	0
MS_ColumnWidth	COLUMN	BURNNOTES	3105
MS_DisplayControl	COLUMN	BURNNOTES	109
MS_Format	COLUMN	BURNNOTES	
MS_IMEMode	COLUMN	BURNNOTES	0
MS_TextAlign	COLUMN	BURNNOTES	0
MS_AggregateType	COLUMN	EMERGENT_VIERECK_-CLASS	-1
MS_ColumnHidden	COLUMN	EMERGENT_VIERECK_-CLASS	False
MS_ColumnOrder	COLUMN	EMERGENT_VIERECK_-CLASS	0
MS_ColumnWidth	COLUMN	EMERGENT_VIERECK_-CLASS	-1
MS_TextAlign	COLUMN	EMERGENT_VIERECK_-	0

		CLASS	
MS_AggregateType	COLUMN	EMERGENT_WIDTH	-1
MS_ColumnHidden	COLUMN	EMERGENT_WIDTH	False
MS_ColumnOrder	COLUMN	EMERGENT_WIDTH	0
MS_ColumnWidth	COLUMN	EMERGENT_WIDTH	-1
MS_TextAlign	COLUMN	EMERGENT_WIDTH	0
MS_AggregateType	COLUMN	FISHPRESENT	-1
MS_ColumnHidden	COLUMN	FISHPRESENT	False
MS_ColumnOrder	COLUMN	FISHPRESENT	0
MS_ColumnWidth	COLUMN	FISHPRESENT	-1
MS_DisplayControl	COLUMN	FISHPRESENT	109
MS_Format	COLUMN	FISHPRESENT	True/False
MS_TextAlign	COLUMN	FISHPRESENT	0
MS_AggregateType	COLUMN	ISSHOREBURNED	-1
MS_ColumnHidden	COLUMN	ISSHOREBURNED	False
MS_ColumnOrder	COLUMN	ISSHOREBURNED	0
MS_ColumnWidth	COLUMN	ISSHOREBURNED	-1
MS_DisplayControl	COLUMN	ISSHOREBURNED	109
MS_Format	COLUMN	ISSHOREBURNED	True/False
MS_TextAlign	COLUMN	ISSHOREBURNED	0
MS_AggregateType	COLUMN	LOONSPRESENT	-1
MS_ColumnHidden	COLUMN	LOONSPRESENT	False
MS_ColumnOrder	COLUMN	LOONSPRESENT	0
MS_ColumnWidth	COLUMN	LOONSPRESENT	-1
MS_DisplayControl	COLUMN	LOONSPRESENT	109
MS_Format	COLUMN	LOONSPRESENT	True/False
MS_IMEMode	COLUMN	LOONSPRESENT	0
MS_TextAlign	COLUMN	LOONSPRESENT	0
MS_AggregateType	COLUMN	OBSERVERS	-1
MS_AllowValueListEdits	COLUMN	OBSERVERS	False
MS_ColumnCount	COLUMN	OBSERVERS	5
MS_ColumnHidden	COLUMN	OBSERVERS	False
MS_ColumnOrder	COLUMN	OBSERVERS	0
MS_ColumnWidth	COLUMN	OBSERVERS	-1
MS_ColumnWidths	COLUMN	OBSERVERS	576.000;1440.000;1440.000;0.000;0.000
MS_DisplayControl	COLUMN	OBSERVERS	111
MS_Format	COLUMN	OBSERVERS	>
MS_ListItemsEditForm	COLUMN	OBSERVERS	
MS_ListWidth	COLUMN	OBSERVERS	3456.000
MS_RowSource	COLUMN	OBSERVERS	SELECT "dbo"."tlu-Observer"."OBSINITS", "dbo"."tlu-Observer"."LASTNAME",

			"dbo"."tlu-Observer"."FIRSTNAME", "dbo"."tlu-Observer"."MIDDLEINIT", "dbo"."tlu-Observer"."SORTNUMBER" FROM "dbo"."tluObserver" ORDER BY "SORTNUMBER", "LASTNAME";
MS_ShowOnlyRowSourceValues	COLUMN	OBSERVERS	False
MS_TextAlign	COLUMN	OBSERVERS	0
MS_AggregateType	COLUMN	PERCENTCLOUDS	-1
MS_ColumnHidden	COLUMN	PERCENTCLOUDS	False
MS_ColumnOrder	COLUMN	PERCENTCLOUDS	0
MS_ColumnWidth	COLUMN	PERCENTCLOUDS	840
MS_TextAlign	COLUMN	PERCENTCLOUDS	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	1
MS_ColumnWidth	COLUMN	PONDNAME	2175
MS_Format	COLUMN	PONDNAME	
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	PRECIPITATION	-1
MS_AllowValueListEdits	COLUMN	PRECIPITATION	False
MS_ColumnHidden	COLUMN	PRECIPITATION	False
MS_ColumnOrder	COLUMN	PRECIPITATION	0
MS_ColumnWidth	COLUMN	PRECIPITATION	945
MS_DisplayControl	COLUMN	PRECIPITATION	111
MS_ListItemsEditForm	COLUMN	PRECIPITATION	
MS_RowSource	COLUMN	PRECIPITATION	None;Rain;Sleet;Snow
MS_RowSourceType	COLUMN	PRECIPITATION	Value List
MS_ShowOnlyRowSourceValues	COLUMN	PRECIPITATION	False
MS_TextAlign	COLUMN	PRECIPITATION	0
MS_AggregateType	COLUMN	PRECIPITATIONINTENSITY	-1
MS_AllowValueListEdits	COLUMN	PRECIPITATIONINTENSITY	False
MS_ColumnHidden	COLUMN	PRECIPITATIONINTENSITY	False
MS_ColumnOrder	COLUMN	PRECIPITATIONINTENSITY	0
MS_ColumnWidth	COLUMN	PRECIPITATIONINTENSITY	720
MS_DisplayControl	COLUMN	PRECIPITATIONINTENSITY	111
MS_ListItemsEditForm	COLUMN	PRECIPITATIONINTENSITY	
MS_RowSource	COLUMN	PRECIPITATIONINTENSITY	N/A;Light;Moderate;Heavy
MS_RowSourceType	COLUMN	PRECIPITATIONINTENSITY	Value List
MS_ShowOnlyRowSourceValues	COLUMN	PRECIPITATIONINTENSITY	False
MS_TextAlign	COLUMN	PRECIPITATIONINTENSITY	0

MS_AggregateType	COLUMN	RUSTYBBIRDSPRESENT	-1
MS_ColumnHidden	COLUMN	RUSTYBBIRDSPRESENT	False
MS_ColumnOrder	COLUMN	RUSTYBBIRDSPRESENT	0
MS_ColumnWidth	COLUMN	RUSTYBBIRDSPRESENT	-1
MS_DisplayControl	COLUMN	RUSTYBBIRDSPRESENT	109
MS_Format	COLUMN	RUSTYBBIRDSPRESENT	True/False
MS_IMEMode	COLUMN	RUSTYBBIRDSPRESENT	0
MS_TextAlign	COLUMN	RUSTYBBIRDSPRESENT	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	0
MS_ColumnWidth	COLUMN	SAMPLEDATE	1635
MS_Format	COLUMN	SAMPLEDATE	Short Date
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SECCHIDEPTH	-1
MS_ColumnHidden	COLUMN	SECCHIDEPTH	False
MS_ColumnOrder	COLUMN	SECCHIDEPTH	0
MS_ColumnWidth	COLUMN	SECCHIDEPTH	-1
MS_TextAlign	COLUMN	SECCHIDEPTH	0
MS_AggregateType	COLUMN	SECCHINOTES	-1
MS_ColumnHidden	COLUMN	SECCHINOTES	False
MS_ColumnOrder	COLUMN	SECCHINOTES	0
MS_ColumnWidth	COLUMN	SECCHINOTES	1245
MS_DisplayControl	COLUMN	SECCHINOTES	109
MS_Format	COLUMN	SECCHINOTES	
MS_IMEMode	COLUMN	SECCHINOTES	0
MS_TextAlign	COLUMN	SECCHINOTES	0
MS_AggregateType	COLUMN	SITECONDITIONSCOMMENTS	-1
MS_ColumnHidden	COLUMN	SITECONDITIONSCOMMENTS	False
MS_ColumnOrder	COLUMN	SITECONDITIONSCOMMENTS	0
MS_ColumnWidth	COLUMN	SITECONDITIONSCOMMENTS	11910
MS_TextAlign	COLUMN	SITECONDITIONSCOMMENTS	0
MS_AggregateType	COLUMN	START_TIME	-1
MS_ColumnHidden	COLUMN	START_TIME	False
MS_ColumnOrder	COLUMN	START_TIME	0
MS_ColumnWidth	COLUMN	START_TIME	-1
MS_TextAlign	COLUMN	START_TIME	0
MS_AggregateType	COLUMN	SUBMERGENT_COVER	-1
MS_AllowValueListEdits	COLUMN	SUBMERGENT_COVER	False

MS_ColumnCount	COLUMN	SUBMERGENT_COVER	2
MS_ColumnHidden	COLUMN	SUBMERGENT_COVER	False
MS_ColumnOrder	COLUMN	SUBMERGENT_COVER	0
MS_ColumnWidth	COLUMN	SUBMERGENT_COVER	2415
MS_ColumnWidths	COLUMN	SUBMERGENT_COVER	432.000;3168.000
MS_DisplayControl	COLUMN	SUBMERGENT_COVER	111
MS_Format	COLUMN	SUBMERGENT_COVER	
MS_IMEMode	COLUMN	SUBMERGENT_COVER	0
MS_ListItemsEditForm	COLUMN	SUBMERGENT_COVER	
MS_ListWidth	COLUMN	SUBMERGENT_COVER	3600.000
MS_RowSource	COLUMN	SUBMERGENT_COVER	dbo.tluSubmergedVeg
MS_ShowOnlyRowSourceValues	COLUMN	SUBMERGENT_COVER	False
MS_TextAlign	COLUMN	SUBMERGENT_COVER	0
MS_AggregateType	COLUMN	SUBMERGENT_VIERECK_-CLASS	-1
MS_ColumnHidden	COLUMN	SUBMERGENT_VIERECK_-CLASS	False
MS_ColumnOrder	COLUMN	SUBMERGENT_VIERECK_-CLASS	0
MS_ColumnWidth	COLUMN	SUBMERGENT_VIERECK_-CLASS	3210
MS_TextAlign	COLUMN	SUBMERGENT_VIERECK_-CLASS	0
MS_AggregateType	COLUMN	SUBMERGENT_WIDTH	-1
MS_ColumnHidden	COLUMN	SUBMERGENT_WIDTH	False
MS_ColumnOrder	COLUMN	SUBMERGENT_WIDTH	0
MS_ColumnWidth	COLUMN	SUBMERGENT_WIDTH	2415
MS_TextAlign	COLUMN	SUBMERGENT_WIDTH	0
MS_AggregateType	COLUMN	THERMOKARSTEVIDENCE	-1
MS_ColumnHidden	COLUMN	THERMOKARSTEVIDENCE	False
MS_ColumnOrder	COLUMN	THERMOKARSTEVIDENCE	0
MS_ColumnWidth	COLUMN	THERMOKARSTEVIDENCE	-1
MS_DisplayControl	COLUMN	THERMOKARSTEVIDENCE	109
MS_Format	COLUMN	THERMOKARSTEVIDENCE	True/False
MS_TextAlign	COLUMN	THERMOKARSTEVIDENCE	0
MS_AggregateType	COLUMN	THERMOKARSTLOCATION	-1
MS_ColumnHidden	COLUMN	THERMOKARSTLOCATION	False
MS_ColumnOrder	COLUMN	THERMOKARSTLOCATION	0
MS_ColumnWidth	COLUMN	THERMOKARSTLOCATION	1290
MS_TextAlign	COLUMN	THERMOKARSTLOCATION	0
MS_AggregateType	COLUMN	TURBIDITY_FIELD	-1
MS_ColumnHidden	COLUMN	TURBIDITY_FIELD	False
MS_ColumnOrder	COLUMN	TURBIDITY_FIELD	0
MS_ColumnWidth	COLUMN	TURBIDITY_FIELD	2430

MS_TextAlign	COLUMN	TURBIDITY_FIELD	0
MS_AggregateType	COLUMN	UPLAND_VIERECK_CLASS	-1
MS_ColumnHidden	COLUMN	UPLAND_VIERECK_CLASS	False
MS_ColumnOrder	COLUMN	UPLAND_VIERECK_CLASS	0
MS_ColumnWidth	COLUMN	UPLAND_VIERECK_CLASS	-1
MS_TextAlign	COLUMN	UPLAND_VIERECK_CLASS	0
MS_AggregateType	COLUMN	WATERLEVEL_CM	-1
MS_ColumnHidden	COLUMN	WATERLEVEL_CM	False
MS_ColumnOrder	COLUMN	WATERLEVEL_CM	0
MS_ColumnWidth	COLUMN	WATERLEVEL_CM	1995
MS_TextAlign	COLUMN	WATERLEVEL_CM	0
MS_AggregateType	COLUMN	WEATHERCOMMENTS	-1
MS_ColumnHidden	COLUMN	WEATHERCOMMENTS	False
MS_ColumnOrder	COLUMN	WEATHERCOMMENTS	0
MS_ColumnWidth	COLUMN	WEATHERCOMMENTS	975
MS_TextAlign	COLUMN	WEATHERCOMMENTS	0
MS_AggregateType	COLUMN	WIND	-1
MS_AllowValueListEdits	COLUMN	WIND	False
MS_ColumnHidden	COLUMN	WIND	False
MS_ColumnOrder	COLUMN	WIND	0
MS_ColumnWidth	COLUMN	WIND	1110
MS_DisplayControl	COLUMN	WIND	111
MS_ListItemsEditForm	COLUMN	WIND	
MS_RowSource	COLUMN	WIND	Calm;Light;Moderate;Gusty
MS_RowSourceType	COLUMN	WIND	Value List
MS_ShowOnlyRowSourceValues	COLUMN	WIND	False
MS_TextAlign	COLUMN	WIND	0
MS_AggregateType	COLUMN	WOODFROGPRESENT	-1
MS_ColumnHidden	COLUMN	WOODFROGPRESENT	False
MS_ColumnOrder	COLUMN	WOODFROGPRESENT	0
MS_ColumnWidth	COLUMN	WOODFROGPRESENT	825
MS_DisplayControl	COLUMN	WOODFROGPRESENT	109
MS_Format	COLUMN	WOODFROGPRESENT	True/False
MS_TextAlign	COLUMN	WOODFROGPRESENT	0
MS_AggregateType	COLUMN	YEAR	-1
MS_ColumnHidden	COLUMN	YEAR	False
MS_ColumnOrder	COLUMN	YEAR	0
MS_ColumnWidth	COLUMN	YEAR	-1
MS_TextAlign	COLUMN	YEAR	0

Uses

[dbo].[tblPonds]
dbo

Used By

[dbo].[tblInvertebrateSamples]
[dbo].[tblLoons]
[dbo].[tblPondDepths]
[dbo].[tblTransQuadrats]
[dbo].[tblTransSpeciesPointIntercepts]
[dbo].[tblUSGSLabData]
[dbo].[tblVegProfiles]
[dbo].[tblVegTransects]
[dbo].[tblWaterSamples]

[dbo].[tblInvertebrates]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblInvertebrates

This table contains all of the laboratory results for invertebrate samples. It has been updated from the previous tbl-Invertebrates to streamline the primary key format, and unused fields have been marked for deletion.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	9323
Created	12:24:52 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
🔑	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗	
🔑	SAMPLEDATE *The date of the sample; automatically populated when a new form is opened*	datetime	8	✗	
🔑	SAMPLENUMBER *Alphabetic designation given when the sample is collected; start with "a" for the first sample taken, and label each sample consecutively*	nvarchar(50)	100	✗	
🔑	INVERTID *Unique identifier assigned to each record.*	uniqueidentifier	16	✗	(newid())
	LABSAMPLEID *ID assigned by laboratory at the time of analysis.*	nvarchar(50)	100	✓	
	LABCOUNT *Number of individuals found in the sample*	int	4	✓	
	TAXONSHORT *Unique name for each taxon*	nvarchar(50)	100	✓	
	LIFESTAGE *Lifestage of the taxon*	nvarchar(50)	100	✓	
	LIFESTAGE2 *Additional lifestage of the taxon (from data formerly added on to the taxonshort field)*	nvarchar(50)	100	✓	
	VOUCHER *The voucher number of the specimen, if applicable.*	nvarchar(50)	100	✓	
	COMMENTS *Comments about the analysis.*	nvarchar(max)	max	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name( ))
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name( ))

Indexes

	Name	Columns	Unique
🔑	PK_tblInvertebrates_2009	PONDNAME, SAMPLEDATE, SAMPLENUMBER, INVERTID	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblInvertebrates_2009_tblInvertebrate-Samples	✓	Cascade	Cascade	PONDNAME->[dbo].[tbl-Invertebrate-Samples].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Invertebrate-Samples].[SAMPLEDATE] SAMPLENUMBER->[dbo].[tblInvertebrate-Samples].[SAMPLENUMBER]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			[tblInvertebrates_2009].[TAXONSHORT]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	0
MS_ColumnWidth	COLUMN	COMMENTS	-1
MS_DisplayControl	COLUMN	COMMENTS	109
MS_Format	COLUMN	COMMENTS	
MS_IMEMode	COLUMN	COMMENTS	0
MS_TextAlign	COLUMN	COMMENTS	0
MS_DisplayControl	COLUMN	INVERTID	
MS_Format	COLUMN	INVERTID	
MS_IMEMode	COLUMN	INVERTID	0
MS_AggregateType	COLUMN	LABCOUNT	-1
MS_ColumnHidden	COLUMN	LABCOUNT	False
MS_ColumnOrder	COLUMN	LABCOUNT	0
MS_ColumnWidth	COLUMN	LABCOUNT	-1
MS_TextAlign	COLUMN	LABCOUNT	0
MS_AggregateType	COLUMN	LABSAMPLEID	-1
MS_ColumnHidden	COLUMN	LABSAMPLEID	False
MS_ColumnOrder	COLUMN	LABSAMPLEID	0
MS_ColumnWidth	COLUMN	LABSAMPLEID	-1
MS_TextAlign	COLUMN	LABSAMPLEID	0
MS_AggregateType	COLUMN	LIFESTAGE	-1
MS_ColumnHidden	COLUMN	LIFESTAGE	False
MS_ColumnOrder	COLUMN	LIFESTAGE	0
MS_ColumnWidth	COLUMN	LIFESTAGE	-1
MS_TextAlign	COLUMN	LIFESTAGE	0
MS_AggregateType	COLUMN	LIFESTAGE2	-1
MS_ColumnHidden	COLUMN	LIFESTAGE2	False
MS_ColumnOrder	COLUMN	LIFESTAGE2	0

MS_ColumnWidth	COLUMN	LIFESTAGE2	-1
MS_DisplayControl	COLUMN	LIFESTAGE2	109
MS_Format	COLUMN	LIFESTAGE2	
MS_IMEMode	COLUMN	LIFESTAGE2	0
MS_TextAlign	COLUMN	LIFESTAGE2	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	0
MS_ColumnWidth	COLUMN	PONDNAME	-1
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	0
MS_ColumnWidth	COLUMN	SAMPLEDATE	-1
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SAMPLENUMBER	-1
MS_ColumnHidden	COLUMN	SAMPLENUMBER	False
MS_ColumnOrder	COLUMN	SAMPLENUMBER	0
MS_ColumnWidth	COLUMN	SAMPLENUMBER	-1
MS_Format	COLUMN	SAMPLENUMBER	>
MS_TextAlign	COLUMN	SAMPLENUMBER	0
MS_AggregateType	COLUMN	TAXONSHORT	-1
MS_ColumnHidden	COLUMN	TAXONSHORT	False
MS_ColumnOrder	COLUMN	TAXONSHORT	0
MS_ColumnWidth	COLUMN	TAXONSHORT	-1
MS_TextAlign	COLUMN	TAXONSHORT	0
MS_AggregateType	COLUMN	VOUCHER	-1
MS_ColumnHidden	COLUMN	VOUCHER	False
MS_ColumnOrder	COLUMN	VOUCHER	0
MS_ColumnWidth	COLUMN	VOUCHER	-1
MS_TextAlign	COLUMN	VOUCHER	0

Uses

[dbo].[tblInvertebrateSamples]
dbo

[dbo].[tblInvertebrateSamples]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblInvertebrateSamples

This table contains the information about samples collected for invertebrate analysis. It relates to tblEvents by PONDNAME and SAMPLEDATE.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	686
Created	1:16:23 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗	
	SAMPLEDATE *The date and time of the sample; automatically populated when a new form is opened*	datetime	8	✗	
	SAMPLENUMBER *Alphabetic designation given when the sample is collected; start with "a" for the first sample taken, and label each sample consecutively*	nvarchar(50)	100	✗	
	LABSAMPLEID *The identifier assigned to the sample by the laboratory when processing the sample*	nvarchar(50)	100	✓	
	TRANSECTNUMBER *If more than one transect is used for collection, the transect number is entered here. This is not generally done, and is for historical understanding only.*	int	4	✓	
	SAMPLECOLLECTORS *Initials of the individual/s collecting the samples*	nvarchar(50)	100	✓	
	STANDARDIZEDSWEEP *(Data no longer collected) Was the collection done using a standardized sweep?*	bit	1	✓	
	QUALITATIVESURVEY *(Data no longer collected) Was the collection done using a qualitative survey?*	bit	1	✓	
	DOMINANTHABITAT *Select the appropriate habitat type from the drop-down list*	nvarchar(50)	100	✓	
	WATERDEPTH *Water depth in meters at collection point*	float	8	✓	
	DISTANCETOSHORE *Distance from the shore in meters at collection point*	float	8	✓	
	NUM_OF_BOTTLES *Number of sample bottles used to contain the sample*	numeric(18,0)	9	✓	
	FRACTIONANALYZED *Fraction of the sample analyzed by the lab (post-collection data)*	float	8	✓	
	COMMENTS *Additional comments about the site or sample collection*	nvarchar(max)	max	✓	
	QUALITATIVESAMPLEHABITATDESCRIPTION *Description of the lake habitat*	nvarchar(max)	max	✓	
	HABITATDESCRIPTION *Description of the habitat of the sampling site, and any additional comments about*	nvarchar(max)	max	✓	

	the site or sample collection (Combination of Comments and Qualitative Sample Habitat Description fields)				
	SOURCEDB *The source database or file for the data in the record (artifact of concatenation)*	nvarchar(50)	100	✓	
	SHIPPING_DATE *Date when the samples were shipped to the lab for analysis*	datetime	8	✓	
	SHIPPING_INFO *Notes regarding the shipment of the samples (crate numbers, condition, etc.)*	nvarchar(255)	510	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblInvertebrateSamples_1	PONDNAME, SAMPLEDATE, SAMPLENUMBER	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblInvertebrateSamples_tblEvents1	✓	Cascade	Cascade	PONDNAME->[dbo].[tbl-Events].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Events].[SAMPLEDATE]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			(WATERDEPTH In (30,5))
MS_FilterOnLoad			False
MS_HideNewField			False
MS_LinkChildFields			PONDNAME;SAMPLEDATE;SAMPLENUMBER
MS_LinkMasterFields			PONDNAME;SAMPLEDATE;SAMPLENUMBER
MS_OrderBy			[tblInvertebrate-Samples].[SAMPLEDATE], [tblInvertebrate-Samples].[PONDNAME], [tbl-Invertebrate-Samples].[SAMPLENUMBER]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_SubdatasheetName			dbo.tblInvertebrates_2009
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	14
MS_ColumnWidth	COLUMN	COMMENTS	5865
MS_TextAlign	COLUMN	COMMENTS	0
MS_AggregateType	COLUMN	DISTANCETOSHORE	-1
MS_ColumnHidden	COLUMN	DISTANCETOSHORE	False
MS_ColumnOrder	COLUMN	DISTANCETOSHORE	13
MS_ColumnWidth	COLUMN	DISTANCETOSHORE	855
MS_TextAlign	COLUMN	DISTANCETOSHORE	0
MS_AggregateType	COLUMN	DOMINANTHABITAT	-1
MS_AllowValueListEdits	COLUMN	DOMINANTHABITAT	False
MS_ColumnCount	COLUMN	DOMINANTHABITAT	2
MS_ColumnHidden	COLUMN	DOMINANTHABITAT	False
MS_ColumnOrder	COLUMN	DOMINANTHABITAT	11
MS_ColumnWidth	COLUMN	DOMINANTHABITAT	1725
MS_ColumnWidths	COLUMN	DOMINANTHABITAT	1584.000;16416.000
MS_DisplayControl	COLUMN	DOMINANTHABITAT	111
MS_ListItemsEditForm	COLUMN	DOMINANTHABITAT	
MS_ListWidth	COLUMN	DOMINANTHABITAT	18000.000
MS_RowSource	COLUMN	DOMINANTHABITAT	dbo.tluLittoralHabitat
MS_ShowOnlyRowSourceValues	COLUMN	DOMINANTHABITAT	False

MS_TextAlign	COLUMN	DOMINANTHABITAT	0
MS_AggregateType	COLUMN	FRACTIONANALYZED	-1
MS_ColumnHidden	COLUMN	FRACTIONANALYZED	False
MS_ColumnOrder	COLUMN	FRACTIONANALYZED	20
MS_ColumnWidth	COLUMN	FRACTIONANALYZED	2325
MS_TextAlign	COLUMN	FRACTIONANALYZED	0
MS_AggregateType	COLUMN	HABITATDESCRIPTION	-1
MS_ColumnHidden	COLUMN	HABITATDESCRIPTION	False
MS_ColumnOrder	COLUMN	HABITATDESCRIPTION	16
MS_ColumnWidth	COLUMN	HABITATDESCRIPTION	6825
MS_DisplayControl	COLUMN	HABITATDESCRIPTION	109
MS_Format	COLUMN	HABITATDESCRIPTION	
MS_IMEMode	COLUMN	HABITATDESCRIPTION	0
MS_TextAlign	COLUMN	HABITATDESCRIPTION	0
MS_AggregateType	COLUMN	LABSAMPLEID	-1
MS_ColumnHidden	COLUMN	LABSAMPLEID	False
MS_ColumnOrder	COLUMN	LABSAMPLEID	18
MS_ColumnWidth	COLUMN	LABSAMPLEID	1695
MS_TextAlign	COLUMN	LABSAMPLEID	0
MS_AggregateType	COLUMN	NUM_OF_BOTTLES	-1
MS_ColumnHidden	COLUMN	NUM_OF_BOTTLES	False
MS_ColumnOrder	COLUMN	NUM_OF_BOTTLES	1
MS_ColumnWidth	COLUMN	NUM_OF_BOTTLES	-1
MS_DisplayControl	COLUMN	NUM_OF_BOTTLES	109
MS_Format	COLUMN	NUM_OF_BOTTLES	
MS_IMEMode	COLUMN	NUM_OF_BOTTLES	0
MS_TextAlign	COLUMN	NUM_OF_BOTTLES	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	2
MS_ColumnWidth	COLUMN	PONDNAME	-1
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	QUALITATIVESAMPLEHABITATDESCRIPTION	-1
MS_ColumnHidden	COLUMN	QUALITATIVESAMPLEHABITATDESCRIPTION	False
MS_ColumnOrder	COLUMN	QUALITATIVESAMPLEHABITATDESCRIPTION	15
MS_ColumnWidth	COLUMN	QUALITATIVESAMPLEHABITATDESCRIPTION	2220
MS_TextAlign	COLUMN	QUALITATIVESAMPLEHABITATDESCRIPTION	0
MS_AggregateType	COLUMN	QUALITATIVESURVEY	-1
MS_ColumnHidden	COLUMN	QUALITATIVESURVEY	False

MS_ColumnOrder	COLUMN	QUALITATIVESURVEY	10
MS_ColumnWidth	COLUMN	QUALITATIVESURVEY	600
MS_TextAlign	COLUMN	QUALITATIVESURVEY	0
MS_AggregateType	COLUMN	SAMPLECOLLECTORS	-1
MS_ColumnHidden	COLUMN	SAMPLECOLLECTORS	False
MS_ColumnOrder	COLUMN	SAMPLECOLLECTORS	8
MS_ColumnWidth	COLUMN	SAMPLECOLLECTORS	1545
MS_TextAlign	COLUMN	SAMPLECOLLECTORS	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	3
MS_ColumnWidth	COLUMN	SAMPLEDATE	1425
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SAMPLENUMBER	-1
MS_ColumnHidden	COLUMN	SAMPLENUMBER	False
MS_ColumnOrder	COLUMN	SAMPLENUMBER	4
MS_ColumnWidth	COLUMN	SAMPLENUMBER	420
MS_Format	COLUMN	SAMPLENUMBER	>
MS_TextAlign	COLUMN	SAMPLENUMBER	0
MS_AggregateType	COLUMN	SHIPPING_DATE	-1
MS_ColumnHidden	COLUMN	SHIPPING_DATE	False
MS_ColumnOrder	COLUMN	SHIPPING_DATE	0
MS_ColumnWidth	COLUMN	SHIPPING_DATE	-1
MS_DisplayControl	COLUMN	SHIPPING_DATE	
MS_Format	COLUMN	SHIPPING_DATE	
MS_IMEMode	COLUMN	SHIPPING_DATE	0
MS_TextAlign	COLUMN	SHIPPING_DATE	0
MS_AggregateType	COLUMN	SHIPPING_INFO	-1
MS_ColumnHidden	COLUMN	SHIPPING_INFO	False
MS_ColumnOrder	COLUMN	SHIPPING_INFO	0
MS_ColumnWidth	COLUMN	SHIPPING_INFO	-1
MS_DisplayControl	COLUMN	SHIPPING_INFO	109
MS_Format	COLUMN	SHIPPING_INFO	
MS_IMEMode	COLUMN	SHIPPING_INFO	0
MS_TextAlign	COLUMN	SHIPPING_INFO	0
MS_AggregateType	COLUMN	SOURCEDB	-1
MS_ColumnHidden	COLUMN	SOURCEDB	False
MS_ColumnOrder	COLUMN	SOURCEDB	17
MS_ColumnWidth	COLUMN	SOURCEDB	1410
MS_TextAlign	COLUMN	SOURCEDB	0
MS_AggregateType	COLUMN	STANDARDIZEDSWEEP	-1
MS_ColumnHidden	COLUMN	STANDARDIZEDSWEEP	False

MS_ColumnOrder	COLUMN	STANDARDIZEDSWEEP	9
MS_ColumnWidth	COLUMN	STANDARDIZEDSWEEP	585
MS_TextAlign	COLUMN	STANDARDIZEDSWEEP	0
MS_AggregateType	COLUMN	TRANSECTNUMBER	-1
MS_ColumnHidden	COLUMN	TRANSECTNUMBER	False
MS_ColumnOrder	COLUMN	TRANSECTNUMBER	6
MS_ColumnWidth	COLUMN	TRANSECTNUMBER	525
MS_TextAlign	COLUMN	TRANSECTNUMBER	0
MS_AggregateType	COLUMN	WATERDEPTH	-1
MS_ColumnHidden	COLUMN	WATERDEPTH	False
MS_ColumnOrder	COLUMN	WATERDEPTH	12
MS_ColumnWidth	COLUMN	WATERDEPTH	1845
MS_TextAlign	COLUMN	WATERDEPTH	0

Uses

[dbo].[tblEvents]
dbo

Used By

[dbo].[tblInvertebrates]

[dbo].[tblLoons]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblLoons

This table contains information about Loon sightings in the field, collected on behalf of Mel Flamme.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	4
Created	1:16:48 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
🔑🔍	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✘	
🔑🔍	SAMPLEDATE *The date and time of the sample; automatically populated when a new form is opened*	datetime	8	✘	
🔑	LOONID *Observation number for the site (start at 1 and number observations sequentially)*	int	4	✘	
	OBSERVER *Initials of the person making the observation*	nvarchar(50)	100	✓	
	SPECIES *Loon species; select from drop-down list*	nvarchar(50)	100	✓	
	NUM_BIRDS *Number of individual birds observed*	int	4	✓	
	DETECTION_TYPE *Method in which birds were detected; select from drop-down list*	nvarchar(50)	100	✓	
	VEG_TYPE *Type of vegetation where birds observed; select from drop-down list*	nvarchar(50)	100	✓	
	LATITUDE *GPS latitude specific to bird location (when available)*	float	8	✓	
	LONGITUDE *GPS longitude specific to bird location (when available)*	float	8	✓	
	COMMENTS *Additional comments regarding observation*	nvarchar(max)	max	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
🔑	PK_tblLoons	PONDNAME, SAMPLEDATE, LOONID	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblLoons_tblEvents	✓	Cascade	Cascade	PONDNAME->[dbo].[tblEvents].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Events].[SAMPLEDATE]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	0
MS_ColumnWidth	COLUMN	COMMENTS	3840
MS_DisplayControl	COLUMN	COMMENTS	109
MS_Format	COLUMN	COMMENTS	
MS_IMEMode	COLUMN	COMMENTS	0
MS_TextAlign	COLUMN	COMMENTS	0
MS_AggregateType	COLUMN	DETECTION_TYPE	-1
MS_AllowValueListEdits	COLUMN	DETECTION_TYPE	False
MS_ColumnHidden	COLUMN	DETECTION_TYPE	False
MS_ColumnOrder	COLUMN	DETECTION_TYPE	0
MS_ColumnWidth	COLUMN	DETECTION_TYPE	1995
MS_DisplayControl	COLUMN	DETECTION_TYPE	111
MS_Format	COLUMN	DETECTION_TYPE	
MS_IMEMode	COLUMN	DETECTION_TYPE	0
MS_ListItemsEditForm	COLUMN	DETECTION_TYPE	
MS_RowSource	COLUMN	DETECTION_TYPE	dbo.tluLoonDetection
MS_ShowOnlyRowSourceValues	COLUMN	DETECTION_TYPE	False
MS_TextAlign	COLUMN	DETECTION_TYPE	0
MS_AggregateType	COLUMN	LATITUDE	-1
MS_ColumnHidden	COLUMN	LATITUDE	False
MS_ColumnOrder	COLUMN	LATITUDE	0
MS_ColumnWidth	COLUMN	LATITUDE	1560
MS_DisplayControl	COLUMN	LATITUDE	109
MS_Format	COLUMN	LATITUDE	
MS_IMEMode	COLUMN	LATITUDE	0
MS_TextAlign	COLUMN	LATITUDE	0
MS_AggregateType	COLUMN	LONGITUDE	-1

MS_ColumnHidden	COLUMN	LONGITUDE	False
MS_ColumnOrder	COLUMN	LONGITUDE	0
MS_ColumnWidth	COLUMN	LONGITUDE	1485
MS_DisplayControl	COLUMN	LONGITUDE	109
MS_Format	COLUMN	LONGITUDE	
MS_IMEMode	COLUMN	LONGITUDE	0
MS_TextAlign	COLUMN	LONGITUDE	0
MS_AggregateType	COLUMN	LOONID	-1
MS_ColumnHidden	COLUMN	LOONID	False
MS_ColumnOrder	COLUMN	LOONID	0
MS_ColumnWidth	COLUMN	LOONID	1155
MS_DisplayControl	COLUMN	LOONID	109
MS_Format	COLUMN	LOONID	
MS_IMEMode	COLUMN	LOONID	0
MS_TextAlign	COLUMN	LOONID	0
MS_AggregateType	COLUMN	NUM_BIRDS	-1
MS_ColumnHidden	COLUMN	NUM_BIRDS	False
MS_ColumnOrder	COLUMN	NUM_BIRDS	0
MS_ColumnWidth	COLUMN	NUM_BIRDS	-1
MS_DisplayControl	COLUMN	NUM_BIRDS	109
MS_Format	COLUMN	NUM_BIRDS	
MS_IMEMode	COLUMN	NUM_BIRDS	0
MS_TextAlign	COLUMN	NUM_BIRDS	0
MS_AggregateType	COLUMN	OBSERVER	-1
MS_ColumnHidden	COLUMN	OBSERVER	False
MS_ColumnOrder	COLUMN	OBSERVER	0
MS_ColumnWidth	COLUMN	OBSERVER	1380
MS_DisplayControl	COLUMN	OBSERVER	109
MS_Format	COLUMN	OBSERVER	
MS_IMEMode	COLUMN	OBSERVER	0
MS_TextAlign	COLUMN	OBSERVER	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	0
MS_ColumnWidth	COLUMN	PONDNAME	1545
MS_DisplayControl	COLUMN	PONDNAME	109
MS_Format	COLUMN	PONDNAME	
MS_IMEMode	COLUMN	PONDNAME	0
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	0

MS_ColumnWidth	COLUMN	SAMPLEDATE	1635
MS_DisplayControl	COLUMN	SAMPLEDATE	
MS_Format	COLUMN	SAMPLEDATE	
MS_IMEMode	COLUMN	SAMPLEDATE	0
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SPECIES	-1
MS_AllowValueListEdits	COLUMN	SPECIES	False
MS_ColumnHidden	COLUMN	SPECIES	False
MS_ColumnOrder	COLUMN	SPECIES	0
MS_ColumnWidth	COLUMN	SPECIES	2115
MS_DisplayControl	COLUMN	SPECIES	111
MS_Format	COLUMN	SPECIES	
MS_IMEMode	COLUMN	SPECIES	0
MS_ListItemsEditForm	COLUMN	SPECIES	
MS_RowSource	COLUMN	SPECIES	dbo.tluLoonSpecies
MS_ShowOnlyRowSourceValues	COLUMN	SPECIES	False
MS_TextAlign	COLUMN	SPECIES	0
MS_AggregateType	COLUMN	VEG_TYPE	-1
MS_AllowValueListEdits	COLUMN	VEG_TYPE	False
MS_ColumnHidden	COLUMN	VEG_TYPE	False
MS_ColumnOrder	COLUMN	VEG_TYPE	0
MS_ColumnWidth	COLUMN	VEG_TYPE	3015
MS_DisplayControl	COLUMN	VEG_TYPE	111
MS_Format	COLUMN	VEG_TYPE	
MS_IMEMode	COLUMN	VEG_TYPE	0
MS_ListItemsEditForm	COLUMN	VEG_TYPE	
MS_RowSource	COLUMN	VEG_TYPE	dbo.tluLoonVeg
MS_ShowOnlyRowSourceValues	COLUMN	VEG_TYPE	False
MS_TextAlign	COLUMN	VEG_TYPE	0

Uses

[dbo].[tblEvents]
dbo

[dbo].[tblPhotos]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblPhotos

This table is not currently functioning. It appears to have been started, but minimally populated. It is not currently part of the sampling protocol.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	75
Created	1:18:11 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
🔑	PHOTO_ID	int	4	✗	
	EVENT_ID	nvarchar(50)	100	✓	
	DATA_LOCATION_ID	int	4	✓	
	EVENT_GROUP_ID	int	4	✓	
	SITE_ID	nvarchar(50)	100	✗	
	SITE_NAME	nvarchar(255)	510	✓	
	UNIT_CODE	nvarchar(12)	24	✓	
	WAYPOINT	int	4	✓	
	LOCATION	nvarchar(255)	510	✓	
	DESCRIPTION	nvarchar(max)	max	✓	
	DATE	datetime	8	✓	
	TIME	datetime	8	✓	
	PHOTO_PATH	nvarchar(255)	510	✗	
	SOURCE_FILE	nvarchar(255)	510	✓	
	PHOTOGRAPHER	nvarchar(50)	100	✓	
	TYPE	nvarchar(50)	100	✓	
	COLLECTION	nvarchar(255)	510	✓	
	PUBLISHER	nvarchar(255)	510	✓	
	FORMAT	nvarchar(255)	510	✓	
	CREDITS	nvarchar(255)	510	✓	
	DISTRIBUTION_RESTRICTIONS	nvarchar(255)	510	✓	
	KEYWORDS	nvarchar(255)	510	✓	
	DRAWING	image	max	✓	
	FLAGGED	bit	1	✓	
	PONDNAME	nvarchar(50)	100	✓	
	SOURCEDB	nvarchar(50)	100	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
🔑	PK_tbl_Photos_1	PHOTO_ID	✓

Uses

dbo

[dbo].[tblPondDepths]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblPondDepths

This table contains bathymetry data for sampled lakes. Most of the data is imported from Trimble GPS units, but data can be manually entered if the Trimble is unavailable.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	7186
Created	1:19:40 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Identity	Default
🔑	LAKEDEPTHID *An unique identifier automatically assigned to each record. This should probably be changed to a alphanumeric unique identifier.*	int	4	✗	1 - 1	
🔑🔑	SAMPLEDATE *The date and time of the sample; automatically populated when a new Sampling Event form is opened*	datetime	8	✗		
🔑🔑	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗		
	GPS_DATE *Date as recorded by GPS unit*	datetime	8	✓		
	GPS_TIME *Time as recorded by GPS unit*	datetime	8	✓		
	DEPTH *Measured depth of the lake at a specific point*	float	8	✓		
	LONGITUDE *Longitude for point depth from Trimble*	float	8	✓		
	LATITUDE *Latitude for point depth from Trimble*	float	8	✓		
	COMMENTS_DEPTHS *Comments recorded on Trimble during bathymetery measurements*	nvarchar(max)	max	✓		
	HEIGHT *Height measurement from Trimble*	float	8	✓		
	FEAT_NAME *Trimble feature name (from data dictionary)*	nvarchar(50)	100	✓		
	DATAFILE *Trimble datafile reference*	nvarchar(50)	100	✓		
	GPS_HEIGHT *GPS Height*	float	8	✓		
	VERT_PREC *GPS Vertical Precision*	float	8	✓		
	HORZ_PREC *GPS Horizontal Precision*	float	8	✓		
	POINT_ID *Point ID (assigned by GPS unit) - can be added for reference during manual entry as well*	int	4	✓		
	SOURCE *Name of the source file*	nvarchar(50)	100	✓		
	RecordInsertedDate	datetime	8	✓		(getdate())

	RecordInsertedBy	nvarchar(50)	100	✓		(suser_name( ))
	RecordUpdatedDate	datetime	8	✓		(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓		(suser_name( ))

Indexes

	Name	Columns	Unique
	PK_tbl_Lake_Depths	LAKEDEPTHID, SAMPLEDATE, PONDNAME	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblPondDepths_tblEvents	✓	Cascade	Cascade	PONDNAME->[dbo].[tbl-Events].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Events].[SAMPLEDATE]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_FrozenColumns			1
MS_HideNewField			False
MS_OrderBy			[tblPondDepths].[PONDNAME], [tblPond-Depths].[SAMPLEDATE], [tblPond-Depths].[GPS_DATE], [tblPond-Depths].[GPS_TIME]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	COMMENTS_DEPTHS	-1
MS_ColumnHidden	COLUMN	COMMENTS_DEPTHS	False
MS_ColumnOrder	COLUMN	COMMENTS_DEPTHS	9
MS_ColumnWidth	COLUMN	COMMENTS_DEPTHS	2490
MS_DisplayControl	COLUMN	COMMENTS_DEPTHS	109
MS_Format	COLUMN	COMMENTS_DEPTHS	
MS_IMEMode	COLUMN	COMMENTS_DEPTHS	0
MS_TextAlign	COLUMN	COMMENTS_DEPTHS	0
MS_AggregateType	COLUMN	DATAFILE	-1
MS_ColumnHidden	COLUMN	DATAFILE	False
MS_ColumnOrder	COLUMN	DATAFILE	10
MS_ColumnWidth	COLUMN	DATAFILE	4320
MS_TextAlign	COLUMN	DATAFILE	0
MS_AggregateType	COLUMN	DEPTH	-1
MS_ColumnHidden	COLUMN	DEPTH	False
MS_ColumnOrder	COLUMN	DEPTH	8
MS_ColumnWidth	COLUMN	DEPTH	1020
MS_TextAlign	COLUMN	DEPTH	0
MS_AggregateType	COLUMN	FEAT_NAME	-1
MS_ColumnHidden	COLUMN	FEAT_NAME	False
MS_ColumnOrder	COLUMN	FEAT_NAME	17
MS_ColumnWidth	COLUMN	FEAT_NAME	2145
MS_TextAlign	COLUMN	FEAT_NAME	0
MS_AggregateType	COLUMN	GPS_DATE	-1
MS_ColumnHidden	COLUMN	GPS_DATE	False
MS_ColumnOrder	COLUMN	GPS_DATE	4

MS_ColumnWidth	COLUMN	GPS_DATE	1365
MS_TextAlign	COLUMN	GPS_DATE	0
MS_AggregateType	COLUMN	GPS_HEIGHT	-1
MS_ColumnHidden	COLUMN	GPS_HEIGHT	False
MS_ColumnOrder	COLUMN	GPS_HEIGHT	12
MS_ColumnWidth	COLUMN	GPS_HEIGHT	1815
MS_TextAlign	COLUMN	GPS_HEIGHT	0
MS_AggregateType	COLUMN	GPS_TIME	-1
MS_ColumnHidden	COLUMN	GPS_TIME	False
MS_ColumnOrder	COLUMN	GPS_TIME	5
MS_ColumnWidth	COLUMN	GPS_TIME	1335
MS_TextAlign	COLUMN	GPS_TIME	0
MS_AggregateType	COLUMN	HEIGHT	-1
MS_ColumnHidden	COLUMN	HEIGHT	False
MS_ColumnOrder	COLUMN	HEIGHT	11
MS_ColumnWidth	COLUMN	HEIGHT	1095
MS_TextAlign	COLUMN	HEIGHT	0
MS_AggregateType	COLUMN	HORZ_PREC	-1
MS_ColumnHidden	COLUMN	HORZ_PREC	False
MS_ColumnOrder	COLUMN	HORZ_PREC	14
MS_ColumnWidth	COLUMN	HORZ_PREC	1920
MS_TextAlign	COLUMN	HORZ_PREC	0
MS_AggregateType	COLUMN	LAKEDEPTHID	-1
MS_ColumnHidden	COLUMN	LAKEDEPTHID	False
MS_ColumnOrder	COLUMN	LAKEDEPTHID	3
MS_ColumnWidth	COLUMN	LAKEDEPTHID	1665
MS_TextAlign	COLUMN	LAKEDEPTHID	0
MS_AggregateType	COLUMN	LATITUDE	-1
MS_ColumnHidden	COLUMN	LATITUDE	False
MS_ColumnOrder	COLUMN	LATITUDE	6
MS_ColumnWidth	COLUMN	LATITUDE	1395
MS_TextAlign	COLUMN	LATITUDE	0
MS_AggregateType	COLUMN	LONGITUDE	-1
MS_ColumnHidden	COLUMN	LONGITUDE	False
MS_ColumnOrder	COLUMN	LONGITUDE	7
MS_ColumnWidth	COLUMN	LONGITUDE	1575
MS_TextAlign	COLUMN	LONGITUDE	0
MS_AggregateType	COLUMN	POINT_ID	-1
MS_ColumnHidden	COLUMN	POINT_ID	False
MS_ColumnOrder	COLUMN	POINT_ID	15
MS_ColumnWidth	COLUMN	POINT_ID	1305
MS_TextAlign	COLUMN	POINT_ID	0

MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	1
MS_ColumnWidth	COLUMN	PONDNAME	1605
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	2
MS_ColumnWidth	COLUMN	SAMPLEDATE	1635
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SOURCE	-1
MS_ColumnHidden	COLUMN	SOURCE	False
MS_ColumnOrder	COLUMN	SOURCE	16
MS_ColumnWidth	COLUMN	SOURCE	2730
MS_TextAlign	COLUMN	SOURCE	0
MS_AggregateType	COLUMN	VERT_PREC	-1
MS_ColumnHidden	COLUMN	VERT_PREC	False
MS_ColumnOrder	COLUMN	VERT_PREC	13
MS_ColumnWidth	COLUMN	VERT_PREC	1815
MS_TextAlign	COLUMN	VERT_PREC	0

Uses

[dbo].[tblEvents]
dbo

[dbo].[tblPonds]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblPonds

This table contains all of the sampling sites included in the Shallow Lakes project. This data is the stable, long-term information recorded for each site, and is referenced each time a Sampling Event is entered.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	226
Created	11:26:03 AM Wednesday, April 14, 2010
Last Modified	11:26:04 AM Wednesday, April 14, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
🔑	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗	
	PARK *Park in which the pond is located*	nvarchar(50)	100	✓	
	LATITUDE *Latitude of the Monument placed at a pond site in decimal degrees. When no monument is placed, this is the latitude of the start of the Vegetation Transect.*	float	8	✓	
	LONGITUDE *Longitude of the Monument placed at a pond site in decimal degrees. When no monument is placed, this is the longitude of the start of the Vegetation Transect.*	float	8	✓	
	GPSTYPE *Type of GPS unit used; select from drop-down list*	nvarchar(50)	100	✓	
	GPSDATUM *Datum in use by the GPS unit (generally WGS84); select from drop-down list*	nvarchar(50)	100	✓	
	GPSDATE *The date the coordinate data was collected*	datetime	8	✓	
	QUAD *Name of Topographic Quadrat in which the pond is located (i.e. Charley River)*	nvarchar(50)	100	✓	
	QUADNUMBER *Number within the Topographic Quadrat in which the pond is located (i.e. B-6)*	nvarchar(50)	100	✓	
	ELEVATION *Elevation at the monumented point*	nvarchar(50)	100	✓	
	ELEVATION_NUM *Elevation at the monumented point in numeric format (original field was in nchar format)*	decimal(18,0)	9	✓	
	ELEVATIONSOURCE *If the monument location taken with a GPS unit does not include a measurement for elevation, the data can be taken from other sources. Note the source here (i.e. topo map, NED, etc.)*	nvarchar(50)	100	✓	
	HYDROLOGIC_REGIME *Connectivity type; select from drop-down list*	int	4	✓	
	HYDROLOGIC_CLASS *Source of water and nutrients for the pond; select from drop-down list*	nvarchar(50)	100	✓	
	UPDATED_DATE *HK: Unsure what this is. Maybe a GPS function?*	datetime	8	✓	
	EST_H_ERROR	real	4	✓	
	EST_V_ERROR	real	4	✓	

	LOC_NOTES *Comments on the placement of the monument (this field is included in the Monuments data dictionary in the Trimble)*	nvarchar(max)	max	✓	
	LOC_TYPE *Indicates if the GPS location is taken for a monument (Lake Level Monument) or some other feature (this field is included in the Monuments data dictionary in the Trimble)*	nvarchar(50)	100	✓	
	LOC_MATERIAL *Material used (generally rebar_cap) for the monument (this field is included in the Monuments data dictionary in the Trimble)*	nvarchar(50)	100	✓	
	GRTS_NUM *Number assigned to the lake in the GRTS sample draw*	int	4	✓	
	MAPLAKENUM *Reference number on the MapPack (aerial photo/topo map reference) for this lake*	int	4	✓	
	SITESELECTIONNOTES *Comments regarding the site selection (i.e. sampled instead of the selected lake due to access issues)*	ntext	max	✓	
	CONTINUOUS_DATA *Is there continuous monitoring data for this site (i.e. a logger deployed throughout the summer season)?*	bit	1	✓	
	SALINITY *Degree of salinity; select from drop-down list (based on conductivity)*	nvarchar(255)	510	✓	
	EMERGENTS *Set as true if emergent grasses, sedges or forbs form sufficiently large stands to map*	bit	1	✓	
	GENESIS *Process by which the pond was formed; select from drop-down list*	nvarchar(255)	510	✓	
	ISLANDS *Set as true if there are islands greater than 0.5 m and more than 2 m from shore*	bit	1	✓	
	SHORELINE *Shoreline type; select from drop-down list*	nvarchar(255)	510	✓	
	SUBSTRATE_TEXTURE *Comment on the substrate, including sediment size when possible, and noting the extent of an organic component*	nvarchar(255)	510	✓	
	COMMENTS *Notes describing permanent or long-term features of the lake. Temporally variable or ephemeral comments should be added to the sampling event form instead.*	nvarchar(max)	max	✓	
	ECOREGION	nchar(50)	100	✓	
	SUBSECTION	nchar(50)	100	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())

	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblPondsite_1	PONDNAME	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			(EMERGENTS="0 ")
MS_FilterOnLoad			False
MS_FrozenColumns			5
MS_HideNewField			False
MS_OrderBy			[tblPonds].[PONDNAME]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	32
MS_ColumnWidth	COLUMN	COMMENTS	2430
MS_TextAlign	COLUMN	COMMENTS	0
MS_AggregateType	COLUMN	CONTINUOUS_DATA	-1
MS_ColumnHidden	COLUMN	CONTINUOUS_DATA	False
MS_ColumnOrder	COLUMN	CONTINUOUS_DATA	23
MS_ColumnWidth	COLUMN	CONTINUOUS_DATA	1410
MS_TextAlign	COLUMN	CONTINUOUS_DATA	0
MS_AggregateType	COLUMN	ECOREGION	-1
MS_ColumnHidden	COLUMN	ECOREGION	False
MS_ColumnOrder	COLUMN	ECOREGION	0
MS_ColumnWidth	COLUMN	ECOREGION	4020
MS_TextAlign	COLUMN	ECOREGION	0
MS_AggregateType	COLUMN	ELEVATION	-1
MS_ColumnHidden	COLUMN	ELEVATION	False
MS_ColumnOrder	COLUMN	ELEVATION	9
MS_ColumnWidth	COLUMN	ELEVATION	2040
MS_TextAlign	COLUMN	ELEVATION	0
MS_AggregateType	COLUMN	ELEVATION_NUM	-1
MS_ColumnHidden	COLUMN	ELEVATION_NUM	False
MS_ColumnOrder	COLUMN	ELEVATION_NUM	10
MS_ColumnWidth	COLUMN	ELEVATION_NUM	2025
MS_DecimalPlaces	COLUMN	ELEVATION_NUM	0
MS_DisplayControl	COLUMN	ELEVATION_NUM	109
MS_Format	COLUMN	ELEVATION_NUM	
MS_IMEMode	COLUMN	ELEVATION_NUM	0

MS_TextAlign	COLUMN	ELEVATION_NUM	0
MS_AggregateType	COLUMN	ELEVATIONSOURCE	-1
MS_ColumnHidden	COLUMN	ELEVATIONSOURCE	False
MS_ColumnOrder	COLUMN	ELEVATIONSOURCE	11
MS_ColumnWidth	COLUMN	ELEVATIONSOURCE	-1
MS_TextAlign	COLUMN	ELEVATIONSOURCE	0
MS_AggregateType	COLUMN	EMERGENTS	-1
MS_ColumnHidden	COLUMN	EMERGENTS	False
MS_ColumnOrder	COLUMN	EMERGENTS	26
MS_ColumnWidth	COLUMN	EMERGENTS	-1
MS_TextAlign	COLUMN	EMERGENTS	0
MS_AggregateType	COLUMN	EST_H_ERROR	-1
MS_ColumnHidden	COLUMN	EST_H_ERROR	False
MS_ColumnOrder	COLUMN	EST_H_ERROR	15
MS_ColumnWidth	COLUMN	EST_H_ERROR	-1
MS_TextAlign	COLUMN	EST_H_ERROR	0
MS_AggregateType	COLUMN	EST_V_ERROR	-1
MS_ColumnHidden	COLUMN	EST_V_ERROR	False
MS_ColumnOrder	COLUMN	EST_V_ERROR	16
MS_ColumnWidth	COLUMN	EST_V_ERROR	-1
MS_TextAlign	COLUMN	EST_V_ERROR	0
MS_AggregateType	COLUMN	GENESIS	-1
MS_ColumnHidden	COLUMN	GENESIS	False
MS_ColumnOrder	COLUMN	GENESIS	27
MS_ColumnWidth	COLUMN	GENESIS	-1
MS_TextAlign	COLUMN	GENESIS	0
MS_AggregateType	COLUMN	GPSDATE	-1
MS_ColumnHidden	COLUMN	GPSDATE	False
MS_ColumnOrder	COLUMN	GPSDATE	39
MS_ColumnWidth	COLUMN	GPSDATE	-1
MS_DisplayControl	COLUMN	GPSDATE	
MS_Format	COLUMN	GPSDATE	
MS_IMEMode	COLUMN	GPSDATE	0
MS_TextAlign	COLUMN	GPSDATE	0
MS_AggregateType	COLUMN	GPSDATUM	-1
MS_ColumnHidden	COLUMN	GPSDATUM	False
MS_ColumnOrder	COLUMN	GPSDATUM	6
MS_ColumnWidth	COLUMN	GPSDATUM	-1
MS_TextAlign	COLUMN	GPSDATUM	0
MS_AggregateType	COLUMN	GPSTYPE	-1
MS_ColumnHidden	COLUMN	GPSTYPE	False
MS_ColumnOrder	COLUMN	GPSTYPE	5

MS_ColumnWidth	COLUMN	GPSTYPE	-1
MS_TextAlign	COLUMN	GPSTYPE	0
MS_AggregateType	COLUMN	GRTS_NUM	-1
MS_ColumnHidden	COLUMN	GRTS_NUM	False
MS_ColumnOrder	COLUMN	GRTS_NUM	20
MS_ColumnWidth	COLUMN	GRTS_NUM	-1
MS_TextAlign	COLUMN	GRTS_NUM	0
MS_AggregateType	COLUMN	HYDROLOGIC_CLASS	-1
MS_AllowValueListEdits	COLUMN	HYDROLOGIC_CLASS	False
MS_ColumnCount	COLUMN	HYDROLOGIC_CLASS	2
MS_ColumnHidden	COLUMN	HYDROLOGIC_CLASS	False
MS_ColumnOrder	COLUMN	HYDROLOGIC_CLASS	13
MS_ColumnWidth	COLUMN	HYDROLOGIC_CLASS	-1
MS_ColumnWidths	COLUMN	HYDROLOGIC_CLASS	1512.000;4896.000
MS_DisplayControl	COLUMN	HYDROLOGIC_CLASS	111
MS_LimitToList	COLUMN	HYDROLOGIC_CLASS	0
MS_ListItemsEditForm	COLUMN	HYDROLOGIC_CLASS	
MS_ListWidth	COLUMN	HYDROLOGIC_CLASS	6408.000
MS_RowSource	COLUMN	HYDROLOGIC_CLASS	dbo.tluHydrologicClass
MS_ShowOnlyRowSourceValues	COLUMN	HYDROLOGIC_CLASS	False
MS_TextAlign	COLUMN	HYDROLOGIC_CLASS	0
MS_AggregateType	COLUMN	HYDROLOGIC_REGIME	-1
MS_AllowValueListEdits	COLUMN	HYDROLOGIC_REGIME	False
MS_BoundColumn	COLUMN	HYDROLOGIC_REGIME	1
MS_ColumnCount	COLUMN	HYDROLOGIC_REGIME	2
MS_ColumnHeads	COLUMN	HYDROLOGIC_REGIME	-1
MS_ColumnHidden	COLUMN	HYDROLOGIC_REGIME	False
MS_ColumnOrder	COLUMN	HYDROLOGIC_REGIME	12
MS_ColumnWidth	COLUMN	HYDROLOGIC_REGIME	2430
MS_ColumnWidths	COLUMN	HYDROLOGIC_REGIME	288.000;5184.000
MS_DisplayControl	COLUMN	HYDROLOGIC_REGIME	111
MS_LimitToList	COLUMN	HYDROLOGIC_REGIME	-1
MS_ListItemsEditForm	COLUMN	HYDROLOGIC_REGIME	
MS_ListWidth	COLUMN	HYDROLOGIC_REGIME	5472.000
MS_RowSource	COLUMN	HYDROLOGIC_REGIME	dbo.tluHydrologicRegime
MS_RowSourceType	COLUMN	HYDROLOGIC_REGIME	Tables/Views/Functions
MS_ShowOnlyRowSourceValues	COLUMN	HYDROLOGIC_REGIME	False
MS_TextAlign	COLUMN	HYDROLOGIC_REGIME	0
MS_AggregateType	COLUMN	ISLANDS	-1
MS_ColumnHidden	COLUMN	ISLANDS	False
MS_ColumnOrder	COLUMN	ISLANDS	29
MS_ColumnWidth	COLUMN	ISLANDS	-1

MS_TextAlign	COLUMN	ISLANDS	0
MS_AggregateType	COLUMN	LATITUDE	-1
MS_ColumnHidden	COLUMN	LATITUDE	False
MS_ColumnOrder	COLUMN	LATITUDE	3
MS_ColumnWidth	COLUMN	LATITUDE	-1
MS_TextAlign	COLUMN	LATITUDE	0
MS_AggregateType	COLUMN	LOC_MATERIAL	-1
MS_ColumnHidden	COLUMN	LOC_MATERIAL	False
MS_ColumnOrder	COLUMN	LOC_MATERIAL	19
MS_ColumnWidth	COLUMN	LOC_MATERIAL	2940
MS_TextAlign	COLUMN	LOC_MATERIAL	0
MS_AggregateType	COLUMN	LOC_NOTES	-1
MS_ColumnHidden	COLUMN	LOC_NOTES	False
MS_ColumnOrder	COLUMN	LOC_NOTES	17
MS_ColumnWidth	COLUMN	LOC_NOTES	11430
MS_TextAlign	COLUMN	LOC_NOTES	0
MS_AggregateType	COLUMN	LOC_TYPE	-1
MS_ColumnHidden	COLUMN	LOC_TYPE	False
MS_ColumnOrder	COLUMN	LOC_TYPE	18
MS_ColumnWidth	COLUMN	LOC_TYPE	2490
MS_TextAlign	COLUMN	LOC_TYPE	0
MS_AggregateType	COLUMN	LONGITUDE	-1
MS_ColumnHidden	COLUMN	LONGITUDE	False
MS_ColumnOrder	COLUMN	LONGITUDE	4
MS_ColumnWidth	COLUMN	LONGITUDE	1575
MS_TextAlign	COLUMN	LONGITUDE	0
MS_AggregateType	COLUMN	MAPLAKENUM	-1
MS_ColumnHidden	COLUMN	MAPLAKENUM	False
MS_ColumnOrder	COLUMN	MAPLAKENUM	21
MS_ColumnWidth	COLUMN	MAPLAKENUM	-1
MS_TextAlign	COLUMN	MAPLAKENUM	0
MS_AggregateType	COLUMN	PARK	-1
MS_ColumnHidden	COLUMN	PARK	False
MS_ColumnOrder	COLUMN	PARK	2
MS_ColumnWidth	COLUMN	PARK	-1
MS_TextAlign	COLUMN	PARK	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	1
MS_ColumnWidth	COLUMN	PONDNAME	-1
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	QUAD	-1

MS_ColumnHidden	COLUMN	QUAD	False
MS_ColumnOrder	COLUMN	QUAD	7
MS_ColumnWidth	COLUMN	QUAD	-1
MS_TextAlign	COLUMN	QUAD	0
MS_AggregateType	COLUMN	QUADNUMBER	-1
MS_ColumnHidden	COLUMN	QUADNUMBER	False
MS_ColumnOrder	COLUMN	QUADNUMBER	8
MS_ColumnWidth	COLUMN	QUADNUMBER	-1
MS_TextAlign	COLUMN	QUADNUMBER	0
MS_AggregateType	COLUMN	RecordInsertedBy	-1
MS_ColumnHidden	COLUMN	RecordInsertedBy	False
MS_ColumnOrder	COLUMN	RecordInsertedBy	0
MS_ColumnWidth	COLUMN	RecordInsertedBy	-1
MS_TextAlign	COLUMN	RecordInsertedBy	0
MS_AggregateType	COLUMN	RecordInsertedDate	-1
MS_ColumnHidden	COLUMN	RecordInsertedDate	False
MS_ColumnOrder	COLUMN	RecordInsertedDate	0
MS_ColumnWidth	COLUMN	RecordInsertedDate	-1
MS_TextAlign	COLUMN	RecordInsertedDate	0
MS_AggregateType	COLUMN	RecordUpdatedBy	-1
MS_ColumnHidden	COLUMN	RecordUpdatedBy	False
MS_ColumnOrder	COLUMN	RecordUpdatedBy	0
MS_ColumnWidth	COLUMN	RecordUpdatedBy	-1
MS_TextAlign	COLUMN	RecordUpdatedBy	0
MS_AggregateType	COLUMN	RecordUpdatedDate	-1
MS_ColumnHidden	COLUMN	RecordUpdatedDate	False
MS_ColumnOrder	COLUMN	RecordUpdatedDate	0
MS_ColumnWidth	COLUMN	RecordUpdatedDate	-1
MS_TextAlign	COLUMN	RecordUpdatedDate	0
MS_AggregateType	COLUMN	SALINITY	-1
MS_ColumnHidden	COLUMN	SALINITY	False
MS_ColumnOrder	COLUMN	SALINITY	24
MS_ColumnWidth	COLUMN	SALINITY	-1
MS_TextAlign	COLUMN	SALINITY	0
MS_AggregateType	COLUMN	SHORELINE	-1
MS_ColumnHidden	COLUMN	SHORELINE	False
MS_ColumnOrder	COLUMN	SHORELINE	30
MS_ColumnWidth	COLUMN	SHORELINE	-1
MS_TextAlign	COLUMN	SHORELINE	0
MS_AggregateType	COLUMN	SITESELECTIONNOTES	-1
MS_ColumnHidden	COLUMN	SITESELECTIONNOTES	False
MS_ColumnOrder	COLUMN	SITESELECTIONNOTES	22

MS_ColumnWidth	COLUMN	SITESELECTIONNOTES	8535
MS_DisplayControl	COLUMN	SITESELECTIONNOTES	109
MS_Format	COLUMN	SITESELECTIONNOTES	
MS_IMEMode	COLUMN	SITESELECTIONNOTES	0
MS_TextAlign	COLUMN	SITESELECTIONNOTES	0
MS_AggregateType	COLUMN	SUBSECTION	-1
MS_ColumnHidden	COLUMN	SUBSECTION	False
MS_ColumnOrder	COLUMN	SUBSECTION	0
MS_ColumnWidth	COLUMN	SUBSECTION	3975
MS_TextAlign	COLUMN	SUBSECTION	0
MS_AggregateType	COLUMN	SUBSTRATE_TEXTURE	-1
MS_ColumnHidden	COLUMN	SUBSTRATE_TEXTURE	False
MS_ColumnOrder	COLUMN	SUBSTRATE_TEXTURE	31
MS_ColumnWidth	COLUMN	SUBSTRATE_TEXTURE	7530
MS_TextAlign	COLUMN	SUBSTRATE_TEXTURE	0
MS_AggregateType	COLUMN	UPDATED_DATE	-1
MS_ColumnHidden	COLUMN	UPDATED_DATE	False
MS_ColumnOrder	COLUMN	UPDATED_DATE	14
MS_ColumnWidth	COLUMN	UPDATED_DATE	1875
MS_TextAlign	COLUMN	UPDATED_DATE	0

Uses

dbo

Used By

[dbo].[tblContinuousDataSites]
[dbo].[tblEvents]

[dbo].[tblTransQuadrats]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblTransQuadrats

This table contains the Nested Frequency Quadrat data collected as part of the Vegetation survey at each site.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	3164
Created	10:56:29 AM Tuesday, April 27, 2010
Last Modified	10:56:29 AM Tuesday, April 27, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Identity	Default
	PONDTRANSID	int	4	✗	1 - 1	
	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗		
	SAMPLEDATE *The date and time of the sample; automatically populated when a new Sampling Event form is opened*	datetime	8	✗		
	TRANSECTNUM *This was the original Transect # field, but was a text field that could not be grouped. It was replaced with the TRANSECT field, but there still seem to be some connections to this field that have not yet been identified. Delete field once determined.*	nvarchar(50)	100	✓		
	TRANSECT *Transect number*	int	4	✗		
	SPECIES *Plant species code (select from available species in the drop-down list or add a new species code)*	nvarchar(50)	100	✗		
	ANALYSIS_CODE *Plant species code to be used in analysis (automatically populated depending on the SPECIES entry)*	nvarchar(50)	100	✓		
	NUMQUADRATSPRESENT	int	4	✓		
	TRANS_1A *Is the species present in the smallest (red) quadrat at the first sampling point?*	bit	1	✓		
	TRANS_1B *Is the species present in the intermediate (blue) quadrat at the first sampling point?*	bit	1	✓		
	TRANS_1C *Is the species present in the largest (green) quadrat at the first sampling point?*	bit	1	✓		
	TRANS_2A *Is the species present in the smallest (red) quadrat at the second sampling point?*	bit	1	✓		
	TRANS_2B *Is the species present in the intermediate (blue) quadrat at the second sampling point?*	bit	1	✓		
	TRANS_2C *Is the species present in the largest (green) quadrat at the second*	bit	1	✓		

	sampling point?					
	TRANS_3A *Is the species present in the smallest (red) quadrat at the third sampling point?*	bit	1	✓		
	TRANS_3B *Is the species present in the intermediate (blue) quadrat at the third sampling point?*	bit	1	✓		
	TRANS_3C *Is the species present in the largest (green) quadrat at the third sampling point?*	bit	1	✓		
	TRANS_4A *Is the species present in the smallest (red) quadrat at the fourth sampling point?*	bit	1	✓		
	TRANS_4B *Is the species present in the intermediate (blue) quadrat at the fourth sampling point?*	bit	1	✓		
	TRANS_4C *Is the species present in the largest (green) quadrat at the fourth sampling point?*	bit	1	✓		
	TRANS_5A *Is the species present in the smallest (red) quadrat at the fifth sampling point?*	bit	1	✓		
	TRANS_5B *Is the species present in the intermediate (blue) quadrat at the fifth sampling point?*	bit	1	✓		
	TRANS_5C *Is the species present in the largest (green) quadrat at the fifth sampling point?*	bit	1	✓		
	TRANS_6A *Is the species present in the smallest (red) quadrat at the sixth sampling point?*	bit	1	✓		
	TRANS_6B *Is the species present in the intermediate (blue) quadrat at the sixth sampling point?*	bit	1	✓		
	TRANS_6C *Is the species present in the largest (green) quadrat at the sixth sampling point?*	bit	1	✓		
	TRANS_7A *Is the species present in the smallest (red) quadrat at the seventh sampling point?*	bit	1	✓		
	TRANS_7B *Is the species present in the intermediate (blue) quadrat at the seventh sampling point?*	bit	1	✓		
	TRANS_7C *Is the species present in the largest*	bit	1	✓		

	(green) quadrat at the seventh sampling point?					
	TRANS_8A *Is the species present in the smallest (red) quadrat at the eighth sampling point?*	bit	1	✓		
	TRANS_8B *Is the species present in the intermediate (blue) quadrat at the eighth sampling point?*	bit	1	✓		
	TRANS_8C *Is the species present in the largest (green) quadrat at the eighth sampling point?*	bit	1	✓		
	TRANS_9A *Is the species present in the smallest (red) quadrat at the ninth sampling point?*	bit	1	✓		
	TRANS_9B *Is the species present in the intermediate (blue) quadrat at the ninth sampling point?*	bit	1	✓		
	TRANS_9C *Is the species present in the largest (green) quadrat at the ninth sampling point?*	bit	1	✓		
	TRANS_10A *Is the species present in the smallest (red) quadrat at the tenth sampling point?*	bit	1	✓		
	TRANS_10B *Is the species present in the intermediate (blue) quadrat at the tenth sampling point?*	bit	1	✓		
	TRANS_10C *Is the species present in the largest (green) quadrat at the tenth sampling point?*	bit	1	✓		
	TRANS_11A *Is the species present in the smallest (red) quadrat at the eleventh sampling point?*	bit	1	✓		
	TRANS_11B *Is the species present in the intermediate (blue) quadrat at the eleventh sampling point?*	bit	1	✓		
	TRANS_11C *Is the species present in the largest (green) quadrat at the eleventh sampling point?*	bit	1	✓		
	TRANS_12A *Is the species present in the smallest (red) quadrat at the twelfth sampling point?*	bit	1	✓		
	TRANS_12B *Is the species present in the intermediate (blue) quadrat at the twelfth sampling point?*	bit	1	✓		
	TRANS_12C	bit	1	✓		

	Is the species present in the largest (green) quadrat at the twelfth sampling point?					
	TRANS_13A *Is the species present in the smallest (red) quadrat at the thirteenth sampling point?*	bit	1	✓		
	TRANS_13B *Is the species present in the intermediate (blue) quadrat at the thirteenth sampling point?*	bit	1	✓		
	TRANS_13C *Is the species present in the largest (green) quadrat at the thirteenth sampling point?*	bit	1	✓		
	RecordInsertedDate	datetime	8	✓		(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓		(suser_name())
	RecordUpdatedDate	datetime	8	✓		(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓		(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblTransQuadrats	PONDTRANSID	✓

Triggers

Name	ANSI Nulls On	Quoted Identifier On	On
tblTransQuadrats_OnUpdateAnalysisCode	✓	✓	After Insert

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblTransQuadrats_tblEvents	✓	Cascade	Cascade	PONDNAME->[dbo].[tbl-Events].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Events].[SAMPLEDATE]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			((PONDNAME In ("dena-008 ","Yuch-001 ","Yuch-010 ","Yuch-012 ","Yuch-013 ","Yuch-016 ","Yuch-017 ")) And (PONDNAME="dena-008 ")
MS_FilterOnLoad			False
MS_FrozenColumns			6
MS_HideNewField			False
MS_OrderBy			[tblTrans-Quadrats].[PONDNAME], [tbl-Trans-Quadrats].[SAMPLEDATE], [tblTrans-Quadrats].[PONDTRANSID], [tblTrans-Quadrats].[TRANSECT], [tbl-TransQuadrats].[ANALYSIS_-CODE], [tblTrans-Quadrats].[TRANSECTNUM], tblTransQuadrats.SPECIES
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	ANALYSIS_CODE	-1
MS_AllowValueListEdits	COLUMN	ANALYSIS_CODE	False
MS_ColumnCount	COLUMN	ANALYSIS_CODE	3
MS_ColumnHidden	COLUMN	ANALYSIS_CODE	False
MS_ColumnOrder	COLUMN	ANALYSIS_CODE	6
MS_ColumnWidth	COLUMN	ANALYSIS_CODE	-1
MS_ColumnWidths	COLUMN	ANALYSIS_CODE	1440.000;1440.000;2880.000
MS_DisplayControl	COLUMN	ANALYSIS_CODE	111
MS_Format	COLUMN	ANALYSIS_CODE	
MS_IMEMode	COLUMN	ANALYSIS_CODE	0
MS_ListItemsEditForm	COLUMN	ANALYSIS_CODE	
MS_ListWidth	COLUMN	ANALYSIS_CODE	5760.000
MS_RowSource	COLUMN	ANALYSIS_CODE	SELECT ANALYSIS_CODE, SPECIES_CODE, SH_-LAKE_NAME FROM dbo.tlu-VegTaxa
MS_ShowOnlyRowSourceValues	COLUMN	ANALYSIS_CODE	False

MS_TextAlign	COLUMN	ANALYSIS_CODE	0
MS_AggregateType	COLUMN	NUMQUADRATSPRESENT	-1
MS_ColumnHidden	COLUMN	NUMQUADRATSPRESENT	False
MS_ColumnOrder	COLUMN	NUMQUADRATSPRESENT	7
MS_ColumnWidth	COLUMN	NUMQUADRATSPRESENT	2715
MS_TextAlign	COLUMN	NUMQUADRATSPRESENT	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	1
MS_ColumnWidth	COLUMN	PONDNAME	1485
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	PONDTRANSID	-1
MS_ColumnHidden	COLUMN	PONDTRANSID	True
MS_ColumnOrder	COLUMN	PONDTRANSID	3
MS_ColumnWidth	COLUMN	PONDTRANSID	-1
MS_TextAlign	COLUMN	PONDTRANSID	0
MS_AggregateType	COLUMN	RecordInsertedBy	-1
MS_ColumnHidden	COLUMN	RecordInsertedBy	False
MS_ColumnOrder	COLUMN	RecordInsertedBy	48
MS_ColumnWidth	COLUMN	RecordInsertedBy	-1
MS_TextAlign	COLUMN	RecordInsertedBy	0
MS_AggregateType	COLUMN	RecordInsertedDate	-1
MS_ColumnHidden	COLUMN	RecordInsertedDate	False
MS_ColumnOrder	COLUMN	RecordInsertedDate	47
MS_ColumnWidth	COLUMN	RecordInsertedDate	-1
MS_TextAlign	COLUMN	RecordInsertedDate	0
MS_AggregateType	COLUMN	RecordUpdatedBy	-1
MS_ColumnHidden	COLUMN	RecordUpdatedBy	False
MS_ColumnOrder	COLUMN	RecordUpdatedBy	50
MS_ColumnWidth	COLUMN	RecordUpdatedBy	-1
MS_TextAlign	COLUMN	RecordUpdatedBy	0
MS_AggregateType	COLUMN	RecordUpdatedDate	-1
MS_ColumnHidden	COLUMN	RecordUpdatedDate	False
MS_ColumnOrder	COLUMN	RecordUpdatedDate	49
MS_ColumnWidth	COLUMN	RecordUpdatedDate	-1
MS_TextAlign	COLUMN	RecordUpdatedDate	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	2
MS_ColumnWidth	COLUMN	SAMPLEDATE	1635
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SPECIES	-1

MS_AllowValueListEdits	COLUMN	SPECIES	False
MS_ColumnCount	COLUMN	SPECIES	3
MS_ColumnHidden	COLUMN	SPECIES	False
MS_ColumnOrder	COLUMN	SPECIES	5
MS_ColumnWidth	COLUMN	SPECIES	2190
MS_ColumnWidths	COLUMN	SPECIES	1440.000;2880.000;2880.000
MS_DisplayControl	COLUMN	SPECIES	111
MS_ListItemsEditForm	COLUMN	SPECIES	
MS_ListWidth	COLUMN	SPECIES	7200.000
MS_RowSource	COLUMN	SPECIES	SELECT SPECIES_CODE, SH_LAKE_NAME, COMMON_NAME FROM dbo.tluVegTaxa
MS_ShowOnlyRowSourceValues	COLUMN	SPECIES	False
MS_TextAlign	COLUMN	SPECIES	0
MS_AggregateType	COLUMN	TRANS_10A	-1
MS_ColumnHidden	COLUMN	TRANS_10A	False
MS_ColumnOrder	COLUMN	TRANS_10A	35
MS_ColumnWidth	COLUMN	TRANS_10A	-1
MS_DisplayControl	COLUMN	TRANS_10A	106
MS_TextAlign	COLUMN	TRANS_10A	0
MS_AggregateType	COLUMN	TRANS_10B	-1
MS_ColumnHidden	COLUMN	TRANS_10B	False
MS_ColumnOrder	COLUMN	TRANS_10B	36
MS_ColumnWidth	COLUMN	TRANS_10B	-1
MS_DisplayControl	COLUMN	TRANS_10B	106
MS_TextAlign	COLUMN	TRANS_10B	0
MS_AggregateType	COLUMN	TRANS_10C	-1
MS_ColumnHidden	COLUMN	TRANS_10C	False
MS_ColumnOrder	COLUMN	TRANS_10C	37
MS_ColumnWidth	COLUMN	TRANS_10C	-1
MS_DisplayControl	COLUMN	TRANS_10C	106
MS_TextAlign	COLUMN	TRANS_10C	0
MS_AggregateType	COLUMN	TRANS_11A	-1
MS_ColumnHidden	COLUMN	TRANS_11A	False
MS_ColumnOrder	COLUMN	TRANS_11A	38
MS_ColumnWidth	COLUMN	TRANS_11A	-1
MS_DisplayControl	COLUMN	TRANS_11A	106
MS_TextAlign	COLUMN	TRANS_11A	0
MS_AggregateType	COLUMN	TRANS_11B	-1
MS_ColumnHidden	COLUMN	TRANS_11B	False
MS_ColumnOrder	COLUMN	TRANS_11B	39
MS_ColumnWidth	COLUMN	TRANS_11B	-1

MS_DisplayControl	COLUMN	TRANS_11B	106
MS_TextAlign	COLUMN	TRANS_11B	0
MS_AggregateType	COLUMN	TRANS_11C	-1
MS_ColumnHidden	COLUMN	TRANS_11C	False
MS_ColumnOrder	COLUMN	TRANS_11C	40
MS_ColumnWidth	COLUMN	TRANS_11C	-1
MS_DisplayControl	COLUMN	TRANS_11C	106
MS_TextAlign	COLUMN	TRANS_11C	0
MS_AggregateType	COLUMN	TRANS_12A	-1
MS_ColumnHidden	COLUMN	TRANS_12A	False
MS_ColumnOrder	COLUMN	TRANS_12A	41
MS_ColumnWidth	COLUMN	TRANS_12A	-1
MS_DisplayControl	COLUMN	TRANS_12A	106
MS_TextAlign	COLUMN	TRANS_12A	0
MS_AggregateType	COLUMN	TRANS_12B	-1
MS_ColumnHidden	COLUMN	TRANS_12B	False
MS_ColumnOrder	COLUMN	TRANS_12B	42
MS_ColumnWidth	COLUMN	TRANS_12B	-1
MS_DisplayControl	COLUMN	TRANS_12B	106
MS_TextAlign	COLUMN	TRANS_12B	0
MS_AggregateType	COLUMN	TRANS_12C	-1
MS_ColumnHidden	COLUMN	TRANS_12C	False
MS_ColumnOrder	COLUMN	TRANS_12C	43
MS_ColumnWidth	COLUMN	TRANS_12C	-1
MS_DisplayControl	COLUMN	TRANS_12C	106
MS_TextAlign	COLUMN	TRANS_12C	0
MS_AggregateType	COLUMN	TRANS_13A	-1
MS_ColumnHidden	COLUMN	TRANS_13A	False
MS_ColumnOrder	COLUMN	TRANS_13A	44
MS_ColumnWidth	COLUMN	TRANS_13A	-1
MS_DisplayControl	COLUMN	TRANS_13A	106
MS_TextAlign	COLUMN	TRANS_13A	0
MS_AggregateType	COLUMN	TRANS_13B	-1
MS_ColumnHidden	COLUMN	TRANS_13B	False
MS_ColumnOrder	COLUMN	TRANS_13B	45
MS_ColumnWidth	COLUMN	TRANS_13B	-1
MS_DisplayControl	COLUMN	TRANS_13B	106
MS_TextAlign	COLUMN	TRANS_13B	0
MS_AggregateType	COLUMN	TRANS_13C	-1
MS_ColumnHidden	COLUMN	TRANS_13C	False
MS_ColumnOrder	COLUMN	TRANS_13C	46
MS_ColumnWidth	COLUMN	TRANS_13C	-1

MS_DisplayControl	COLUMN	TRANS_13C	106
MS_TextAlign	COLUMN	TRANS_13C	0
MS_AggregateType	COLUMN	TRANS_1A	-1
MS_ColumnHidden	COLUMN	TRANS_1A	False
MS_ColumnOrder	COLUMN	TRANS_1A	8
MS_ColumnWidth	COLUMN	TRANS_1A	1380
MS_DisplayControl	COLUMN	TRANS_1A	106
MS_TextAlign	COLUMN	TRANS_1A	0
MS_AggregateType	COLUMN	TRANS_1B	-1
MS_ColumnHidden	COLUMN	TRANS_1B	False
MS_ColumnOrder	COLUMN	TRANS_1B	9
MS_ColumnWidth	COLUMN	TRANS_1B	1365
MS_DisplayControl	COLUMN	TRANS_1B	106
MS_TextAlign	COLUMN	TRANS_1B	0
MS_AggregateType	COLUMN	TRANS_1C	-1
MS_ColumnHidden	COLUMN	TRANS_1C	False
MS_ColumnOrder	COLUMN	TRANS_1C	10
MS_ColumnWidth	COLUMN	TRANS_1C	1365
MS_DisplayControl	COLUMN	TRANS_1C	106
MS_TextAlign	COLUMN	TRANS_1C	0
MS_AggregateType	COLUMN	TRANS_2A	-1
MS_ColumnHidden	COLUMN	TRANS_2A	False
MS_ColumnOrder	COLUMN	TRANS_2A	11
MS_ColumnWidth	COLUMN	TRANS_2A	1380
MS_DisplayControl	COLUMN	TRANS_2A	106
MS_TextAlign	COLUMN	TRANS_2A	0
MS_AggregateType	COLUMN	TRANS_2B	-1
MS_ColumnHidden	COLUMN	TRANS_2B	False
MS_ColumnOrder	COLUMN	TRANS_2B	12
MS_ColumnWidth	COLUMN	TRANS_2B	1365
MS_DisplayControl	COLUMN	TRANS_2B	106
MS_TextAlign	COLUMN	TRANS_2B	0
MS_AggregateType	COLUMN	TRANS_2C	-1
MS_ColumnHidden	COLUMN	TRANS_2C	False
MS_ColumnOrder	COLUMN	TRANS_2C	13
MS_ColumnWidth	COLUMN	TRANS_2C	1365
MS_DisplayControl	COLUMN	TRANS_2C	106
MS_TextAlign	COLUMN	TRANS_2C	0
MS_AggregateType	COLUMN	TRANS_3A	-1
MS_ColumnHidden	COLUMN	TRANS_3A	False
MS_ColumnOrder	COLUMN	TRANS_3A	14
MS_ColumnWidth	COLUMN	TRANS_3A	1380

MS_DisplayControl	COLUMN	TRANS_3A	106
MS_TextAlign	COLUMN	TRANS_3A	0
MS_AggregateType	COLUMN	TRANS_3B	-1
MS_ColumnHidden	COLUMN	TRANS_3B	False
MS_ColumnOrder	COLUMN	TRANS_3B	15
MS_ColumnWidth	COLUMN	TRANS_3B	1365
MS_DisplayControl	COLUMN	TRANS_3B	106
MS_TextAlign	COLUMN	TRANS_3B	0
MS_AggregateType	COLUMN	TRANS_3C	-1
MS_ColumnHidden	COLUMN	TRANS_3C	False
MS_ColumnOrder	COLUMN	TRANS_3C	16
MS_ColumnWidth	COLUMN	TRANS_3C	1365
MS_DisplayControl	COLUMN	TRANS_3C	106
MS_TextAlign	COLUMN	TRANS_3C	0
MS_AggregateType	COLUMN	TRANS_4A	-1
MS_ColumnHidden	COLUMN	TRANS_4A	False
MS_ColumnOrder	COLUMN	TRANS_4A	17
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MS_DisplayControl	COLUMN	TRANS_4A	106
MS_TextAlign	COLUMN	TRANS_4A	0
MS_AggregateType	COLUMN	TRANS_4B	-1
MS_ColumnHidden	COLUMN	TRANS_4B	False
MS_ColumnOrder	COLUMN	TRANS_4B	18
MS_ColumnWidth	COLUMN	TRANS_4B	1365
MS_DisplayControl	COLUMN	TRANS_4B	106
MS_TextAlign	COLUMN	TRANS_4B	0
MS_AggregateType	COLUMN	TRANS_4C	-1
MS_ColumnHidden	COLUMN	TRANS_4C	False
MS_ColumnOrder	COLUMN	TRANS_4C	19
MS_ColumnWidth	COLUMN	TRANS_4C	1365
MS_DisplayControl	COLUMN	TRANS_4C	106
MS_TextAlign	COLUMN	TRANS_4C	0
MS_AggregateType	COLUMN	TRANS_5A	-1
MS_ColumnHidden	COLUMN	TRANS_5A	False
MS_ColumnOrder	COLUMN	TRANS_5A	20
MS_ColumnWidth	COLUMN	TRANS_5A	1380
MS_DisplayControl	COLUMN	TRANS_5A	106
MS_TextAlign	COLUMN	TRANS_5A	0
MS_AggregateType	COLUMN	TRANS_5B	-1
MS_ColumnHidden	COLUMN	TRANS_5B	False
MS_ColumnOrder	COLUMN	TRANS_5B	21
MS_ColumnWidth	COLUMN	TRANS_5B	1365

MS_DisplayControl	COLUMN	TRANS_5B	106
MS_TextAlign	COLUMN	TRANS_5B	0
MS_AggregateType	COLUMN	TRANS_5C	-1
MS_ColumnHidden	COLUMN	TRANS_5C	False
MS_ColumnOrder	COLUMN	TRANS_5C	22
MS_ColumnWidth	COLUMN	TRANS_5C	1365
MS_DisplayControl	COLUMN	TRANS_5C	106
MS_TextAlign	COLUMN	TRANS_5C	0
MS_AggregateType	COLUMN	TRANS_6A	-1
MS_ColumnHidden	COLUMN	TRANS_6A	False
MS_ColumnOrder	COLUMN	TRANS_6A	23
MS_ColumnWidth	COLUMN	TRANS_6A	1380
MS_DisplayControl	COLUMN	TRANS_6A	106
MS_TextAlign	COLUMN	TRANS_6A	0
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MS_ColumnHidden	COLUMN	TRANS_6B	False
MS_ColumnOrder	COLUMN	TRANS_6B	24
MS_ColumnWidth	COLUMN	TRANS_6B	1365
MS_DisplayControl	COLUMN	TRANS_6B	106
MS_TextAlign	COLUMN	TRANS_6B	0
MS_AggregateType	COLUMN	TRANS_6C	-1
MS_ColumnHidden	COLUMN	TRANS_6C	False
MS_ColumnOrder	COLUMN	TRANS_6C	25
MS_ColumnWidth	COLUMN	TRANS_6C	1365
MS_DisplayControl	COLUMN	TRANS_6C	106
MS_TextAlign	COLUMN	TRANS_6C	0
MS_AggregateType	COLUMN	TRANS_7A	-1
MS_ColumnHidden	COLUMN	TRANS_7A	False
MS_ColumnOrder	COLUMN	TRANS_7A	26
MS_ColumnWidth	COLUMN	TRANS_7A	1050
MS_DisplayControl	COLUMN	TRANS_7A	106
MS_TextAlign	COLUMN	TRANS_7A	0
MS_AggregateType	COLUMN	TRANS_7B	-1
MS_ColumnHidden	COLUMN	TRANS_7B	False
MS_ColumnOrder	COLUMN	TRANS_7B	27
MS_ColumnWidth	COLUMN	TRANS_7B	-1
MS_DisplayControl	COLUMN	TRANS_7B	106
MS_TextAlign	COLUMN	TRANS_7B	0
MS_AggregateType	COLUMN	TRANS_7C	-1
MS_ColumnHidden	COLUMN	TRANS_7C	False
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MS_DisplayControl	COLUMN	TRANS_7C	106
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MS_AggregateType	COLUMN	TRANS_8A	-1
MS_ColumnHidden	COLUMN	TRANS_8A	False
MS_ColumnOrder	COLUMN	TRANS_8A	29
MS_ColumnWidth	COLUMN	TRANS_8A	-1
MS_DisplayControl	COLUMN	TRANS_8A	106
MS_TextAlign	COLUMN	TRANS_8A	0
MS_AggregateType	COLUMN	TRANS_8B	-1
MS_ColumnHidden	COLUMN	TRANS_8B	False
MS_ColumnOrder	COLUMN	TRANS_8B	30
MS_ColumnWidth	COLUMN	TRANS_8B	-1
MS_DisplayControl	COLUMN	TRANS_8B	106
MS_TextAlign	COLUMN	TRANS_8B	0
MS_AggregateType	COLUMN	TRANS_8C	-1
MS_ColumnHidden	COLUMN	TRANS_8C	False
MS_ColumnOrder	COLUMN	TRANS_8C	31
MS_ColumnWidth	COLUMN	TRANS_8C	-1
MS_DisplayControl	COLUMN	TRANS_8C	106
MS_TextAlign	COLUMN	TRANS_8C	0
MS_AggregateType	COLUMN	TRANS_9A	-1
MS_ColumnHidden	COLUMN	TRANS_9A	False
MS_ColumnOrder	COLUMN	TRANS_9A	32
MS_ColumnWidth	COLUMN	TRANS_9A	-1
MS_DisplayControl	COLUMN	TRANS_9A	106
MS_TextAlign	COLUMN	TRANS_9A	0
MS_AggregateType	COLUMN	TRANS_9B	-1
MS_ColumnHidden	COLUMN	TRANS_9B	False
MS_ColumnOrder	COLUMN	TRANS_9B	33
MS_ColumnWidth	COLUMN	TRANS_9B	-1
MS_DisplayControl	COLUMN	TRANS_9B	106
MS_TextAlign	COLUMN	TRANS_9B	0
MS_AggregateType	COLUMN	TRANS_9C	-1
MS_ColumnHidden	COLUMN	TRANS_9C	False
MS_ColumnOrder	COLUMN	TRANS_9C	34
MS_ColumnWidth	COLUMN	TRANS_9C	-1
MS_DisplayControl	COLUMN	TRANS_9C	106
MS_TextAlign	COLUMN	TRANS_9C	0
MS_AggregateType	COLUMN	TRANSECT	-1
MS_ColumnHidden	COLUMN	TRANSECT	False
MS_ColumnOrder	COLUMN	TRANSECT	4
MS_ColumnWidth	COLUMN	TRANSECT	660

MS_DisplayControl	COLUMN	TRANSECT	109
MS_Format	COLUMN	TRANSECT	
MS_IMEMode	COLUMN	TRANSECT	0
MS_TextAlign	COLUMN	TRANSECT	0
MS_AggregateType	COLUMN	TRANSECTNUM	-1
MS_ColumnHidden	COLUMN	TRANSECTNUM	False
MS_ColumnOrder	COLUMN	TRANSECTNUM	51
MS_ColumnWidth	COLUMN	TRANSECTNUM	-1
MS_DisplayControl	COLUMN	TRANSECTNUM	109
MS_Format	COLUMN	TRANSECTNUM	
MS_IMEMode	COLUMN	TRANSECTNUM	0
MS_TextAlign	COLUMN	TRANSECTNUM	0

Uses

[dbo].[tblEvents]
dbo

[dbo].[tblTransSpeciesPointIntercepts]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblTransSpeciesPointIntercepts

This table contains point intercept data, which was collected in an earlier protocol for vegetation surveys. Data is not being actively appended to this table, as the survey protocols have changed.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	1628
Created	3:08:59 PM Monday, April 05, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Identity	Default
	SPPNTINTID	int	4	✗	1 - 1	
	PONDNAME	nvarchar(50)	100	✗		
	SAMPLEDATE	datetime	8	✗		
	TRANSECTNUM	nvarchar(50)	100	✗		
	DISTANCE_CM	int	4	✓		
	DEPTH_CM	int	4	✓		
	SPECIES_1	nvarchar(50)	100	✓		
	SPECIES_2	nvarchar(50)	100	✓		
	SPECIES_3	nvarchar(50)	100	✓		
	SPECIES_4	nvarchar(50)	100	✓		
	SPECIES_5	nvarchar(50)	100	✓		
	COMMENTS	nvarchar(max)	max	✓		
	RecordInsertedDate	datetime	8	✓		(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓		(suser_name())
	RecordUpdatedDate	datetime	8	✓		(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓		(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblTransSpeciesPointIntercepts	SPPNTINTID	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblTransSpeciesPointIntercepts_tblEvents	✓	Cascade	Cascade	PONDNAME->[dbo].[tbl-Events].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Events].[SAMPLEDATE]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			[tblTransSpeciesPoint-Intercepts].[TRANSECTNUM], [tbl-TransSpeciesPoint-Intercepts].[DISTANCE_CM]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	12
MS_ColumnWidth	COLUMN	COMMENTS	1515
MS_TextAlign	COLUMN	COMMENTS	0
MS_AggregateType	COLUMN	DEPTH_CM	-1
MS_ColumnHidden	COLUMN	DEPTH_CM	False
MS_ColumnOrder	COLUMN	DEPTH_CM	6
MS_ColumnWidth	COLUMN	DEPTH_CM	1425
MS_TextAlign	COLUMN	DEPTH_CM	0
MS_AggregateType	COLUMN	DISTANCE_CM	-1
MS_ColumnHidden	COLUMN	DISTANCE_CM	False
MS_ColumnOrder	COLUMN	DISTANCE_CM	5
MS_ColumnWidth	COLUMN	DISTANCE_CM	1740
MS_TextAlign	COLUMN	DISTANCE_CM	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	2
MS_ColumnWidth	COLUMN	PONDNAME	2955
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	3
MS_ColumnWidth	COLUMN	SAMPLEDATE	1635
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SPECIES_1	-1
MS_AllowValueListEdits	COLUMN	SPECIES_1	False

MS_ColumnCount	COLUMN	SPECIES_1	2
MS_ColumnHeads	COLUMN	SPECIES_1	-1
MS_ColumnHidden	COLUMN	SPECIES_1	False
MS_ColumnOrder	COLUMN	SPECIES_1	7
MS_ColumnWidth	COLUMN	SPECIES_1	3075
MS_ColumnWidths	COLUMN	SPECIES_1	1440.000;2880.000
MS_DisplayControl	COLUMN	SPECIES_1	111
MS_LimitToList	COLUMN	SPECIES_1	-1
MS_ListItemsEditForm	COLUMN	SPECIES_1	
MS_ListRows	COLUMN	SPECIES_1	40
MS_RowSource	COLUMN	SPECIES_1	dbo.vwLutTaxon
MS_ShowOnlyRowSourceValues	COLUMN	SPECIES_1	False
MS_TextAlign	COLUMN	SPECIES_1	0
MS_AggregateType	COLUMN	SPECIES_2	-1
MS_AllowValueListEdits	COLUMN	SPECIES_2	False
MS_ColumnCount	COLUMN	SPECIES_2	2
MS_ColumnHeads	COLUMN	SPECIES_2	-1
MS_ColumnHidden	COLUMN	SPECIES_2	False
MS_ColumnOrder	COLUMN	SPECIES_2	8
MS_ColumnWidth	COLUMN	SPECIES_2	3045
MS_ColumnWidths	COLUMN	SPECIES_2	1440.000;2880.000
MS_DisplayControl	COLUMN	SPECIES_2	111
MS_LimitToList	COLUMN	SPECIES_2	-1
MS_ListItemsEditForm	COLUMN	SPECIES_2	
MS_ListRows	COLUMN	SPECIES_2	40
MS_RowSource	COLUMN	SPECIES_2	dbo.vwLutTaxon
MS_ShowOnlyRowSourceValues	COLUMN	SPECIES_2	False
MS_TextAlign	COLUMN	SPECIES_2	0
MS_AggregateType	COLUMN	SPECIES_3	-1
MS_AllowValueListEdits	COLUMN	SPECIES_3	False
MS_ColumnCount	COLUMN	SPECIES_3	2
MS_ColumnHeads	COLUMN	SPECIES_3	-1
MS_ColumnHidden	COLUMN	SPECIES_3	False
MS_ColumnOrder	COLUMN	SPECIES_3	9
MS_ColumnWidth	COLUMN	SPECIES_3	2685
MS_ColumnWidths	COLUMN	SPECIES_3	1440.000;2880.000
MS_DisplayControl	COLUMN	SPECIES_3	111
MS_LimitToList	COLUMN	SPECIES_3	-1
MS_ListItemsEditForm	COLUMN	SPECIES_3	
MS_ListRows	COLUMN	SPECIES_3	40
MS_RowSource	COLUMN	SPECIES_3	dbo.vwLutTaxon
MS_ShowOnlyRowSourceValues	COLUMN	SPECIES_3	False

MS_TextAlign	COLUMN	SPECIES_3	0
MS_AggregateType	COLUMN	SPECIES_4	-1
MS_AllowValueListEdits	COLUMN	SPECIES_4	False
MS_ColumnCount	COLUMN	SPECIES_4	2
MS_ColumnHeads	COLUMN	SPECIES_4	-1
MS_ColumnHidden	COLUMN	SPECIES_4	False
MS_ColumnOrder	COLUMN	SPECIES_4	10
MS_ColumnWidth	COLUMN	SPECIES_4	2685
MS_ColumnWidths	COLUMN	SPECIES_4	1440.000;2880.000
MS_DisplayControl	COLUMN	SPECIES_4	111
MS_LimitToList	COLUMN	SPECIES_4	-1
MS_ListItemsEditForm	COLUMN	SPECIES_4	
MS_ListRows	COLUMN	SPECIES_4	40
MS_RowSource	COLUMN	SPECIES_4	dbo.vwLutTaxon
MS_ShowOnlyRowSourceValues	COLUMN	SPECIES_4	False
MS_TextAlign	COLUMN	SPECIES_4	0
MS_AggregateType	COLUMN	SPECIES_5	-1
MS_AllowValueListEdits	COLUMN	SPECIES_5	False
MS_ColumnCount	COLUMN	SPECIES_5	2
MS_ColumnHeads	COLUMN	SPECIES_5	-1
MS_ColumnHidden	COLUMN	SPECIES_5	False
MS_ColumnOrder	COLUMN	SPECIES_5	11
MS_ColumnWidth	COLUMN	SPECIES_5	2685
MS_ColumnWidths	COLUMN	SPECIES_5	1440.000;2880.000
MS_DisplayControl	COLUMN	SPECIES_5	111
MS_LimitToList	COLUMN	SPECIES_5	-1
MS_ListItemsEditForm	COLUMN	SPECIES_5	
MS_ListRows	COLUMN	SPECIES_5	40
MS_RowSource	COLUMN	SPECIES_5	dbo.vwLutTaxon
MS_ShowOnlyRowSourceValues	COLUMN	SPECIES_5	False
MS_TextAlign	COLUMN	SPECIES_5	0
MS_AggregateType	COLUMN	SPPNTINTID	-1
MS_ColumnHidden	COLUMN	SPPNTINTID	True
MS_ColumnOrder	COLUMN	SPPNTINTID	1
MS_ColumnWidth	COLUMN	SPPNTINTID	-1
MS_TextAlign	COLUMN	SPPNTINTID	0
MS_AggregateType	COLUMN	TRANSECTNUM	-1
MS_ColumnHidden	COLUMN	TRANSECTNUM	False
MS_ColumnOrder	COLUMN	TRANSECTNUM	4
MS_ColumnWidth	COLUMN	TRANSECTNUM	2490
MS_TextAlign	COLUMN	TRANSECTNUM	0

Uses

[dbo].[tblEvents]
dbo

[dbo].[tblUSGSLabData]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblUSGSLabData

This table contains the laboratory data returned from the USGS. Samples for gases, dissolved carbon and isotopes are collected on behalf of the USGS, and they share the results with the Shallow Lakes project.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	132
Created	1:25:12 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	Master_Num *Number assigned by USGS for the measurement.*	float	8	✗	
	SiteName *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗	
	SiteDate *Date of sample collection*	datetime	8	✗	
	SampleNumber *Alphabetic designation given when the sample is collected; start with "a" for the first sample taken, and label each sample consecutively*	nvarchar(50)	100	✓	
	DOC_WW *Dissolved Organic Carbon concentration (ppm)*	float	8	✓	
	UV_WW *Ultraviolet*	float	8	✓	
	SUVA_WW *Specific Ultraviolet absorbance*	float	8	✓	
	Delta_H2 *Delta 2H (ratio of 2H:1H) (per mil)*	decimal(18,2)	9	✓	
	Delta_O18 *Delta 18O (ratio of 18O:16O) (standard mean ocean water) (per mil)*	decimal(18,2)	9	✓	
	CO2_ppm *Carbon Dioxide concentration (ppm)*	float	8	✓	
	CH4_ppm *Methane concentration (ppm)*	float	8	✓	
	DIC_umolesL *Dissolved Inorganic Carbon (umol/L)*	float	8	✓	
	Comments *Comments about the data/measurements*	nvarchar(max)	max	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblUSGSLabData	Master_Num, SiteName, SiteDate	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblUSGSLabData_tblEvents	✓	Cascade	Cascade	SiteName->[dbo].[tbl-Events].[PONDNAME] SiteDate->[dbo].[tbl-Events].[SAMPLEDATE]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			[tblUSGSLabData].[SiteName], [tblUSGSLab-Data].[SiteDate]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	CH4_ppm	-1
MS_ColumnHidden	COLUMN	CH4_ppm	False
MS_ColumnOrder	COLUMN	CH4_ppm	0
MS_ColumnWidth	COLUMN	CH4_ppm	1305
MS_TextAlign	COLUMN	CH4_ppm	0
MS_AggregateType	COLUMN	CO2_ppm	-1
MS_ColumnHidden	COLUMN	CO2_ppm	False
MS_ColumnOrder	COLUMN	CO2_ppm	0
MS_ColumnWidth	COLUMN	CO2_ppm	1320
MS_TextAlign	COLUMN	CO2_ppm	0
MS_AggregateType	COLUMN	Comments	-1
MS_ColumnHidden	COLUMN	Comments	False
MS_ColumnOrder	COLUMN	Comments	0
MS_ColumnWidth	COLUMN	Comments	8835
MS_TextAlign	COLUMN	Comments	0
MS_AggregateType	COLUMN	Delta_H2	-1
MS_ColumnHidden	COLUMN	Delta_H2	False
MS_ColumnOrder	COLUMN	Delta_H2	0
MS_ColumnWidth	COLUMN	Delta_H2	1470
MS_DisplayControl	COLUMN	Delta_H2	109
MS_Format	COLUMN	Delta_H2	
MS_TextAlign	COLUMN	Delta_H2	0
MS_AggregateType	COLUMN	Delta_O18	-1
MS_ColumnHidden	COLUMN	Delta_O18	False
MS_ColumnOrder	COLUMN	Delta_O18	0
MS_ColumnWidth	COLUMN	Delta_O18	1455
MS_DisplayControl	COLUMN	Delta_O18	109
MS_Format	COLUMN	Delta_O18	
MS_TextAlign	COLUMN	Delta_O18	0

MS_AggregateType	COLUMN	DIC_umolesL	-1
MS_ColumnHidden	COLUMN	DIC_umolesL	False
MS_ColumnOrder	COLUMN	DIC_umolesL	0
MS_ColumnWidth	COLUMN	DIC_umolesL	1620
MS_TextAlign	COLUMN	DIC_umolesL	0
MS_AggregateType	COLUMN	DOC_WW	-1
MS_ColumnHidden	COLUMN	DOC_WW	False
MS_ColumnOrder	COLUMN	DOC_WW	0
MS_ColumnWidth	COLUMN	DOC_WW	765
MS_DisplayControl	COLUMN	DOC_WW	109
MS_Format	COLUMN	DOC_WW	
MS_TextAlign	COLUMN	DOC_WW	0
MS_AggregateType	COLUMN	Master_Num	-1
MS_ColumnHidden	COLUMN	Master_Num	False
MS_ColumnOrder	COLUMN	Master_Num	1
MS_ColumnWidth	COLUMN	Master_Num	765
MS_TextAlign	COLUMN	Master_Num	0
MS_DisplayControl	COLUMN	SampleNumber	109
MS_Format	COLUMN	SampleNumber	
MS_IMEMode	COLUMN	SampleNumber	0
MS_AggregateType	COLUMN	SiteDate	-1
MS_ColumnHidden	COLUMN	SiteDate	False
MS_ColumnOrder	COLUMN	SiteDate	0
MS_ColumnWidth	COLUMN	SiteDate	1215
MS_TextAlign	COLUMN	SiteDate	0
MS_AggregateType	COLUMN	SiteName	-1
MS_ColumnHidden	COLUMN	SiteName	False
MS_ColumnOrder	COLUMN	SiteName	0
MS_ColumnWidth	COLUMN	SiteName	1440
MS_DisplayControl	COLUMN	SiteName	109
MS_Format	COLUMN	SiteName	
MS_IMEMode	COLUMN	SiteName	0
MS_TextAlign	COLUMN	SiteName	0
MS_AggregateType	COLUMN	SUVA_WW	-1
MS_ColumnHidden	COLUMN	SUVA_WW	False
MS_ColumnOrder	COLUMN	SUVA_WW	0
MS_ColumnWidth	COLUMN	SUVA_WW	765
MS_TextAlign	COLUMN	SUVA_WW	0
MS_AggregateType	COLUMN	UV_WW	-1
MS_ColumnHidden	COLUMN	UV_WW	False
MS_ColumnOrder	COLUMN	UV_WW	0
MS_ColumnWidth	COLUMN	UV_WW	765

MS_TextAlign	COLUMN	UV_WW	0

Uses

[dbo].[tblEvents]
dbo

[dbo].[tblVegProfiles]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblVegProfiles

This table contains the data from the Vegetation Profile protocol (VegMat). The depth of the various layers of the lake margin are profiled using an avalanche probe. Data is generally imported from a Trimble GPS unit, but can also be manually entered.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	2366
Created	1:25:42 PM Friday, April 02, 2010
Last Modified	3:11:15 PM Thursday, April 08, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Identity	Default
	PROFILEID	int	4	✗	1 - 1	
	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗		
	SAMPLEDATE *The date and time of the sample; automatically populated when a new Sampling Event form is opened*	datetime	8	✗		
	SAMPLE_TIME	datetime	8	✓		
	TRANSECT_POINT *During manual entry this can be entered as the location on the transect tape (m)*	int	4	✓		
	WATER_DEPTH *Depth of standing water above the vegetation (m)*	float	8	✓		
	MAT_DEPTH *Depth of the vegetated layer or thickness of the floating mat (m)*	float	8	✓		
	BOTTOM_DEPTH *Distace to the bottom of the lake / sediment surface (m)*	float	8	✓		
	MAX_PENETRATION *Maximum depth to which the probe can be pushed (m)*	float	8	✓		
	GPS_TIME *Time as recorded by GPS unit*	datetime	8	✓		
	LONGITUDE *Longitude for point from Trimble*	float	8	✓		
	LATITUDE *Latitude for point from Trimble*	float	8	✓		
	HEIGHT	float	8	✓		
	TRANSECT_NUM *Transect number*	float	8	✓		
	FEAT_NAME *Trimble feature name (from data dictionary)*	nvarchar(255)	510	✓		
	DATAFILE *Trimble datafile reference*	nvarchar(255)	510	✓		
	GPS_HEIGHT *GPS Height*	float	8	✓		
	VERT_PREC *GPS Vertical Precision*	float	8	✓		
	HORZ_PREC *GPS Horizontal Precision*	float	8	✓		
	POINT_ID	float	8	✓		

	Point ID (assigned by GPS unit)					
	SOURCE *Name of source file*	nvarchar(255)	510	✓		
	COMMENTS	nvarchar(max)	max	✓		
	RecordInsertedDate	datetime	8	✓		(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓		(suser_name())
	RecordUpdatedDate	datetime	8	✓		(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓		(suser_name())
	RecordCertifiedDate	datetime	8	✓		
	RecordCertifiedBy	nvarchar(50)	100	✓		

Indexes

	Name	Columns	Unique
	PK_tbl_Veg_Profiles	PROFILEID	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblVegProfiles_tblEvents	✓	Cascade	Cascade	PONDNAME->[dbo].[tbl-Events].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Events].[SAMPLEDATE]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			[tblVegProfiles].[PONDNAME], [tblVeg-Profiles].[SAMPLEDATE], [tblVeg-Profiles].[SAMPLE_TIME], [tblVeg-Profiles].[TRANSECT_NUM], [tblVeg-Profiles].[TRANSECT_POINT]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	BOTTOM_DEPTH	-1
MS_ColumnHidden	COLUMN	BOTTOM_DEPTH	False
MS_ColumnOrder	COLUMN	BOTTOM_DEPTH	9
MS_ColumnWidth	COLUMN	BOTTOM_DEPTH	690
MS_TextAlign	COLUMN	BOTTOM_DEPTH	0
MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	0
MS_ColumnWidth	COLUMN	COMMENTS	7620
MS_TextAlign	COLUMN	COMMENTS	0
MS_AggregateType	COLUMN	DATAFILE	-1
MS_ColumnHidden	COLUMN	DATAFILE	False
MS_ColumnOrder	COLUMN	DATAFILE	0
MS_ColumnWidth	COLUMN	DATAFILE	3840
MS_TextAlign	COLUMN	DATAFILE	0
MS_AggregateType	COLUMN	FEAT_NAME	-1
MS_ColumnHidden	COLUMN	FEAT_NAME	False
MS_ColumnOrder	COLUMN	FEAT_NAME	0
MS_ColumnWidth	COLUMN	FEAT_NAME	1920
MS_TextAlign	COLUMN	FEAT_NAME	0
MS_AggregateType	COLUMN	GPS_HEIGHT	-1
MS_ColumnHidden	COLUMN	GPS_HEIGHT	False
MS_ColumnOrder	COLUMN	GPS_HEIGHT	0
MS_ColumnWidth	COLUMN	GPS_HEIGHT	1815
MS_TextAlign	COLUMN	GPS_HEIGHT	0
MS_AggregateType	COLUMN	GPS_TIME	-1
MS_ColumnHidden	COLUMN	GPS_TIME	False

MS_ColumnOrder	COLUMN	GPS_TIME	11
MS_ColumnWidth	COLUMN	GPS_TIME	1335
MS_TextAlign	COLUMN	GPS_TIME	0
MS_AggregateType	COLUMN	HEIGHT	-1
MS_ColumnHidden	COLUMN	HEIGHT	False
MS_ColumnOrder	COLUMN	HEIGHT	14
MS_ColumnWidth	COLUMN	HEIGHT	1095
MS_TextAlign	COLUMN	HEIGHT	0
MS_AggregateType	COLUMN	HORZ_PREC	-1
MS_ColumnHidden	COLUMN	HORZ_PREC	False
MS_ColumnOrder	COLUMN	HORZ_PREC	0
MS_ColumnWidth	COLUMN	HORZ_PREC	1920
MS_TextAlign	COLUMN	HORZ_PREC	0
MS_AggregateType	COLUMN	LATITUDE	-1
MS_ColumnHidden	COLUMN	LATITUDE	False
MS_ColumnOrder	COLUMN	LATITUDE	13
MS_ColumnWidth	COLUMN	LATITUDE	1395
MS_TextAlign	COLUMN	LATITUDE	0
MS_AggregateType	COLUMN	LONGITUDE	-1
MS_ColumnHidden	COLUMN	LONGITUDE	False
MS_ColumnOrder	COLUMN	LONGITUDE	12
MS_ColumnWidth	COLUMN	LONGITUDE	1575
MS_TextAlign	COLUMN	LONGITUDE	0
MS_AggregateType	COLUMN	MAT_DEPTH	-1
MS_ColumnHidden	COLUMN	MAT_DEPTH	False
MS_ColumnOrder	COLUMN	MAT_DEPTH	8
MS_ColumnWidth	COLUMN	MAT_DEPTH	675
MS_TextAlign	COLUMN	MAT_DEPTH	0
MS_AggregateType	COLUMN	MAX_PENETRATION	-1
MS_ColumnHidden	COLUMN	MAX_PENETRATION	False
MS_ColumnOrder	COLUMN	MAX_PENETRATION	10
MS_ColumnWidth	COLUMN	MAX_PENETRATION	660
MS_TextAlign	COLUMN	MAX_PENETRATION	0
MS_AggregateType	COLUMN	POINT_ID	-1
MS_ColumnHidden	COLUMN	POINT_ID	False
MS_ColumnOrder	COLUMN	POINT_ID	0
MS_ColumnWidth	COLUMN	POINT_ID	1305
MS_TextAlign	COLUMN	POINT_ID	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	2
MS_ColumnWidth	COLUMN	PONDNAME	1185

MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	PROFILEID	-1
MS_ColumnHidden	COLUMN	PROFILEID	True
MS_ColumnOrder	COLUMN	PROFILEID	1
MS_ColumnWidth	COLUMN	PROFILEID	-1
MS_TextAlign	COLUMN	PROFILEID	0
MS_AggregateType	COLUMN	SAMPLE_TIME	-1
MS_ColumnHidden	COLUMN	SAMPLE_TIME	True
MS_ColumnOrder	COLUMN	SAMPLE_TIME	4
MS_ColumnWidth	COLUMN	SAMPLE_TIME	-1
MS_TextAlign	COLUMN	SAMPLE_TIME	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	3
MS_ColumnWidth	COLUMN	SAMPLEDATE	1185
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SOURCE	-1
MS_ColumnHidden	COLUMN	SOURCE	False
MS_ColumnOrder	COLUMN	SOURCE	0
MS_ColumnWidth	COLUMN	SOURCE	11085
MS_TextAlign	COLUMN	SOURCE	0
MS_AggregateType	COLUMN	TRANSECT_NUM	-1
MS_ColumnHidden	COLUMN	TRANSECT_NUM	False
MS_ColumnOrder	COLUMN	TRANSECT_NUM	5
MS_ColumnWidth	COLUMN	TRANSECT_NUM	555
MS_TextAlign	COLUMN	TRANSECT_NUM	0
MS_AggregateType	COLUMN	TRANSECT_POINT	-1
MS_ColumnHidden	COLUMN	TRANSECT_POINT	False
MS_ColumnOrder	COLUMN	TRANSECT_POINT	6
MS_ColumnWidth	COLUMN	TRANSECT_POINT	495
MS_TextAlign	COLUMN	TRANSECT_POINT	0
MS_AggregateType	COLUMN	VERT_PREC	-1
MS_ColumnHidden	COLUMN	VERT_PREC	False
MS_ColumnOrder	COLUMN	VERT_PREC	0
MS_ColumnWidth	COLUMN	VERT_PREC	1815
MS_TextAlign	COLUMN	VERT_PREC	0
MS_AggregateType	COLUMN	WATER_DEPTH	-1
MS_ColumnHidden	COLUMN	WATER_DEPTH	False
MS_ColumnOrder	COLUMN	WATER_DEPTH	7
MS_ColumnWidth	COLUMN	WATER_DEPTH	630
MS_TextAlign	COLUMN	WATER_DEPTH	0

Uses

[dbo].[tblEvents]
dbo

[dbo].[tblVegTransects]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblVegTransects

This table contains the data for the line intercept vegetation transects performed at each lake as part of the vegetation survey protocol.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	5088
Created	2:43:41 PM Friday, April 23, 2010
Last Modified	3:42:39 PM Friday, April 23, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Identity	Default
🔑	PONDVEGTRANSSPPID	int	4	✗	1 - 1	
🔑	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗		
🔑	SAMPLEDATE *The date and time of the sample; automatically populated when a new Sampling Event form is opened*	datetime	8	✗		
🔑	TRANSECT *Transect number*	int	4	✗		
	OBSERVERS *Initials of person performing the survey*	nvarchar(50)	100	✓		
	SPECIES *Plant species code (select from available species in the drop-down list or add a new species code)*	nvarchar(50)	100	✓		
	SPECIESSTART *Point (in cm) on transect tape where the species appears*	int	4	✓		
	SPECIESSTOP *Point (in cm) on transect tape where the species is no longer present*	int	4	✓		
	SPECIESDISTANCE *Distance in cm for this species record (calculated from SPECIESSTOP-SPECIESSTART using an UPDATE trigger)*	int	4	✓		
	VEGTRANSNOTES *Notes regarding the entry*	nvarchar(4000)	8000	✓		
	ESTDISTANCE *Set as true if the species distance was estimated after returning from the field (using photos, species extent in other transects, etc.), due to incomplete data entry.*	bit	1	✓		((0))
	EXCLUDE *Set as true if record should be excluded from data analysis*	bit	1	✓		((0))
	ANALYSIS_CODE *The species code to be used for analysis*	nvarchar(50)	100	✓		
	RecordInsertedDate	datetime	8	✓		(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓		
	RecordUpdatedDate	datetime	8	✓		(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓		

Indexes

	Name	Columns	Unique
	PK_tblPondVegTransSpp	PONDVEGTRANSSPPID, PONDNAME, SAMPLEDATE, TRANSECT	✓

Triggers

Name	ANSI Nulls On	Quoted Identifier On	On
tblVegTransects_OnUpdate	✓	✓	After Update
tblVegTransects_OnUpdateAnalysisCode	✓	✓	After Insert

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblVegTransSpp_tblEvents	✓	Cascade	Cascade	PONDNAME->[dbo].[tbl-Events].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Events].[SAMPLEDATE]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			(SPECIES In ("poaarc ","poaspp","poaspp "))
MS_FilterOnLoad			False
MS_FrozenColumns			4
MS_HideNewField			False
MS_OrderBy			[tblVeg-Transects].[PONDNAME], [tblVeg-Transects].[SAMPLEDATE], [tblVeg-Transects].[TRANSECT], [tbl-VegTransects].[ANALYSIS_-CODE], [tblVeg-Transects].[SPECIES], [tbl-Veg-Transects].[SPECIESSTART], [tblVeg-Transects].[SPECIESSTOP]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_RowHeight			300
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	ANALYSIS_CODE	-1
MS_AllowValueListEdits	COLUMN	ANALYSIS_CODE	False
MS_ColumnCount	COLUMN	ANALYSIS_CODE	3
MS_ColumnHidden	COLUMN	ANALYSIS_CODE	False
MS_ColumnOrder	COLUMN	ANALYSIS_CODE	7
MS_ColumnWidth	COLUMN	ANALYSIS_CODE	-1
MS_ColumnWidths	COLUMN	ANALYSIS_CODE	1440.000;1440.000;2880.000
MS_DisplayControl	COLUMN	ANALYSIS_CODE	111
MS_Format	COLUMN	ANALYSIS_CODE	
MS_IMEMode	COLUMN	ANALYSIS_CODE	0
MS_ListItemsEditForm	COLUMN	ANALYSIS_CODE	
MS_ListWidth	COLUMN	ANALYSIS_CODE	5760.000
MS_RowSource	COLUMN	ANALYSIS_CODE	SELECT ANALYSIS_CODE, SPECIES_CODE, SH_-LAKE_NAME FROM dbo.tlu-VegTaxa
MS_ShowOnlyRowSourceValues	COLUMN	ANALYSIS_CODE	False
MS_TextAlign	COLUMN	ANALYSIS_CODE	0
MS_AggregateType	COLUMN	ESTDISTANCE	-1
MS_ColumnHidden	COLUMN	ESTDISTANCE	False

MS_ColumnOrder	COLUMN	ESTDISTANCE	12
MS_ColumnWidth	COLUMN	ESTDISTANCE	-1
MS_DisplayControl	COLUMN	ESTDISTANCE	106
MS_Format	COLUMN	ESTDISTANCE	
MS_IMEMode	COLUMN	ESTDISTANCE	0
MS_TextAlign	COLUMN	ESTDISTANCE	0
MS_AggregateType	COLUMN	EXCLUDE	-1
MS_ColumnHidden	COLUMN	EXCLUDE	False
MS_ColumnOrder	COLUMN	EXCLUDE	13
MS_ColumnWidth	COLUMN	EXCLUDE	-1
MS_DisplayControl	COLUMN	EXCLUDE	106
MS_Format	COLUMN	EXCLUDE	
MS_IMEMode	COLUMN	EXCLUDE	0
MS_TextAlign	COLUMN	EXCLUDE	0
MS_AggregateType	COLUMN	OBSERVERS	-1
MS_ColumnHidden	COLUMN	OBSERVERS	False
MS_ColumnOrder	COLUMN	OBSERVERS	5
MS_ColumnWidth	COLUMN	OBSERVERS	705
MS_TextAlign	COLUMN	OBSERVERS	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	1
MS_ColumnWidth	COLUMN	PONDNAME	-1
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	PONDVEGTRANSSPPID	-1
MS_ColumnHidden	COLUMN	PONDVEGTRANSSPPID	True
MS_ColumnOrder	COLUMN	PONDVEGTRANSSPPID	4
MS_ColumnWidth	COLUMN	PONDVEGTRANSSPPID	-1
MS_TextAlign	COLUMN	PONDVEGTRANSSPPID	0
MS_AggregateType	COLUMN	RecordInsertedBy	-1
MS_ColumnHidden	COLUMN	RecordInsertedBy	False
MS_ColumnOrder	COLUMN	RecordInsertedBy	0
MS_ColumnWidth	COLUMN	RecordInsertedBy	-1
MS_TextAlign	COLUMN	RecordInsertedBy	0
MS_AggregateType	COLUMN	RecordInsertedDate	-1
MS_ColumnHidden	COLUMN	RecordInsertedDate	False
MS_ColumnOrder	COLUMN	RecordInsertedDate	0
MS_ColumnWidth	COLUMN	RecordInsertedDate	2280
MS_TextAlign	COLUMN	RecordInsertedDate	0
MS_AggregateType	COLUMN	RecordUpdatedBy	-1
MS_ColumnHidden	COLUMN	RecordUpdatedBy	False
MS_ColumnOrder	COLUMN	RecordUpdatedBy	0

MS_ColumnWidth	COLUMN	RecordUpdatedBy	-1
MS_TextAlign	COLUMN	RecordUpdatedBy	0
MS_AggregateType	COLUMN	RecordUpdatedDate	-1
MS_ColumnHidden	COLUMN	RecordUpdatedDate	False
MS_ColumnOrder	COLUMN	RecordUpdatedDate	0
MS_ColumnWidth	COLUMN	RecordUpdatedDate	2295
MS_TextAlign	COLUMN	RecordUpdatedDate	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	2
MS_ColumnWidth	COLUMN	SAMPLEDATE	-1
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SPECIES	-1
MS_AllowValueListEdits	COLUMN	SPECIES	False
MS_ColumnCount	COLUMN	SPECIES	3
MS_ColumnHeads	COLUMN	SPECIES	0
MS_ColumnHidden	COLUMN	SPECIES	False
MS_ColumnOrder	COLUMN	SPECIES	6
MS_ColumnWidth	COLUMN	SPECIES	3780
MS_ColumnWidths	COLUMN	SPECIES	1440.000;2880.000;2880.000
MS_DisplayControl	COLUMN	SPECIES	111
MS_ListItemsEditForm	COLUMN	SPECIES	
MS_ListRows	COLUMN	SPECIES	8
MS_ListWidth	COLUMN	SPECIES	7200.000
MS_RowSource	COLUMN	SPECIES	SELECT SPECIES_CODE, SH_LAKE_NAME, COMMON_NAME FROM dbo.tluVegTaxa
MS_RowSourceType	COLUMN	SPECIES	Tables/Views/Functions
MS_ShowOnlyRowSourceValues	COLUMN	SPECIES	False
MS_TextAlign	COLUMN	SPECIES	0
MS_AggregateType	COLUMN	SPECIESDISTANCE	-1
MS_ColumnHidden	COLUMN	SPECIESDISTANCE	False
MS_ColumnOrder	COLUMN	SPECIESDISTANCE	10
MS_ColumnWidth	COLUMN	SPECIESDISTANCE	-1
MS_DisplayControl	COLUMN	SPECIESDISTANCE	109
MS_Format	COLUMN	SPECIESDISTANCE	
MS_IMEMode	COLUMN	SPECIESDISTANCE	0
MS_TextAlign	COLUMN	SPECIESDISTANCE	0
MS_AggregateType	COLUMN	SPECIESSTART	-1
MS_ColumnHidden	COLUMN	SPECIESSTART	False
MS_ColumnOrder	COLUMN	SPECIESSTART	8
MS_ColumnWidth	COLUMN	SPECIESSTART	-1

MS_DisplayControl	COLUMN	SPECIESSTART	109
MS_Format	COLUMN	SPECIESSTART	
MS_IMEMode	COLUMN	SPECIESSTART	0
MS_TextAlign	COLUMN	SPECIESSTART	0
MS_AggregateType	COLUMN	SPECIESSTOP	-1
MS_ColumnHidden	COLUMN	SPECIESSTOP	False
MS_ColumnOrder	COLUMN	SPECIESSTOP	9
MS_ColumnWidth	COLUMN	SPECIESSTOP	-1
MS_DisplayControl	COLUMN	SPECIESSTOP	109
MS_Format	COLUMN	SPECIESSTOP	
MS_IMEMode	COLUMN	SPECIESSTOP	0
MS_TextAlign	COLUMN	SPECIESSTOP	0
MS_AggregateType	COLUMN	TRANSECT	-1
MS_ColumnHidden	COLUMN	TRANSECT	False
MS_ColumnOrder	COLUMN	TRANSECT	3
MS_ColumnWidth	COLUMN	TRANSECT	705
MS_TextAlign	COLUMN	TRANSECT	0
MS_AggregateType	COLUMN	VEGTRANSNOTES	-1
MS_ColumnHidden	COLUMN	VEGTRANSNOTES	False
MS_ColumnOrder	COLUMN	VEGTRANSNOTES	11
MS_ColumnWidth	COLUMN	VEGTRANSNOTES	5355
MS_DisplayControl	COLUMN	VEGTRANSNOTES	109
MS_Format	COLUMN	VEGTRANSNOTES	
MS_IMEMode	COLUMN	VEGTRANSNOTES	0
MS_TextAlign	COLUMN	VEGTRANSNOTES	0

Uses

[dbo].[tblEvents]
dbo

[dbo].[tblWaterChemistry]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblWaterChemistry

This table contains the data received from the lab, detailing the results of water chemistry analyses. Data is imported from spreadsheets received from the lab.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	939
Created	10:16:50 AM Wednesday, April 28, 2010
Last Modified	10:59:59 AM Wednesday, April 28, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	WaterChemistryID *A unique identifier automatically assigned to each record*	uniqueidentifier	16	✗	(newid())
	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗	
	SAMPLEDATE *The date and time of the sample; automatically populated when a new form is opened*	datetime	8	✗	
	SAMPLENUMBER *Alphabetic designation given when the sample is collected; start with "a" for the first sample taken, and label each sample consecutively*	nvarchar(50)	100	✗	
	CHEM_LAB *The laboratory performing the analysis of the water chemistry*	nvarchar(50)	100	✓	
	CHEM_METHOD *The laboratory method used for water chemistry analysis*	nvarchar(50)	100	✓	
	LAB_SAMPLE_NUMBER *The sample number assigned by the laboratory during analysis*	int	4	✓	
	LAB_DATE *The date the sample was analyzed in the lab*	datetime	8	✓	
	DUPLICATED_CHEM_ANALYSIS *Indicates if this was a duplicate analysis on the same sample, run as a laboratory check*	bit	1	✓	
	PH *pH measured by lab analysis*	float	8	✓	
	PH_Notes *Notes on the pH measurement*	nvarchar(50)	100	✓	
	PH_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	PH_MDL_LEVEL *Minimum Detection Level of lab analysis for pH*	float	8	✓	((0.1))
	TOTAL_ALKALINITY *Total Alkalinity, measured by lab analysis*	float	8	✓	
	TOTAL_ALKALINITY_Notes *Notes on the total alkalinity measurement*	nvarchar(50)	100	✓	
	ALKALINITY_MG_L *Alkalinity in mg/L, measured by lab analysis*	float	8	✓	
	ALKALINITY_MG_L_Notes *Notes on the alkalinity measurement*	nvarchar(255)	510	✓	
	ALK_MDL_YN *Enter True if below the Minimum Detection*	bit	1	✓	

	Level				
	ALK_MDL_LEVEL *Minimum Detection Level of lab analysis for alkalinity*	float	8	✓	((0.2))
	CONDUCTIVITY_AES *Conductivity in AES, measured by lab analysis*	float	8	✓	
	CONDUCTIVITY_AES_Notes *Notes on the alkalinity measurement*	nvarchar(255)	510	✓	
	COND_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	COND_MDL_LEVEL *Minimum Detection Level of lab analysis for conductivity*	float	8	✓	((0.4))
	TKN_MG_L *Total Kjeldahl Nitrogen, measured by lab analysis (NTL-AI lab analysis only)*	float	8	✓	
	TKN_Notes *Notes on the Total Kjeldahl Nitrogen measurement*	nvarchar(255)	510	✓	
	TKN_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	TKN_MDL_LEVEL *Minimum Detection Level of lab analysis for TKN*	float	8	✓	
	TN_MG_L *Total nitrogen in mg/L, measured by lab analysis. For data analyzed by NTL-AI, this is the sum of the values of TKN and NO3*	float	8	✓	
	TN_Notes *Notes on the total nitrogen measurement*	nvarchar(255)	510	✓	
	TN_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	TN_MDL_LEVEL *Minimum Detection Level of lab analysis for TN*	float	8	✓	((0.010))
	TP_MG_L *Total phosphorus in mg/L, measured by lab analysis*	float	8	✓	
	TP_Notes *Notes on the total phosphorus measurement*	nvarchar(255)	510	✓	
	TP_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	TP_MDL_LEVEL *Minimum Detection Level of lab analysis for TP*	float	8	✓	((0.002))
	PO4_P_MG_L *Phosphate in mg/L, measured by lab analysis*	float	8	✓	
	PO4_P_Notes *Notes on the phosphate measurement*	nvarchar(255)	510	✓	

	PO4_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	PO4_MDL_LEVEL *Minimum Detection Level of lab analysis for PO4*	float	8	✓	((0.001))
	NO3_N_MG_L *Nitrate in mg/L, measured by lab analysis*	float	8	✓	
	NO3_N_Notes *Notes on the nitrate measurement*	nvarchar(255)	510	✓	
	NO3_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	NO3_MDL_LEVEL *Minimum Detection Level of lab analysis for NO3*	float	8	✓	((0.001))
	NH3_N_MG_L *Ammonia in mg/L, measured by lab analysis*	float	8	✓	
	NH3_N_Notes *Notes on the ammonia measurement*	nvarchar(255)	510	✓	
	NH3_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	NH3_MDL_LEVEL *Minimum Detection Level of lab analysis for NH3*	float	8	✓	((0.005))
	SI_MG_L *Silica in mg/L, measured by lab analysis*	float	8	✓	
	SI_Notes *Notes on the silica measurement*	nvarchar(255)	510	✓	
	SI_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	SI_MDL_LEVEL *Minimum Detection Level of lab analysis for Si*	float	8	✓	((0.20))
	NA_MG_L *Sodium in mg/L, measured by lab analysis*	float	8	✓	
	NA_Notes *Notes on the sodium measurement*	nvarchar(255)	510	✓	
	NA_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	NA_MDL_LEVEL *Minimum Detection Level of lab analysis for Na*	float	8	✓	((0.01))
	K_MG_L *Potassium in mg/L, measured by lab analysis*	float	8	✓	
	K_Notes *Notes on the potassium measurement*	nvarchar(255)	510	✓	
	K_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	

	K_MDL_LEVEL *Minimum Detection Level of lab analysis for K*	float	8	✓	((0.03))
	CA_MG_L *Calcium in mg/L, measured by lab analysis*	float	8	✓	
	CA_Notes *Notes on the calcium measurement*	nvarchar(255)	510	✓	
	CA_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	CA_MDL_LEVEL *Minimum Detection Level of lab analysis for Ca*	float	8	✓	((0.06))
	MG_MG_L *Magnesium in mg/L, measured by lab analysis*	float	8	✓	
	MG_Notes *Notes on the magnesium measurement*	nvarchar(50)	100	✓	
	MG_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	MG_MDL_LEVEL *Minimum Detection Level of lab analysis for Mg*	float	8	✓	((0.02))
	SO4_S_MG_L *Sulfate in mg/L, measured by lab analysis*	float	8	✓	
	SO4_S_Notes *Notes on the sulfate measurement*	nvarchar(50)	100	✓	
	SO4_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	SO4_MDL_LEVEL *Minimum Detection Level of lab analysis for SO4*	float	8	✓	((0.02))
	CL_MG_L *Chloride in mg/L, measured by lab analysis*	float	8	✓	
	CL_Notes *Notes on the chloride measurement*	nvarchar(50)	100	✓	
	CL_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	CL_MDL_LEVEL *Minimum Detection Level of lab analysis for Cl*	float	8	✓	((0.01))
	DOC_MG_L *Dissolved Organic Carbin in mg/L, measured by lab analysis*	float	8	✓	
	DOC_Notes *Notes on the DOC measurement*	nvarchar(50)	100	✓	
	DOC_MDL_YN *Enter True if below the Minimum Detection Level*	bit	1	✓	
	DOC_MDL_LEVEL *Minimum Detection Level of lab analysis for DOC*	float	8	✓	((0.05))

	NOTES *General notes on the lab analysis of this sample*	nvarchar(4000)	8000	✓	
	COMMENTS *Comments on the condition of samples when received by the lab for anlysis*	nvarchar(4000)	8000	✓	
	SOURCE *The source database or file for the data in the record.*	nvarchar(50)	100	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name( ))
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name( ))
	RecordCertifiedDate	datetime	8	✓	
	RecordCertifiedBy	nvarchar(50)	100	✓	

Indexes

	Name	Columns	Unique
	PK_tblWaterChemistry	WaterChemistryID, PONDNAME, SAMPLEDATE, SAMPLENUMBER	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblWaterChemistry_tblWaterSamples	✓	Cascade	Cascade	PONDNAME->[dbo].[tbl-Water-Samples].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Water-Samples].[SAMPLEDATE] SAMPLENUMBER->[dbo].[tblWater-Samples].[SAMPLENUMBER]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			(SOURCE Is Null Or SOURCE="")
MS_FilterOnLoad			False
MS_FrozenColumns			4
MS_HideNewField			False
MS_OrderBy			[tblWater-Chemistry].[SAMPLEDATE], [tblWater-Chemistry].[PONDNAME], [tblWater-Chemistry].[SAMPLENUMBER]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	ALK_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	ALK_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	ALK_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	ALK_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	ALK_MDL_LEVEL	109
MS_Format	COLUMN	ALK_MDL_LEVEL	
MS_IMEMode	COLUMN	ALK_MDL_LEVEL	0
MS_TextAlign	COLUMN	ALK_MDL_LEVEL	0
MS_AggregateType	COLUMN	ALK_MDL_YN	-1
MS_ColumnHidden	COLUMN	ALK_MDL_YN	False
MS_ColumnOrder	COLUMN	ALK_MDL_YN	0
MS_ColumnWidth	COLUMN	ALK_MDL_YN	-1
MS_DisplayControl	COLUMN	ALK_MDL_YN	109
MS_Format	COLUMN	ALK_MDL_YN	
MS_IMEMode	COLUMN	ALK_MDL_YN	0
MS_TextAlign	COLUMN	ALK_MDL_YN	0
MS_AggregateType	COLUMN	ALKALINITY_MG_L	-1
MS_ColumnHidden	COLUMN	ALKALINITY_MG_L	False
MS_ColumnOrder	COLUMN	ALKALINITY_MG_L	0
MS_ColumnWidth	COLUMN	ALKALINITY_MG_L	705
MS_TextAlign	COLUMN	ALKALINITY_MG_L	0
MS_AggregateType	COLUMN	ALKALINITY_MG_L_Notes	-1
MS_ColumnHidden	COLUMN	ALKALINITY_MG_L_Notes	False
MS_ColumnOrder	COLUMN	ALKALINITY_MG_L_Notes	0

MS_ColumnWidth	COLUMN	ALKALINITY_MG_L_Notes	720
MS_TextAlign	COLUMN	ALKALINITY_MG_L_Notes	0
MS_AggregateType	COLUMN	CA_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	CA_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	CA_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	CA_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	CA_MDL_LEVEL	109
MS_Format	COLUMN	CA_MDL_LEVEL	
MS_IMEMode	COLUMN	CA_MDL_LEVEL	0
MS_TextAlign	COLUMN	CA_MDL_LEVEL	0
MS_AggregateType	COLUMN	CA_MDL_YN	-1
MS_ColumnHidden	COLUMN	CA_MDL_YN	False
MS_ColumnOrder	COLUMN	CA_MDL_YN	0
MS_ColumnWidth	COLUMN	CA_MDL_YN	-1
MS_DisplayControl	COLUMN	CA_MDL_YN	109
MS_Format	COLUMN	CA_MDL_YN	
MS_IMEMode	COLUMN	CA_MDL_YN	0
MS_TextAlign	COLUMN	CA_MDL_YN	0
MS_AggregateType	COLUMN	CA_MG_L	-1
MS_ColumnHidden	COLUMN	CA_MG_L	False
MS_ColumnOrder	COLUMN	CA_MG_L	0
MS_ColumnWidth	COLUMN	CA_MG_L	690
MS_TextAlign	COLUMN	CA_MG_L	0
MS_AggregateType	COLUMN	CA_Notes	-1
MS_ColumnHidden	COLUMN	CA_Notes	False
MS_ColumnOrder	COLUMN	CA_Notes	0
MS_ColumnWidth	COLUMN	CA_Notes	690
MS_TextAlign	COLUMN	CA_Notes	0
MS_AggregateType	COLUMN	CHEM_LAB	-1
MS_ColumnHidden	COLUMN	CHEM_LAB	False
MS_ColumnOrder	COLUMN	CHEM_LAB	5
MS_ColumnWidth	COLUMN	CHEM_LAB	825
MS_DisplayControl	COLUMN	CHEM_LAB	109
MS_Format	COLUMN	CHEM_LAB	
MS_IMEMode	COLUMN	CHEM_LAB	0
MS_TextAlign	COLUMN	CHEM_LAB	0
MS_AggregateType	COLUMN	CHEM_METHOD	-1
MS_ColumnHidden	COLUMN	CHEM_METHOD	False
MS_ColumnOrder	COLUMN	CHEM_METHOD	6
MS_ColumnWidth	COLUMN	CHEM_METHOD	195
MS_TextAlign	COLUMN	CHEM_METHOD	0
MS_AggregateType	COLUMN	CL_MDL_LEVEL	-1

MS_ColumnHidden	COLUMN	CL_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	CL_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	CL_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	CL_MDL_LEVEL	109
MS_Format	COLUMN	CL_MDL_LEVEL	
MS_IMEMode	COLUMN	CL_MDL_LEVEL	0
MS_TextAlign	COLUMN	CL_MDL_LEVEL	0
MS_AggregateType	COLUMN	CL_MDL_YN	-1
MS_ColumnHidden	COLUMN	CL_MDL_YN	False
MS_ColumnOrder	COLUMN	CL_MDL_YN	0
MS_ColumnWidth	COLUMN	CL_MDL_YN	-1
MS_DisplayControl	COLUMN	CL_MDL_YN	109
MS_Format	COLUMN	CL_MDL_YN	
MS_IMEMode	COLUMN	CL_MDL_YN	0
MS_TextAlign	COLUMN	CL_MDL_YN	0
MS_AggregateType	COLUMN	CL_MG_L	-1
MS_ColumnHidden	COLUMN	CL_MG_L	False
MS_ColumnOrder	COLUMN	CL_MG_L	0
MS_ColumnWidth	COLUMN	CL_MG_L	870
MS_TextAlign	COLUMN	CL_MG_L	0
MS_AggregateType	COLUMN	CL_Notes	-1
MS_ColumnHidden	COLUMN	CL_Notes	False
MS_ColumnOrder	COLUMN	CL_Notes	0
MS_ColumnWidth	COLUMN	CL_Notes	870
MS_TextAlign	COLUMN	CL_Notes	0
MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	0
MS_ColumnWidth	COLUMN	COMMENTS	6225
MS_TextAlign	COLUMN	COMMENTS	0
MS_AggregateType	COLUMN	COND_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	COND_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	COND_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	COND_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	COND_MDL_LEVEL	109
MS_Format	COLUMN	COND_MDL_LEVEL	
MS_IMEMode	COLUMN	COND_MDL_LEVEL	0
MS_TextAlign	COLUMN	COND_MDL_LEVEL	0
MS_AggregateType	COLUMN	COND_MDL_YN	-1
MS_ColumnHidden	COLUMN	COND_MDL_YN	False
MS_ColumnOrder	COLUMN	COND_MDL_YN	0
MS_ColumnWidth	COLUMN	COND_MDL_YN	-1

MS_DisplayControl	COLUMN	COND_MDL_YN	109
MS_Format	COLUMN	COND_MDL_YN	
MS_IMEMode	COLUMN	COND_MDL_YN	0
MS_TextAlign	COLUMN	COND_MDL_YN	0
MS_AggregateType	COLUMN	CONDUCTIVITY_AES	-1
MS_ColumnHidden	COLUMN	CONDUCTIVITY_AES	False
MS_ColumnOrder	COLUMN	CONDUCTIVITY_AES	0
MS_ColumnWidth	COLUMN	CONDUCTIVITY_AES	615
MS_TextAlign	COLUMN	CONDUCTIVITY_AES	0
MS_AggregateType	COLUMN	CONDUCTIVITY_AES_Notes	-1
MS_ColumnHidden	COLUMN	CONDUCTIVITY_AES_Notes	False
MS_ColumnOrder	COLUMN	CONDUCTIVITY_AES_Notes	0
MS_ColumnWidth	COLUMN	CONDUCTIVITY_AES_Notes	690
MS_TextAlign	COLUMN	CONDUCTIVITY_AES_Notes	0
MS_AggregateType	COLUMN	DOC_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	DOC_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	DOC_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	DOC_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	DOC_MDL_LEVEL	109
MS_Format	COLUMN	DOC_MDL_LEVEL	
MS_IMEMode	COLUMN	DOC_MDL_LEVEL	0
MS_TextAlign	COLUMN	DOC_MDL_LEVEL	0
MS_AggregateType	COLUMN	DOC_MDL_YN	-1
MS_ColumnHidden	COLUMN	DOC_MDL_YN	False
MS_ColumnOrder	COLUMN	DOC_MDL_YN	0
MS_ColumnWidth	COLUMN	DOC_MDL_YN	-1
MS_DisplayControl	COLUMN	DOC_MDL_YN	109
MS_Format	COLUMN	DOC_MDL_YN	
MS_IMEMode	COLUMN	DOC_MDL_YN	0
MS_TextAlign	COLUMN	DOC_MDL_YN	0
MS_AggregateType	COLUMN	DOC_MG_L	-1
MS_ColumnHidden	COLUMN	DOC_MG_L	False
MS_ColumnOrder	COLUMN	DOC_MG_L	0
MS_ColumnWidth	COLUMN	DOC_MG_L	870
MS_TextAlign	COLUMN	DOC_MG_L	0
MS_AggregateType	COLUMN	DOC_Notes	-1
MS_ColumnHidden	COLUMN	DOC_Notes	False
MS_ColumnOrder	COLUMN	DOC_Notes	0
MS_ColumnWidth	COLUMN	DOC_Notes	870
MS_TextAlign	COLUMN	DOC_Notes	0
MS_AggregateType	COLUMN	DUPLICATED_CHEM_-ANALYSIS	-1

MS_ColumnHidden	COLUMN	DUPLICATED_CHEM_-ANALYSIS	False
MS_ColumnOrder	COLUMN	DUPLICATED_CHEM_-ANALYSIS	9
MS_ColumnWidth	COLUMN	DUPLICATED_CHEM_-ANALYSIS	810
MS_DisplayControl	COLUMN	DUPLICATED_CHEM_-ANALYSIS	109
MS_TextAlign	COLUMN	DUPLICATED_CHEM_-ANALYSIS	0
MS_AggregateType	COLUMN	K_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	K_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	K_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	K_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	K_MDL_LEVEL	109
MS_Format	COLUMN	K_MDL_LEVEL	
MS_IMEMode	COLUMN	K_MDL_LEVEL	0
MS_TextAlign	COLUMN	K_MDL_LEVEL	0
MS_AggregateType	COLUMN	K_MDL_YN	-1
MS_ColumnHidden	COLUMN	K_MDL_YN	False
MS_ColumnOrder	COLUMN	K_MDL_YN	0
MS_ColumnWidth	COLUMN	K_MDL_YN	-1
MS_DisplayControl	COLUMN	K_MDL_YN	109
MS_Format	COLUMN	K_MDL_YN	
MS_IMEMode	COLUMN	K_MDL_YN	0
MS_TextAlign	COLUMN	K_MDL_YN	0
MS_AggregateType	COLUMN	K_MG_L	-1
MS_ColumnHidden	COLUMN	K_MG_L	False
MS_ColumnOrder	COLUMN	K_MG_L	0
MS_ColumnWidth	COLUMN	K_MG_L	690
MS_TextAlign	COLUMN	K_MG_L	0
MS_AggregateType	COLUMN	K_Notes	-1
MS_ColumnHidden	COLUMN	K_Notes	False
MS_ColumnOrder	COLUMN	K_Notes	0
MS_ColumnWidth	COLUMN	K_Notes	690
MS_TextAlign	COLUMN	K_Notes	0
MS_AggregateType	COLUMN	LAB_DATE	-1
MS_ColumnHidden	COLUMN	LAB_DATE	False
MS_ColumnOrder	COLUMN	LAB_DATE	8
MS_ColumnWidth	COLUMN	LAB_DATE	1230
MS_TextAlign	COLUMN	LAB_DATE	0
MS_AggregateType	COLUMN	LAB_SAMPLE_NUMBER	-1
MS_ColumnHidden	COLUMN	LAB_SAMPLE_NUMBER	False
MS_ColumnOrder	COLUMN	LAB_SAMPLE_NUMBER	7

MS_ColumnWidth	COLUMN	LAB_SAMPLE_NUMBER	570
MS_TextAlign	COLUMN	LAB_SAMPLE_NUMBER	0
MS_AggregateType	COLUMN	MG_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	MG_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	MG_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	MG_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	MG_MDL_LEVEL	109
MS_Format	COLUMN	MG_MDL_LEVEL	
MS_IMEMode	COLUMN	MG_MDL_LEVEL	0
MS_TextAlign	COLUMN	MG_MDL_LEVEL	0
MS_AggregateType	COLUMN	MG_MDL_YN	-1
MS_ColumnHidden	COLUMN	MG_MDL_YN	False
MS_ColumnOrder	COLUMN	MG_MDL_YN	0
MS_ColumnWidth	COLUMN	MG_MDL_YN	-1
MS_DisplayControl	COLUMN	MG_MDL_YN	109
MS_Format	COLUMN	MG_MDL_YN	
MS_IMEMode	COLUMN	MG_MDL_YN	0
MS_TextAlign	COLUMN	MG_MDL_YN	0
MS_AggregateType	COLUMN	MG_MG_L	-1
MS_ColumnHidden	COLUMN	MG_MG_L	False
MS_ColumnOrder	COLUMN	MG_MG_L	0
MS_ColumnWidth	COLUMN	MG_MG_L	870
MS_TextAlign	COLUMN	MG_MG_L	0
MS_AggregateType	COLUMN	MG_Notes	-1
MS_ColumnHidden	COLUMN	MG_Notes	False
MS_ColumnOrder	COLUMN	MG_Notes	0
MS_ColumnWidth	COLUMN	MG_Notes	870
MS_TextAlign	COLUMN	MG_Notes	0
MS_AggregateType	COLUMN	NA_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	NA_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	NA_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	NA_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	NA_MDL_LEVEL	109
MS_Format	COLUMN	NA_MDL_LEVEL	
MS_IMEMode	COLUMN	NA_MDL_LEVEL	0
MS_TextAlign	COLUMN	NA_MDL_LEVEL	0
MS_AggregateType	COLUMN	NA_MDL_YN	-1
MS_ColumnHidden	COLUMN	NA_MDL_YN	False
MS_ColumnOrder	COLUMN	NA_MDL_YN	0
MS_ColumnWidth	COLUMN	NA_MDL_YN	-1
MS_DisplayControl	COLUMN	NA_MDL_YN	109
MS_Format	COLUMN	NA_MDL_YN	

MS_IMEMode	COLUMN	NA_MDL_YN	0
MS_TextAlign	COLUMN	NA_MDL_YN	0
MS_AggregateType	COLUMN	NA_MG_L	-1
MS_ColumnHidden	COLUMN	NA_MG_L	False
MS_ColumnOrder	COLUMN	NA_MG_L	0
MS_ColumnWidth	COLUMN	NA_MG_L	690
MS_TextAlign	COLUMN	NA_MG_L	0
MS_AggregateType	COLUMN	NA_Notes	-1
MS_ColumnHidden	COLUMN	NA_Notes	False
MS_ColumnOrder	COLUMN	NA_Notes	0
MS_ColumnWidth	COLUMN	NA_Notes	690
MS_TextAlign	COLUMN	NA_Notes	0
MS_AggregateType	COLUMN	NH3_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	NH3_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	NH3_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	NH3_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	NH3_MDL_LEVEL	109
MS_Format	COLUMN	NH3_MDL_LEVEL	
MS_IMEMode	COLUMN	NH3_MDL_LEVEL	0
MS_TextAlign	COLUMN	NH3_MDL_LEVEL	0
MS_AggregateType	COLUMN	NH3_MDL_YN	-1
MS_ColumnHidden	COLUMN	NH3_MDL_YN	False
MS_ColumnOrder	COLUMN	NH3_MDL_YN	0
MS_ColumnWidth	COLUMN	NH3_MDL_YN	780
MS_DisplayControl	COLUMN	NH3_MDL_YN	109
MS_Format	COLUMN	NH3_MDL_YN	
MS_IMEMode	COLUMN	NH3_MDL_YN	0
MS_TextAlign	COLUMN	NH3_MDL_YN	0
MS_AggregateType	COLUMN	NH3_N_MG_L	-1
MS_AllowValueListEdits	COLUMN	NH3_N_MG_L	False
MS_ColumnHidden	COLUMN	NH3_N_MG_L	False
MS_ColumnOrder	COLUMN	NH3_N_MG_L	0
MS_ColumnWidth	COLUMN	NH3_N_MG_L	660
MS_DisplayControl	COLUMN	NH3_N_MG_L	110
MS_ListItemsEditForm	COLUMN	NH3_N_MG_L	
MS_RowSource	COLUMN	NH3_N_MG_L	-99999
MS_RowSourceType	COLUMN	NH3_N_MG_L	Value List
MS_ShowOnlyRowSourceValues	COLUMN	NH3_N_MG_L	False
MS_TextAlign	COLUMN	NH3_N_MG_L	0
MS_AggregateType	COLUMN	NH3_N_Notes	-1
MS_ColumnHidden	COLUMN	NH3_N_Notes	False
MS_ColumnOrder	COLUMN	NH3_N_Notes	0

MS_ColumnWidth	COLUMN	NH3_N_Notes	825
MS_TextAlign	COLUMN	NH3_N_Notes	0
MS_AggregateType	COLUMN	NO3_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	NO3_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	NO3_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	NO3_MDL_LEVEL	660
MS_DisplayControl	COLUMN	NO3_MDL_LEVEL	109
MS_Format	COLUMN	NO3_MDL_LEVEL	
MS_IMEMode	COLUMN	NO3_MDL_LEVEL	0
MS_TextAlign	COLUMN	NO3_MDL_LEVEL	0
MS_AggregateType	COLUMN	NO3_MDL_YN	-1
MS_ColumnHidden	COLUMN	NO3_MDL_YN	False
MS_ColumnOrder	COLUMN	NO3_MDL_YN	0
MS_ColumnWidth	COLUMN	NO3_MDL_YN	660
MS_DisplayControl	COLUMN	NO3_MDL_YN	109
MS_Format	COLUMN	NO3_MDL_YN	
MS_IMEMode	COLUMN	NO3_MDL_YN	0
MS_TextAlign	COLUMN	NO3_MDL_YN	0
MS_AggregateType	COLUMN	NO3_N_MG_L	-1
MS_AllowValueListEdits	COLUMN	NO3_N_MG_L	False
MS_ColumnHidden	COLUMN	NO3_N_MG_L	False
MS_ColumnOrder	COLUMN	NO3_N_MG_L	0
MS_ColumnWidth	COLUMN	NO3_N_MG_L	870
MS_DisplayControl	COLUMN	NO3_N_MG_L	110
MS_ListItemsEditForm	COLUMN	NO3_N_MG_L	
MS_RowSource	COLUMN	NO3_N_MG_L	-99999;0.001
MS_RowSourceType	COLUMN	NO3_N_MG_L	Value List
MS_ShowOnlyRowSourceValues	COLUMN	NO3_N_MG_L	False
MS_TextAlign	COLUMN	NO3_N_MG_L	0
MS_AggregateType	COLUMN	NO3_N_Notes	-1
MS_ColumnHidden	COLUMN	NO3_N_Notes	False
MS_ColumnOrder	COLUMN	NO3_N_Notes	0
MS_ColumnWidth	COLUMN	NO3_N_Notes	870
MS_TextAlign	COLUMN	NO3_N_Notes	0
MS_AggregateType	COLUMN	NOTES	-1
MS_ColumnHidden	COLUMN	NOTES	False
MS_ColumnOrder	COLUMN	NOTES	0
MS_ColumnWidth	COLUMN	NOTES	11655
MS_DisplayControl	COLUMN	NOTES	109
MS_Format	COLUMN	NOTES	
MS_IMEMode	COLUMN	NOTES	0
MS_TextAlign	COLUMN	NOTES	0

MS_AggregateType	COLUMN	PH	-1
MS_ColumnHidden	COLUMN	PH	False
MS_ColumnOrder	COLUMN	PH	10
MS_ColumnWidth	COLUMN	PH	675
MS_TextAlign	COLUMN	PH	0
MS_AggregateType	COLUMN	PH_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	PH_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	PH_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	PH_MDL_LEVEL	1815
MS_DisplayControl	COLUMN	PH_MDL_LEVEL	109
MS_Format	COLUMN	PH_MDL_LEVEL	
MS_IMEMode	COLUMN	PH_MDL_LEVEL	0
MS_TextAlign	COLUMN	PH_MDL_LEVEL	0
MS_AggregateType	COLUMN	PH_MDL_YN	-1
MS_ColumnHidden	COLUMN	PH_MDL_YN	False
MS_ColumnOrder	COLUMN	PH_MDL_YN	0
MS_ColumnWidth	COLUMN	PH_MDL_YN	-1
MS_DisplayControl	COLUMN	PH_MDL_YN	109
MS_Format	COLUMN	PH_MDL_YN	
MS_IMEMode	COLUMN	PH_MDL_YN	0
MS_TextAlign	COLUMN	PH_MDL_YN	0
MS_AggregateType	COLUMN	PH_Notes	-1
MS_ColumnHidden	COLUMN	PH_Notes	False
MS_ColumnOrder	COLUMN	PH_Notes	11
MS_ColumnWidth	COLUMN	PH_Notes	675
MS_TextAlign	COLUMN	PH_Notes	0
MS_AggregateType	COLUMN	PO4_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	PO4_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	PO4_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	PO4_MDL_LEVEL	690
MS_DisplayControl	COLUMN	PO4_MDL_LEVEL	109
MS_Format	COLUMN	PO4_MDL_LEVEL	
MS_IMEMode	COLUMN	PO4_MDL_LEVEL	0
MS_TextAlign	COLUMN	PO4_MDL_LEVEL	0
MS_AggregateType	COLUMN	PO4_MDL_YN	-1
MS_ColumnHidden	COLUMN	PO4_MDL_YN	False
MS_ColumnOrder	COLUMN	PO4_MDL_YN	0
MS_ColumnWidth	COLUMN	PO4_MDL_YN	690
MS_DisplayControl	COLUMN	PO4_MDL_YN	109
MS_Format	COLUMN	PO4_MDL_YN	
MS_IMEMode	COLUMN	PO4_MDL_YN	0
MS_TextAlign	COLUMN	PO4_MDL_YN	0

MS_AggregateType	COLUMN	PO4_P_MG_L	-1
MS_AllowValueListEdits	COLUMN	PO4_P_MG_L	False
MS_ColumnHidden	COLUMN	PO4_P_MG_L	False
MS_ColumnOrder	COLUMN	PO4_P_MG_L	0
MS_ColumnWidth	COLUMN	PO4_P_MG_L	690
MS_DisplayControl	COLUMN	PO4_P_MG_L	110
MS_ListItemsEditForm	COLUMN	PO4_P_MG_L	
MS_RowSource	COLUMN	PO4_P_MG_L	-99999
MS_RowSourceType	COLUMN	PO4_P_MG_L	Value List
MS_ShowOnlyRowSourceValues	COLUMN	PO4_P_MG_L	False
MS_TextAlign	COLUMN	PO4_P_MG_L	0
MS_AggregateType	COLUMN	PO4_P_Notes	-1
MS_ColumnHidden	COLUMN	PO4_P_Notes	False
MS_ColumnOrder	COLUMN	PO4_P_Notes	0
MS_ColumnWidth	COLUMN	PO4_P_Notes	900
MS_TextAlign	COLUMN	PO4_P_Notes	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	1
MS_ColumnWidth	COLUMN	PONDNAME	1260
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	RecordCertifiedBy	-1
MS_ColumnHidden	COLUMN	RecordCertifiedBy	False
MS_ColumnOrder	COLUMN	RecordCertifiedBy	0
MS_ColumnWidth	COLUMN	RecordCertifiedBy	-1
MS_TextAlign	COLUMN	RecordCertifiedBy	0
MS_AggregateType	COLUMN	RecordCertifiedDate	-1
MS_ColumnHidden	COLUMN	RecordCertifiedDate	False
MS_ColumnOrder	COLUMN	RecordCertifiedDate	0
MS_ColumnWidth	COLUMN	RecordCertifiedDate	-1
MS_TextAlign	COLUMN	RecordCertifiedDate	0
MS_AggregateType	COLUMN	RecordInsertedBy	-1
MS_ColumnHidden	COLUMN	RecordInsertedBy	False
MS_ColumnOrder	COLUMN	RecordInsertedBy	0
MS_ColumnWidth	COLUMN	RecordInsertedBy	-1
MS_TextAlign	COLUMN	RecordInsertedBy	0
MS_AggregateType	COLUMN	RecordInsertedDate	-1
MS_ColumnHidden	COLUMN	RecordInsertedDate	False
MS_ColumnOrder	COLUMN	RecordInsertedDate	0
MS_ColumnWidth	COLUMN	RecordInsertedDate	-1
MS_TextAlign	COLUMN	RecordInsertedDate	0
MS_AggregateType	COLUMN	RecordUpdatedBy	-1

MS_ColumnHidden	COLUMN	RecordUpdatedBy	False
MS_ColumnOrder	COLUMN	RecordUpdatedBy	0
MS_ColumnWidth	COLUMN	RecordUpdatedBy	-1
MS_TextAlign	COLUMN	RecordUpdatedBy	0
MS_AggregateType	COLUMN	RecordUpdatedDate	-1
MS_ColumnHidden	COLUMN	RecordUpdatedDate	False
MS_ColumnOrder	COLUMN	RecordUpdatedDate	0
MS_ColumnWidth	COLUMN	RecordUpdatedDate	-1
MS_TextAlign	COLUMN	RecordUpdatedDate	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	2
MS_ColumnWidth	COLUMN	SAMPLEDATE	1125
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SAMPLENUMBER	-1
MS_ColumnHidden	COLUMN	SAMPLENUMBER	False
MS_ColumnOrder	COLUMN	SAMPLENUMBER	3
MS_ColumnWidth	COLUMN	SAMPLENUMBER	510
MS_Format	COLUMN	SAMPLENUMBER	>
MS_TextAlign	COLUMN	SAMPLENUMBER	0
MS_AggregateType	COLUMN	SI_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	SI_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	SI_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	SI_MDL_LEVEL	690
MS_DisplayControl	COLUMN	SI_MDL_LEVEL	109
MS_Format	COLUMN	SI_MDL_LEVEL	
MS_IMEMode	COLUMN	SI_MDL_LEVEL	0
MS_TextAlign	COLUMN	SI_MDL_LEVEL	0
MS_AggregateType	COLUMN	SI_MDL_YN	-1
MS_ColumnHidden	COLUMN	SI_MDL_YN	False
MS_ColumnOrder	COLUMN	SI_MDL_YN	0
MS_ColumnWidth	COLUMN	SI_MDL_YN	690
MS_DisplayControl	COLUMN	SI_MDL_YN	109
MS_Format	COLUMN	SI_MDL_YN	
MS_IMEMode	COLUMN	SI_MDL_YN	0
MS_TextAlign	COLUMN	SI_MDL_YN	0
MS_AggregateType	COLUMN	SI_MG_L	-1
MS_AllowValueListEdits	COLUMN	SI_MG_L	False
MS_ColumnHidden	COLUMN	SI_MG_L	False
MS_ColumnOrder	COLUMN	SI_MG_L	0
MS_ColumnWidth	COLUMN	SI_MG_L	690
MS_DisplayControl	COLUMN	SI_MG_L	110

MS_ListItemsEditForm	COLUMN	SI_MG_L	
MS_RowSource	COLUMN	SI_MG_L	-99999
MS_RowSourceType	COLUMN	SI_MG_L	Value List
MS_ShowOnlyRowSourceValues	COLUMN	SI_MG_L	False
MS_TextAlign	COLUMN	SI_MG_L	0
MS_AggregateType	COLUMN	SI_Notes	-1
MS_ColumnHidden	COLUMN	SI_Notes	False
MS_ColumnOrder	COLUMN	SI_Notes	0
MS_ColumnWidth	COLUMN	SI_Notes	690
MS_TextAlign	COLUMN	SI_Notes	0
MS_AggregateType	COLUMN	SO4_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	SO4_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	SO4_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	SO4_MDL_LEVEL	-1
MS_DisplayControl	COLUMN	SO4_MDL_LEVEL	109
MS_Format	COLUMN	SO4_MDL_LEVEL	
MS_IMEMode	COLUMN	SO4_MDL_LEVEL	0
MS_TextAlign	COLUMN	SO4_MDL_LEVEL	0
MS_AggregateType	COLUMN	SO4_MDL_YN	-1
MS_ColumnHidden	COLUMN	SO4_MDL_YN	False
MS_ColumnOrder	COLUMN	SO4_MDL_YN	0
MS_ColumnWidth	COLUMN	SO4_MDL_YN	-1
MS_DisplayControl	COLUMN	SO4_MDL_YN	109
MS_Format	COLUMN	SO4_MDL_YN	
MS_IMEMode	COLUMN	SO4_MDL_YN	0
MS_TextAlign	COLUMN	SO4_MDL_YN	0
MS_AggregateType	COLUMN	SO4_S_MG_L	-1
MS_ColumnHidden	COLUMN	SO4_S_MG_L	False
MS_ColumnOrder	COLUMN	SO4_S_MG_L	0
MS_ColumnWidth	COLUMN	SO4_S_MG_L	870
MS_TextAlign	COLUMN	SO4_S_MG_L	0
MS_AggregateType	COLUMN	SO4_S_Notes	-1
MS_ColumnHidden	COLUMN	SO4_S_Notes	False
MS_ColumnOrder	COLUMN	SO4_S_Notes	0
MS_ColumnWidth	COLUMN	SO4_S_Notes	870
MS_TextAlign	COLUMN	SO4_S_Notes	0
MS_AggregateType	COLUMN	SOURCE	-1
MS_ColumnHidden	COLUMN	SOURCE	False
MS_ColumnOrder	COLUMN	SOURCE	0
MS_ColumnWidth	COLUMN	SOURCE	4275
MS_TextAlign	COLUMN	SOURCE	0
MS_AggregateType	COLUMN	TKN_MDL_LEVEL	-1

MS_ColumnHidden	COLUMN	TKN_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	TKN_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	TKN_MDL_LEVEL	690
MS_DisplayControl	COLUMN	TKN_MDL_LEVEL	109
MS_Format	COLUMN	TKN_MDL_LEVEL	
MS_IMEMode	COLUMN	TKN_MDL_LEVEL	0
MS_TextAlign	COLUMN	TKN_MDL_LEVEL	0
MS_AggregateType	COLUMN	TKN_MDL_YN	-1
MS_ColumnHidden	COLUMN	TKN_MDL_YN	False
MS_ColumnOrder	COLUMN	TKN_MDL_YN	0
MS_ColumnWidth	COLUMN	TKN_MDL_YN	690
MS_DisplayControl	COLUMN	TKN_MDL_YN	109
MS_Format	COLUMN	TKN_MDL_YN	
MS_IMEMode	COLUMN	TKN_MDL_YN	0
MS_TextAlign	COLUMN	TKN_MDL_YN	0
MS_AggregateType	COLUMN	TKN_MG_L	-1
MS_AllowValueListEdits	COLUMN	TKN_MG_L	False
MS_ColumnHidden	COLUMN	TKN_MG_L	False
MS_ColumnOrder	COLUMN	TKN_MG_L	0
MS_ColumnWidth	COLUMN	TKN_MG_L	690
MS_DisplayControl	COLUMN	TKN_MG_L	110
MS_ListItemsEditForm	COLUMN	TKN_MG_L	
MS_RowSource	COLUMN	TKN_MG_L	-99999
MS_RowSourceType	COLUMN	TKN_MG_L	Value List
MS_ShowOnlyRowSourceValues	COLUMN	TKN_MG_L	False
MS_TextAlign	COLUMN	TKN_MG_L	0
MS_AggregateType	COLUMN	TKN_Notes	-1
MS_ColumnHidden	COLUMN	TKN_Notes	False
MS_ColumnOrder	COLUMN	TKN_Notes	0
MS_ColumnWidth	COLUMN	TKN_Notes	690
MS_TextAlign	COLUMN	TKN_Notes	0
MS_AggregateType	COLUMN	TN_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	TN_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	TN_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	TN_MDL_LEVEL	690
MS_DisplayControl	COLUMN	TN_MDL_LEVEL	109
MS_Format	COLUMN	TN_MDL_LEVEL	
MS_IMEMode	COLUMN	TN_MDL_LEVEL	0
MS_TextAlign	COLUMN	TN_MDL_LEVEL	0
MS_AggregateType	COLUMN	TN_MDL_YN	-1
MS_ColumnHidden	COLUMN	TN_MDL_YN	False
MS_ColumnOrder	COLUMN	TN_MDL_YN	0

MS_ColumnWidth	COLUMN	TN_MDL_YN	600
MS_DisplayControl	COLUMN	TN_MDL_YN	109
MS_Format	COLUMN	TN_MDL_YN	
MS_IMEMode	COLUMN	TN_MDL_YN	0
MS_TextAlign	COLUMN	TN_MDL_YN	0
MS_AggregateType	COLUMN	TN_MG_L	-1
MS_AllowValueListEdits	COLUMN	TN_MG_L	False
MS_ColumnHidden	COLUMN	TN_MG_L	False
MS_ColumnOrder	COLUMN	TN_MG_L	0
MS_ColumnWidth	COLUMN	TN_MG_L	1335
MS_DisplayControl	COLUMN	TN_MG_L	110
MS_ListItemsEditForm	COLUMN	TN_MG_L	
MS_RowSource	COLUMN	TN_MG_L	-99999
MS_RowSourceType	COLUMN	TN_MG_L	Value List
MS_ShowOnlyRowSourceValues	COLUMN	TN_MG_L	False
MS_TextAlign	COLUMN	TN_MG_L	0
MS_AggregateType	COLUMN	TN_Notes	-1
MS_ColumnHidden	COLUMN	TN_Notes	False
MS_ColumnOrder	COLUMN	TN_Notes	0
MS_ColumnWidth	COLUMN	TN_Notes	600
MS_TextAlign	COLUMN	TN_Notes	0
MS_AggregateType	COLUMN	TOTAL_ALKALINITY	-1
MS_ColumnHidden	COLUMN	TOTAL_ALKALINITY	False
MS_ColumnOrder	COLUMN	TOTAL_ALKALINITY	0
MS_ColumnWidth	COLUMN	TOTAL_ALKALINITY	-1
MS_DisplayControl	COLUMN	TOTAL_ALKALINITY	109
MS_Format	COLUMN	TOTAL_ALKALINITY	
MS_IMEMode	COLUMN	TOTAL_ALKALINITY	0
MS_TextAlign	COLUMN	TOTAL_ALKALINITY	0
MS_AggregateType	COLUMN	TOTAL_ALKALINITY_Notes	-1
MS_ColumnHidden	COLUMN	TOTAL_ALKALINITY_Notes	False
MS_ColumnOrder	COLUMN	TOTAL_ALKALINITY_Notes	0
MS_ColumnWidth	COLUMN	TOTAL_ALKALINITY_Notes	2820
MS_DisplayControl	COLUMN	TOTAL_ALKALINITY_Notes	109
MS_Format	COLUMN	TOTAL_ALKALINITY_Notes	
MS_IMEMode	COLUMN	TOTAL_ALKALINITY_Notes	0
MS_TextAlign	COLUMN	TOTAL_ALKALINITY_Notes	0
MS_AggregateType	COLUMN	TP_MDL_LEVEL	-1
MS_ColumnHidden	COLUMN	TP_MDL_LEVEL	False
MS_ColumnOrder	COLUMN	TP_MDL_LEVEL	0
MS_ColumnWidth	COLUMN	TP_MDL_LEVEL	690
MS_DisplayControl	COLUMN	TP_MDL_LEVEL	109

MS_Format	COLUMN	TP_MDL_LEVEL	
MS_IMEMode	COLUMN	TP_MDL_LEVEL	0
MS_TextAlign	COLUMN	TP_MDL_LEVEL	0
MS_AggregateType	COLUMN	TP_MDL_YN	-1
MS_ColumnHidden	COLUMN	TP_MDL_YN	False
MS_ColumnOrder	COLUMN	TP_MDL_YN	0
MS_ColumnWidth	COLUMN	TP_MDL_YN	690
MS_DisplayControl	COLUMN	TP_MDL_YN	109
MS_Format	COLUMN	TP_MDL_YN	
MS_IMEMode	COLUMN	TP_MDL_YN	0
MS_TextAlign	COLUMN	TP_MDL_YN	0
MS_AggregateType	COLUMN	TP_MG_L	-1
MS_AllowValueListEdits	COLUMN	TP_MG_L	False
MS_ColumnHidden	COLUMN	TP_MG_L	False
MS_ColumnOrder	COLUMN	TP_MG_L	0
MS_ColumnWidth	COLUMN	TP_MG_L	690
MS_DisplayControl	COLUMN	TP_MG_L	110
MS_ListItemsEditForm	COLUMN	TP_MG_L	
MS_RowSource	COLUMN	TP_MG_L	-99999
MS_RowSourceType	COLUMN	TP_MG_L	Value List
MS_ShowOnlyRowSourceValues	COLUMN	TP_MG_L	False
MS_TextAlign	COLUMN	TP_MG_L	0
MS_AggregateType	COLUMN	TP_Notes	-1
MS_ColumnHidden	COLUMN	TP_Notes	False
MS_ColumnOrder	COLUMN	TP_Notes	0
MS_ColumnWidth	COLUMN	TP_Notes	690
MS_TextAlign	COLUMN	TP_Notes	0
MS_AggregateType	COLUMN	WaterChemistryID	-1
MS_ColumnHidden	COLUMN	WaterChemistryID	False
MS_ColumnOrder	COLUMN	WaterChemistryID	4
MS_ColumnWidth	COLUMN	WaterChemistryID	15
MS_TextAlign	COLUMN	WaterChemistryID	0

Uses

[dbo].[tblWaterSamples]
dbo

[dbo].[tblWaterProfiles]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblWaterProfiles

This table includes the data collected using Sonde multi-meters. The current protocol calls for profiles of measurements taken through the water column, while earlier methods included only a surface measurement. All in-situ Sonde data is included here.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	1455
Created	1:28:36 PM Friday, April 02, 2010
Last Modified	10:59:59 AM Wednesday, April 28, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
🔑	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗	
🔑	SAMPLEDATE *The date and time of the sample; automatically populated when a new Sampling Event form is opened*	datetime	8	✗	
🔑	SAMPLENUMBER *Alphabetic designation given when the sample is collected; start with "a" for the first sample taken, and label each sample consecutively*	nvarchar(50)	100	✗	
	SAMPLETIME *The start time for a sampling event. In the old version of the database, date and time were separated. This field is retained for reference, but not populated with new data.*	datetime	8	✓	
🔑	SAMPLEDEPTH *Depth (m) beneath the surface at which the sample was taken*	float	8	✗	
	TEMPERATURE *Water temperature (Celsius)*	float	8	✓	
	PH *Water pH*	float	8	✓	
	pH_mV *Charge on the pH probe*	float	8	✓	
	SPECIFICCONDUCTANCE *Water Specific Conductivity (uS/cm)*	float	8	✓	
	DO *Dissolved Oxygen (mg/L)*	float	8	✓	
	DO_PCT *Dissolved Oxygen (%)*	float	8	✓	
	DO_Charge *Charge on Dissolved Oxygen sensor*	float	8	✓	
	PROFILE_COMMENTS *Comments regarding the water profiles*	nvarchar(max)	max	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblWaterProfiles	PONDNAME, SAMPLEDATE, SAMPLENUMBER, SAMPLEDEPTH	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblWaterProfiles_tblWaterSamples	✓	Cascade	Cascade	PONDNAME->[dbo].[tblWater-Samples].[PONDNAME] SAMPLEDATE->[dbo].[tblWater-Samples].[SAMPLEDATE] SAMPLENUMBER->[dbo].[tbl-Water-Samples].[SAMPLENUMBER]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			[tblWaterProfiles].[PONDNAME], [tbl-WaterProfiles].[SAMPLEDATE], [tbl-WaterProfiles].[SAMPLENUMBER]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	DO	-1
MS_ColumnHidden	COLUMN	DO	False
MS_ColumnOrder	COLUMN	DO	0
MS_ColumnWidth	COLUMN	DO	-1
MS_TextAlign	COLUMN	DO	0
MS_AggregateType	COLUMN	DO_Charge	-1
MS_ColumnHidden	COLUMN	DO_Charge	False
MS_ColumnOrder	COLUMN	DO_Charge	0
MS_ColumnWidth	COLUMN	DO_Charge	-1
MS_TextAlign	COLUMN	DO_Charge	0
MS_AggregateType	COLUMN	DO_PCT	-1
MS_ColumnHidden	COLUMN	DO_PCT	False
MS_ColumnOrder	COLUMN	DO_PCT	0
MS_ColumnWidth	COLUMN	DO_PCT	-1
MS_TextAlign	COLUMN	DO_PCT	0
MS_AggregateType	COLUMN	PH	-1
MS_ColumnHidden	COLUMN	PH	False
MS_ColumnOrder	COLUMN	PH	0
MS_ColumnWidth	COLUMN	PH	810
MS_TextAlign	COLUMN	PH	0
MS_AggregateType	COLUMN	pH_mV	-1
MS_ColumnHidden	COLUMN	pH_mV	False
MS_ColumnOrder	COLUMN	pH_mV	0
MS_ColumnWidth	COLUMN	pH_mV	1005
MS_DisplayControl	COLUMN	pH_mV	109
MS_Format	COLUMN	pH_mV	
MS_IMEMode	COLUMN	pH_mV	0
MS_TextAlign	COLUMN	pH_mV	0

MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	1
MS_ColumnWidth	COLUMN	PONDNAME	1680
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	PROFILE_COMMENTS	-1
MS_ColumnHidden	COLUMN	PROFILE_COMMENTS	False
MS_ColumnOrder	COLUMN	PROFILE_COMMENTS	0
MS_ColumnWidth	COLUMN	PROFILE_COMMENTS	-1
MS_TextAlign	COLUMN	PROFILE_COMMENTS	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	2
MS_ColumnWidth	COLUMN	SAMPLEDATE	1515
MS_Format	COLUMN	SAMPLEDATE	Short Date
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SAMPLEDEPTH	-1
MS_ColumnHidden	COLUMN	SAMPLEDEPTH	False
MS_ColumnOrder	COLUMN	SAMPLEDEPTH	4
MS_ColumnWidth	COLUMN	SAMPLEDEPTH	1755
MS_TextAlign	COLUMN	SAMPLEDEPTH	0
MS_AggregateType	COLUMN	SAMPLENUMBER	-1
MS_ColumnHidden	COLUMN	SAMPLENUMBER	False
MS_ColumnOrder	COLUMN	SAMPLENUMBER	3
MS_ColumnWidth	COLUMN	SAMPLENUMBER	1845
MS_TextAlign	COLUMN	SAMPLENUMBER	0
MS_AggregateType	COLUMN	SAMPLETIME	-1
MS_ColumnHidden	COLUMN	SAMPLETIME	False
MS_ColumnOrder	COLUMN	SAMPLETIME	5
MS_ColumnWidth	COLUMN	SAMPLETIME	-1
MS_TextAlign	COLUMN	SAMPLETIME	0
MS_AggregateType	COLUMN	SPECIFICCONDUCTANCE	-1
MS_ColumnHidden	COLUMN	SPECIFICCONDUCTANCE	False
MS_ColumnOrder	COLUMN	SPECIFICCONDUCTANCE	0
MS_ColumnWidth	COLUMN	SPECIFICCONDUCTANCE	2955
MS_TextAlign	COLUMN	SPECIFICCONDUCTANCE	0
MS_AggregateType	COLUMN	TEMPERATURE	-1
MS_ColumnHidden	COLUMN	TEMPERATURE	False
MS_ColumnOrder	COLUMN	TEMPERATURE	0
MS_ColumnWidth	COLUMN	TEMPERATURE	870
MS_TextAlign	COLUMN	TEMPERATURE	0

Uses

[dbo].[tblWaterSamples]
dbo

[dbo].[tblWaterSamples]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tblWaterSamples

This table includes the data collected about the water samples taken at lake sites. It links to tblEvents, and includes the results of analyses and processes performed in the field.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	948
Created	10:59:59 AM Wednesday, April 28, 2010
Last Modified	10:59:59 AM Wednesday, April 28, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
	PONDNAME *Official site name, including park code and three-digit number (new numbers added sequentially as new lakes are sampled)*	nvarchar(50)	100	✗	
	SAMPLEDATE *The date and time of the sample; automatically populated when a new Sampling Event form is opened*	datetime	8	✗	
	SAMPLENUMBER *Alphabetic designation given when the sample is collected; start with "a" for the first sample taken, and label each sample consecutively*	nvarchar(50)	100	✗	
	SAMPLEDEPTH *Depth (m) beneath the surface at which the sample was taken*	float	8	✓	((0.5))
	SAMPLETIME *The start time for a sampling event. In the old version of the database, date and time were separated. This field is retained for reference, but not populated with new data.*	datetime	8	✓	
	DEPTH *Pond depth (m) at the point where the sample was taken*	decimal(18,1)	9	✓	
	WATERCOLOR *Water color (determined at camp at the end of the sample day)*	float	8	✓	
	ALKALINITY *Alkalinity in mg/L calcium carbonate (determined at camp at the end of the sample day)*	float	8	✓	
	VOLUMEFILTERED *Volume of water(mL) filtered for chlorophyll analysis*	nvarchar(50)	100	✓	
	COMMENTS *Comments regarding the water samples*	nvarchar(4000)	8000	✓	
	SHIPPING_DATE *Date when the sample was sent for analysis*	datetime	8	✓	
	SHIPPING_INFO *Notes regarding the shipping of the sample (box/shipment number, condition, etc.)*	nvarchar(4000)	8000	✓	
	Methane *Check if a methane sample was collected for USGS*	bit	1	✓	
	DOC_COLL *Check if a DOC sample was collected for USGS*	bit	1	✓	
	O18_COLL *Check if an 18O sample was collected for USGS*	bit	1	✓	

	SI_DOC_COLL *Check if a 125 mL cool filtered sample was collected for Si/DOC*	bit	1	✓	
	IONS_COLL *Check if a 250 mL frozen filtered sample was collected for ions*	bit	1	✓	
	TN_TP_COLL *Check if a 500 mL frozen unfiltered sample was collected for TN/TP*	bit	1	✓	
	NOTES *Notes regarding the water samples or measurements*	nvarchar(4000)	8000	✓	
	RecordInsertedDate	datetime	8	✓	(getdate())
	RecordInsertedBy	nvarchar(50)	100	✓	(suser_name())
	RecordUpdatedDate	datetime	8	✓	(getdate())
	RecordUpdatedBy	nvarchar(50)	100	✓	(suser_name())

Indexes

	Name	Columns	Unique
	PK_tblWaterSamples	PONDNAME, SAMPLEDATE, SAMPLENUMBER	✓
	IX_tblWaterSamples *Makes pondname,sampledate and samplenumber unique*	PONDNAME, SAMPLEDATE, SAMPLENUMBER	✓

Foreign Keys

Name	No Check	Update	Delete	Columns
FK_tblWaterSamples_tblEvents	✓	Cascade	Cascade	PONDNAME->[dbo].[tbl-Events].[PONDNAME] SAMPLEDATE->[dbo].[tbl-Events].[SAMPLEDATE]

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_FrozenColumns			4
MS_HideNewField			False
MS_LinkChildFields			pondname;sampledate;samplenumber
MS_LinkMasterFields			pondname;sampledate;samplenumber
MS_OrderBy			[tblWaterSamples].[SAMPLEDATE], [tbl-WaterSamples].[PONDNAME], [tblWater-Samples].[SAMPLENUMBER]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_SubdatasheetName			dbo.tblWaterChemistry
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	ALKALINITY	-1
MS_ColumnHidden	COLUMN	ALKALINITY	False
MS_ColumnOrder	COLUMN	ALKALINITY	0
MS_ColumnWidth	COLUMN	ALKALINITY	1470
MS_TextAlign	COLUMN	ALKALINITY	0
MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	0
MS_ColumnWidth	COLUMN	COMMENTS	-1
MS_DisplayControl	COLUMN	COMMENTS	109
MS_Format	COLUMN	COMMENTS	
MS_IMEMode	COLUMN	COMMENTS	0
MS_TextAlign	COLUMN	COMMENTS	0
MS_AggregateType	COLUMN	DEPTH	-1
MS_ColumnHidden	COLUMN	DEPTH	False
MS_ColumnOrder	COLUMN	DEPTH	0
MS_ColumnWidth	COLUMN	DEPTH	1020
MS_TextAlign	COLUMN	DEPTH	0
MS_AggregateType	COLUMN	DOC_COLL	-1
MS_ColumnHidden	COLUMN	DOC_COLL	False
MS_ColumnOrder	COLUMN	DOC_COLL	0
MS_ColumnWidth	COLUMN	DOC_COLL	-1
MS_DisplayControl	COLUMN	DOC_COLL	106
MS_Format	COLUMN	DOC_COLL	

MS_IMEMode	COLUMN	DOC_COLL	0
MS_TextAlign	COLUMN	DOC_COLL	0
MS_AggregateType	COLUMN	IONS_COLL	-1
MS_ColumnHidden	COLUMN	IONS_COLL	False
MS_ColumnOrder	COLUMN	IONS_COLL	0
MS_ColumnWidth	COLUMN	IONS_COLL	-1
MS_DisplayControl	COLUMN	IONS_COLL	106
MS_Format	COLUMN	IONS_COLL	
MS_IMEMode	COLUMN	IONS_COLL	0
MS_TextAlign	COLUMN	IONS_COLL	0
MS_AggregateType	COLUMN	Methane	-1
MS_ColumnHidden	COLUMN	Methane	False
MS_ColumnOrder	COLUMN	Methane	0
MS_ColumnWidth	COLUMN	Methane	-1
MS_DisplayControl	COLUMN	Methane	106
MS_Format	COLUMN	Methane	
MS_IMEMode	COLUMN	Methane	0
MS_TextAlign	COLUMN	Methane	0
MS_AggregateType	COLUMN	NOTES	-1
MS_ColumnHidden	COLUMN	NOTES	False
MS_ColumnOrder	COLUMN	NOTES	0
MS_ColumnWidth	COLUMN	NOTES	6840
MS_DisplayControl	COLUMN	NOTES	109
MS_Format	COLUMN	NOTES	
MS_IMEMode	COLUMN	NOTES	0
MS_TextAlign	COLUMN	NOTES	0
MS_AggregateType	COLUMN	O18_COLL	-1
MS_ColumnHidden	COLUMN	O18_COLL	False
MS_ColumnOrder	COLUMN	O18_COLL	0
MS_ColumnWidth	COLUMN	O18_COLL	-1
MS_DisplayControl	COLUMN	O18_COLL	106
MS_Format	COLUMN	O18_COLL	
MS_IMEMode	COLUMN	O18_COLL	0
MS_TextAlign	COLUMN	O18_COLL	0
MS_AggregateType	COLUMN	PONDNAME	-1
MS_ColumnHidden	COLUMN	PONDNAME	False
MS_ColumnOrder	COLUMN	PONDNAME	1
MS_ColumnWidth	COLUMN	PONDNAME	-1
MS_TextAlign	COLUMN	PONDNAME	0
MS_AggregateType	COLUMN	RecordInsertedBy	-1
MS_ColumnHidden	COLUMN	RecordInsertedBy	False
MS_ColumnOrder	COLUMN	RecordInsertedBy	0

MS_ColumnWidth	COLUMN	RecordInsertedBy	-1
MS_TextAlign	COLUMN	RecordInsertedBy	0
MS_AggregateType	COLUMN	RecordInsertedDate	-1
MS_ColumnHidden	COLUMN	RecordInsertedDate	False
MS_ColumnOrder	COLUMN	RecordInsertedDate	0
MS_ColumnWidth	COLUMN	RecordInsertedDate	-1
MS_TextAlign	COLUMN	RecordInsertedDate	0
MS_AggregateType	COLUMN	RecordUpdatedBy	-1
MS_ColumnHidden	COLUMN	RecordUpdatedBy	False
MS_ColumnOrder	COLUMN	RecordUpdatedBy	0
MS_ColumnWidth	COLUMN	RecordUpdatedBy	-1
MS_TextAlign	COLUMN	RecordUpdatedBy	0
MS_AggregateType	COLUMN	RecordUpdatedDate	-1
MS_ColumnHidden	COLUMN	RecordUpdatedDate	False
MS_ColumnOrder	COLUMN	RecordUpdatedDate	0
MS_ColumnWidth	COLUMN	RecordUpdatedDate	-1
MS_TextAlign	COLUMN	RecordUpdatedDate	0
MS_AggregateType	COLUMN	SAMPLEDATE	-1
MS_ColumnHidden	COLUMN	SAMPLEDATE	False
MS_ColumnOrder	COLUMN	SAMPLEDATE	0
MS_ColumnWidth	COLUMN	SAMPLEDATE	2235
MS_TextAlign	COLUMN	SAMPLEDATE	0
MS_AggregateType	COLUMN	SAMPLEDEPTH	-1
MS_ColumnHidden	COLUMN	SAMPLEDEPTH	False
MS_ColumnOrder	COLUMN	SAMPLEDEPTH	0
MS_ColumnWidth	COLUMN	SAMPLEDEPTH	-1
MS_DisplayControl	COLUMN	SAMPLEDEPTH	109
MS_Format	COLUMN	SAMPLEDEPTH	
MS_IMEMode	COLUMN	SAMPLEDEPTH	0
MS_TextAlign	COLUMN	SAMPLEDEPTH	0
MS_AggregateType	COLUMN	SAMPLENUMBER	-1
MS_ColumnHidden	COLUMN	SAMPLENUMBER	False
MS_ColumnOrder	COLUMN	SAMPLENUMBER	0
MS_ColumnWidth	COLUMN	SAMPLENUMBER	1920
MS_Format	COLUMN	SAMPLENUMBER	>
MS_TextAlign	COLUMN	SAMPLENUMBER	0
MS_AggregateType	COLUMN	SAMPLETIME	-1
MS_ColumnHidden	COLUMN	SAMPLETIME	False
MS_ColumnOrder	COLUMN	SAMPLETIME	0
MS_ColumnWidth	COLUMN	SAMPLETIME	1515
MS_TextAlign	COLUMN	SAMPLETIME	0
MS_AggregateType	COLUMN	SHIPPING_DATE	-1

MS_ColumnHidden	COLUMN	SHIPPING_DATE	False
MS_ColumnOrder	COLUMN	SHIPPING_DATE	0
MS_ColumnWidth	COLUMN	SHIPPING_DATE	-1
MS_DisplayControl	COLUMN	SHIPPING_DATE	
MS_Format	COLUMN	SHIPPING_DATE	
MS_IMEMode	COLUMN	SHIPPING_DATE	0
MS_TextAlign	COLUMN	SHIPPING_DATE	0
MS_AggregateType	COLUMN	SHIPPING_INFO	-1
MS_ColumnHidden	COLUMN	SHIPPING_INFO	False
MS_ColumnOrder	COLUMN	SHIPPING_INFO	0
MS_ColumnWidth	COLUMN	SHIPPING_INFO	-1
MS_DisplayControl	COLUMN	SHIPPING_INFO	109
MS_Format	COLUMN	SHIPPING_INFO	
MS_IMEMode	COLUMN	SHIPPING_INFO	0
MS_TextAlign	COLUMN	SHIPPING_INFO	0
MS_AggregateType	COLUMN	SI_DOC_COLL	-1
MS_ColumnHidden	COLUMN	SI_DOC_COLL	False
MS_ColumnOrder	COLUMN	SI_DOC_COLL	0
MS_ColumnWidth	COLUMN	SI_DOC_COLL	-1
MS_DisplayControl	COLUMN	SI_DOC_COLL	106
MS_Format	COLUMN	SI_DOC_COLL	
MS_IMEMode	COLUMN	SI_DOC_COLL	0
MS_TextAlign	COLUMN	SI_DOC_COLL	0
MS_AggregateType	COLUMN	TN_TP_COLL	-1
MS_ColumnHidden	COLUMN	TN_TP_COLL	False
MS_ColumnOrder	COLUMN	TN_TP_COLL	0
MS_ColumnWidth	COLUMN	TN_TP_COLL	-1
MS_DisplayControl	COLUMN	TN_TP_COLL	106
MS_Format	COLUMN	TN_TP_COLL	
MS_IMEMode	COLUMN	TN_TP_COLL	0
MS_TextAlign	COLUMN	TN_TP_COLL	0
MS_AggregateType	COLUMN	VOLUMEFILTERED	-1
MS_ColumnHidden	COLUMN	VOLUMEFILTERED	False
MS_ColumnOrder	COLUMN	VOLUMEFILTERED	0
MS_ColumnWidth	COLUMN	VOLUMEFILTERED	-1
MS_DisplayControl	COLUMN	VOLUMEFILTERED	109
MS_Format	COLUMN	VOLUMEFILTERED	
MS_IMEMode	COLUMN	VOLUMEFILTERED	0
MS_TextAlign	COLUMN	VOLUMEFILTERED	0
MS_AggregateType	COLUMN	WATERCOLOR	-1
MS_ColumnHidden	COLUMN	WATERCOLOR	False
MS_ColumnOrder	COLUMN	WATERCOLOR	0

MS_ColumnWidth	COLUMN	WATERCOLOR	1710
MS_TextAlign	COLUMN	WATERCOLOR	0

Uses

[dbo].[tblEvents]
dbo

Used By

[dbo].[tblChlorophyll]
[dbo].[tblWaterChemistry]
[dbo].[tblWaterProfiles]

[dbo].[tluCloudCover]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluCloudCover

This look-up table is used to select cloud cover codes when recording Sampling Event data.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	4
Created	1:29:16 PM Friday, April 02, 2010
Last Modified	1:29:16 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	CLOUD_COVER_CODE	nvarchar(50)	100	✗
	CLOUD_COVER_MIN_PERCENT	int	4	✓
	CLOUD_COVER_MAX_PERCENT	int	4	✓
	CLOUD_COVER_DESC	nvarchar(100)	200	✓

Indexes

	Name	Columns	Unique
	pk_tluCloudCover	CLOUD_COVER_CODE	✓

Uses

dbo

[dbo].[tluDatum]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluDatum

This look-up table is used to select the datum of the geographic coordinates contained in tblPonds.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	3
Created	1:29:37 PM Friday, April 02, 2010
Last Modified	1:29:37 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	DATUM_CODE	nvarchar(20)	40	✗
	DATUM_DESC	nvarchar(100)	200	✓

Indexes

	Name	Columns	Unique
	pk_tluDatum	DATUM_CODE	✓

Uses

dbo

[dbo].[tluExclusionReason]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluExclusionReason

This look-up table is used to select the reason for exclusion when flagging data in the continuous monitoring log tables for exclusion.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	3
Created	1:29:48 PM Friday, April 02, 2010
Last Modified	1:29:48 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	ExclusionReason	nvarchar(50)	100	✗
	SortOrder	nvarchar(50)	100	✗

Indexes 

	Name	Columns	Unique
	PK_tluExclusionReason	SortOrder	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			[tluExclusionReason].[SortOrder]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	ExclusionReason	-1
MS_ColumnHidden	COLUMN	ExclusionReason	False
MS_ColumnOrder	COLUMN	ExclusionReason	1
MS_ColumnWidth	COLUMN	ExclusionReason	2760
MS_DisplayControl	COLUMN	ExclusionReason	109
MS_Format	COLUMN	ExclusionReason	
MS_IMEMode	COLUMN	ExclusionReason	0
MS_TextAlign	COLUMN	ExclusionReason	0
MS_AggregateType	COLUMN	SortOrder	-1
MS_ColumnHidden	COLUMN	SortOrder	False
MS_ColumnOrder	COLUMN	SortOrder	0
MS_ColumnWidth	COLUMN	SortOrder	-1
MS_DisplayControl	COLUMN	SortOrder	109
MS_Format	COLUMN	SortOrder	
MS_IMEMode	COLUMN	SortOrder	0
MS_TextAlign	COLUMN	SortOrder	0

Uses

dbo

[dbo].[tluFFGCodes]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluFFGCodes

This look-up table contains the list of Functional Feeding Groups, referenced in tluInvertTaxa.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	10
Created	1:29:59 PM Friday, April 02, 2010
Last Modified	1:29:59 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	FFGCODE	nvarchar(255)	510	✗
	FFGDESCRIPTION	nvarchar(255)	510	✓

Indexes

	Name	Columns	Unique
	pk_tluFFGCodes	FFGCODE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	FFGCODE	-1
MS_ColumnHidden	COLUMN	FFGCODE	False
MS_ColumnOrder	COLUMN	FFGCODE	0
MS_ColumnWidth	COLUMN	FFGCODE	-1
MS_TextAlign	COLUMN	FFGCODE	0
MS_AggregateType	COLUMN	FFGDESCRIPTION	-1
MS_ColumnHidden	COLUMN	FFGDESCRIPTION	False
MS_ColumnOrder	COLUMN	FFGDESCRIPTION	0
MS_ColumnWidth	COLUMN	FFGDESCRIPTION	2595
MS_TextAlign	COLUMN	FFGDESCRIPTION	0

Uses

dbo

[dbo].[tluGPS]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluGPS

This look-up table is used to select the code for the type of GPS unit used to collect geographic coordinates entered in tblPonds.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	17
Created	1:30:20 PM Friday, April 02, 2010
Last Modified	1:30:20 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	GPS_TYPE	nvarchar(20)	40	✗
	GPS_DESC	nvarchar(100)	200	✓
	Sort_Order	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	pk_tluGPS	GPS_TYPE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	GPS_DESC	-1
MS_ColumnHidden	COLUMN	GPS_DESC	False
MS_ColumnOrder	COLUMN	GPS_DESC	0
MS_ColumnWidth	COLUMN	GPS_DESC	6405
MS_TextAlign	COLUMN	GPS_DESC	0
MS_AggregateType	COLUMN	GPS_TYPE	-1
MS_ColumnHidden	COLUMN	GPS_TYPE	False
MS_ColumnOrder	COLUMN	GPS_TYPE	0
MS_ColumnWidth	COLUMN	GPS_TYPE	-1
MS_TextAlign	COLUMN	GPS_TYPE	0
MS_DisplayControl	COLUMN	Sort_Order	109
MS_Format	COLUMN	Sort_Order	
MS_IMEMode	COLUMN	Sort_Order	0

Uses

dbo

[dbo].[tluHydrologicClass]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluHydrologicClass

This look-up table is used to select the Hydrologic Class code when entering data into tblPonds.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Heap	✓
Row Count	3
Created	1:33:22 PM Friday, April 02, 2010
Last Modified	1:33:22 PM Friday, April 02, 2010

Columns

Name	Data Type	Max Length (Bytes)	Allow Nulls
CLASS	nvarchar(50)	100	✓
CLASSDESCRIPTION	nvarchar(50)	100	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	CLASS	-1
MS_ColumnHidden	COLUMN	CLASS	False
MS_ColumnOrder	COLUMN	CLASS	0
MS_ColumnWidth	COLUMN	CLASS	1695
MS_TextAlign	COLUMN	CLASS	0
MS_AggregateType	COLUMN	CLASSDESCRIPTION	-1
MS_ColumnHidden	COLUMN	CLASSDESCRIPTION	False
MS_ColumnOrder	COLUMN	CLASSDESCRIPTION	0
MS_ColumnWidth	COLUMN	CLASSDESCRIPTION	4890
MS_TextAlign	COLUMN	CLASSDESCRIPTION	0

Uses

dbo

[dbo].[tluHydrologicRegime]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluHydrologicRegime

This look-up table is used to select the Hydrologic Regime code when entering data into tblPonds.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	4
Created	1:33:34 PM Friday, April 02, 2010
Last Modified	1:33:34 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	REGIMECODE	int	4	✗
	REGIME	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	PK_tluHydrologicRegime	REGIMECODE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	REGIME	-1
MS_ColumnHidden	COLUMN	REGIME	False
MS_ColumnOrder	COLUMN	REGIME	0
MS_ColumnWidth	COLUMN	REGIME	5055
MS_TextAlign	COLUMN	REGIME	0
MS_AggregateType	COLUMN	REGIMECODE	-1
MS_ColumnHidden	COLUMN	REGIMECODE	False
MS_ColumnOrder	COLUMN	REGIMECODE	0
MS_ColumnWidth	COLUMN	REGIMECODE	1635
MS_TextAlign	COLUMN	REGIMECODE	0

Uses

dbo

[dbo].[tluInvertTaxa]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluInvertTaxa

This look-up table contains the taxonomic information for every invertebrate species that has been identified for this project. It is included in the Invertebrate database sent to the lab each year, and must be updated annually with any new additions.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	211
Created	4:08:21 PM Friday, April 02, 2010
Last Modified	4:08:21 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	TAXONSHORT	nvarchar(255)	510	✗
	TSN	float	8	✓
	TAXA_PHYLUM	nvarchar(255)	510	✓
	TAXA_SUBPHYLUM	nvarchar(255)	510	✓
	TAXA_CLASS	nvarchar(255)	510	✓
	TAXA_SUBCLASS	nvarchar(255)	510	✓
	TAXA_ORDER	nvarchar(255)	510	✓
	TAXA_SUBORDER	nvarchar(255)	510	✓
	TAXA_FAMILY	nvarchar(255)	510	✓
	TAXA_SUBFAMILY	nvarchar(255)	510	✓
	TAXA_TRIBE	nvarchar(255)	510	✓
	TAXA_GENUS	nvarchar(255)	510	✓
	TAXA_SUBGENUS	nvarchar(255)	510	✓
	TAXA_SPECIES	nvarchar(255)	510	✓
	FFG *Functional feeding group of the taxon*	nvarchar(100)	200	✓
	CLASSIFY_LEVEL	nvarchar(50)	100	✓
🔑	TAXA_ID	float	8	✗
	EXCLUDE_TAXONSHORT	bit	1	✓
	COMMENTS	nvarchar(max)	max	✓
	CheckedHK	bit	1	✓

Indexes

	Name	Columns	Unique
🔑	PK_tluInvertTaxa2009	TAXA_ID	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			(TAXA_GENUS In ("Stempellina","Stempellinella"))
MS_FilterOnLoad			False
MS_FrozenColumns			1
MS_HideNewField			False
MS_OrderBy			[tluInvertTaxa2009].[TAXA_PHYLUM], [tluInvertTaxa2009].[TAXA_SUBPHYLUM], [tluInvertTaxa2009].[TAXA_CLASS], [tluInvertTaxa2009].[TAXA_SUBCLASS], [tluInvertTaxa2009].[TAXA_ORDER], [tluInvertTaxa2009].[TAXA_SUBORDER], [tluInvertTaxa2009].[TAXA_FAMILY], [tluInvertTaxa2009].[TAXA_SUBFAMILY], [tluInvertTaxa2009].[TAXA_TRIBE], [tluInvertTaxa2009].[TAXA_GENUS], [tluInvertTaxa2009].[TAXA_SUBGENUS], [tluInvertTaxa2009].[TAXA_SPECIES], [tluInvertTaxa2009].[TAXONSHORT], [tluInvertTaxa2009].[TAXA_ID], [tluInvertTaxa2009].[TSN]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	CheckedHK	-1
MS_ColumnHidden	COLUMN	CheckedHK	False
MS_ColumnOrder	COLUMN	CheckedHK	20
MS_ColumnWidth	COLUMN	CheckedHK	1725
MS_DisplayControl	COLUMN	CheckedHK	106
MS_Format	COLUMN	CheckedHK	
MS_IMEMode	COLUMN	CheckedHK	0
MS_TextAlign	COLUMN	CheckedHK	0
MS_AggregateType	COLUMN	CLASSIFY_LEVEL	-1
MS_AllowValueListEdits	COLUMN	CLASSIFY_LEVEL	False
MS_ColumnHidden	COLUMN	CLASSIFY_LEVEL	False
MS_ColumnOrder	COLUMN	CLASSIFY_LEVEL	16
MS_ColumnWidth	COLUMN	CLASSIFY_LEVEL	1845

MS_DisplayControl	COLUMN	CLASSIFY_LEVEL	110
MS_Format	COLUMN	CLASSIFY_LEVEL	
MS_IMEMode	COLUMN	CLASSIFY_LEVEL	0
MS_ListItemsEditForm	COLUMN	CLASSIFY_LEVEL	
MS_RowSource	COLUMN	CLASSIFY_LEVEL	TAXA_PHYLUM;TAXA_- SUBPHYLUM;TAXA_- CLASS;TAXA_- SUBCLASS;TAXA_- ORDER;TAXA_- SUBORDER;TAXA_- FAMILY;TAXA_- SUBFAMILY;TAXA_- TRIBE;TAXA_- GENUS;TAXA_- SUBGENUS;TAXA_SPECIES
MS_RowSourceType	COLUMN	CLASSIFY_LEVEL	Value List
MS_ShowOnlyRowSourceValues	COLUMN	CLASSIFY_LEVEL	False
MS_TextAlign	COLUMN	CLASSIFY_LEVEL	0
MS_AggregateType	COLUMN	COMMENTS	-1
MS_ColumnHidden	COLUMN	COMMENTS	False
MS_ColumnOrder	COLUMN	COMMENTS	18
MS_ColumnWidth	COLUMN	COMMENTS	9990
MS_DisplayControl	COLUMN	COMMENTS	109
MS_Format	COLUMN	COMMENTS	
MS_IMEMode	COLUMN	COMMENTS	0
MS_TextAlign	COLUMN	COMMENTS	0
MS_AggregateType	COLUMN	EXCLUDE_TAXONSHORT	-1
MS_ColumnHidden	COLUMN	EXCLUDE_TAXONSHORT	False
MS_ColumnOrder	COLUMN	EXCLUDE_TAXONSHORT	17
MS_ColumnWidth	COLUMN	EXCLUDE_TAXONSHORT	-1
MS_DisplayControl	COLUMN	EXCLUDE_TAXONSHORT	106
MS_Format	COLUMN	EXCLUDE_TAXONSHORT	
MS_IMEMode	COLUMN	EXCLUDE_TAXONSHORT	0
MS_TextAlign	COLUMN	EXCLUDE_TAXONSHORT	0
MS_AggregateType	COLUMN	FFG	-1
MS_AllowValueListEdits	COLUMN	FFG	False
MS_ColumnCount	COLUMN	FFG	2
MS_ColumnHidden	COLUMN	FFG	False
MS_ColumnOrder	COLUMN	FFG	15
MS_ColumnWidth	COLUMN	FFG	945
MS_ColumnWidths	COLUMN	FFG	576.000;2304.000
MS_DisplayControl	COLUMN	FFG	111
MS_Format	COLUMN	FFG	
MS_IMEMode	COLUMN	FFG	0
MS_ListItemsEditForm	COLUMN	FFG	
MS_ListWidth	COLUMN	FFG	2880.000

MS_RowSource	COLUMN	FFG	dbo.tluFFGCodes
MS_ShowOnlyRowSourceValues	COLUMN	FFG	False
MS_TextAlign	COLUMN	FFG	0
MS_AggregateType	COLUMN	TAXA_CLASS	-1
MS_ColumnHidden	COLUMN	TAXA_CLASS	False
MS_ColumnOrder	COLUMN	TAXA_CLASS	5
MS_ColumnWidth	COLUMN	TAXA_CLASS	1635
MS_TextAlign	COLUMN	TAXA_CLASS	0
MS_AggregateType	COLUMN	TAXA_FAMILY	-1
MS_ColumnHidden	COLUMN	TAXA_FAMILY	False
MS_ColumnOrder	COLUMN	TAXA_FAMILY	9
MS_ColumnWidth	COLUMN	TAXA_FAMILY	1890
MS_TextAlign	COLUMN	TAXA_FAMILY	0
MS_AggregateType	COLUMN	TAXA_GENUS	-1
MS_ColumnHidden	COLUMN	TAXA_GENUS	False
MS_ColumnOrder	COLUMN	TAXA_GENUS	12
MS_ColumnWidth	COLUMN	TAXA_GENUS	3870
MS_TextAlign	COLUMN	TAXA_GENUS	0
MS_AggregateType	COLUMN	TAXA_ID	-1
MS_ColumnHidden	COLUMN	TAXA_ID	False
MS_ColumnOrder	COLUMN	TAXA_ID	19
MS_ColumnWidth	COLUMN	TAXA_ID	1980
MS_TextAlign	COLUMN	TAXA_ID	0
MS_AggregateType	COLUMN	TAXA_ORDER	-1
MS_ColumnHidden	COLUMN	TAXA_ORDER	False
MS_ColumnOrder	COLUMN	TAXA_ORDER	7
MS_ColumnWidth	COLUMN	TAXA_ORDER	1755
MS_TextAlign	COLUMN	TAXA_ORDER	0
MS_AggregateType	COLUMN	TAXA_PHYLUM	-1
MS_ColumnHidden	COLUMN	TAXA_PHYLUM	False
MS_ColumnOrder	COLUMN	TAXA_PHYLUM	3
MS_ColumnWidth	COLUMN	TAXA_PHYLUM	1635
MS_TextAlign	COLUMN	TAXA_PHYLUM	0
MS_AggregateType	COLUMN	TAXA_SPECIES	-1
MS_ColumnHidden	COLUMN	TAXA_SPECIES	False
MS_ColumnOrder	COLUMN	TAXA_SPECIES	14
MS_ColumnWidth	COLUMN	TAXA_SPECIES	1455
MS_DisplayControl	COLUMN	TAXA_SPECIES	109
MS_Format	COLUMN	TAXA_SPECIES	
MS_IMEMode	COLUMN	TAXA_SPECIES	0
MS_TextAlign	COLUMN	TAXA_SPECIES	0
MS_AggregateType	COLUMN	TAXA_SUBCLASS	-1

MS_ColumnHidden	COLUMN	TAXA_SUBCLASS	False
MS_ColumnOrder	COLUMN	TAXA_SUBCLASS	6
MS_ColumnWidth	COLUMN	TAXA_SUBCLASS	1395
MS_DisplayControl	COLUMN	TAXA_SUBCLASS	109
MS_Format	COLUMN	TAXA_SUBCLASS	
MS_IMEMode	COLUMN	TAXA_SUBCLASS	0
MS_TextAlign	COLUMN	TAXA_SUBCLASS	0
MS_AggregateType	COLUMN	TAXA_SUBFAMILY	-1
MS_ColumnHidden	COLUMN	TAXA_SUBFAMILY	False
MS_ColumnOrder	COLUMN	TAXA_SUBFAMILY	10
MS_ColumnWidth	COLUMN	TAXA_SUBFAMILY	1905
MS_DisplayControl	COLUMN	TAXA_SUBFAMILY	109
MS_Format	COLUMN	TAXA_SUBFAMILY	
MS_IMEMode	COLUMN	TAXA_SUBFAMILY	0
MS_TextAlign	COLUMN	TAXA_SUBFAMILY	0
MS_AggregateType	COLUMN	TAXA_SUBGENUS	-1
MS_ColumnHidden	COLUMN	TAXA_SUBGENUS	False
MS_ColumnOrder	COLUMN	TAXA_SUBGENUS	13
MS_ColumnWidth	COLUMN	TAXA_SUBGENUS	-1
MS_DisplayControl	COLUMN	TAXA_SUBGENUS	109
MS_Format	COLUMN	TAXA_SUBGENUS	
MS_IMEMode	COLUMN	TAXA_SUBGENUS	0
MS_TextAlign	COLUMN	TAXA_SUBGENUS	0
MS_AggregateType	COLUMN	TAXA_SUBORDER	-1
MS_ColumnHidden	COLUMN	TAXA_SUBORDER	False
MS_ColumnOrder	COLUMN	TAXA_SUBORDER	8
MS_ColumnWidth	COLUMN	TAXA_SUBORDER	1755
MS_DisplayControl	COLUMN	TAXA_SUBORDER	109
MS_Format	COLUMN	TAXA_SUBORDER	
MS_IMEMode	COLUMN	TAXA_SUBORDER	0
MS_TextAlign	COLUMN	TAXA_SUBORDER	0
MS_AggregateType	COLUMN	TAXA_SUBPHYLUM	-1
MS_ColumnHidden	COLUMN	TAXA_SUBPHYLUM	False
MS_ColumnOrder	COLUMN	TAXA_SUBPHYLUM	4
MS_ColumnWidth	COLUMN	TAXA_SUBPHYLUM	1350
MS_DisplayControl	COLUMN	TAXA_SUBPHYLUM	109
MS_Format	COLUMN	TAXA_SUBPHYLUM	
MS_IMEMode	COLUMN	TAXA_SUBPHYLUM	0
MS_TextAlign	COLUMN	TAXA_SUBPHYLUM	0
MS_AggregateType	COLUMN	TAXA_TRIBE	-1
MS_ColumnHidden	COLUMN	TAXA_TRIBE	False
MS_ColumnOrder	COLUMN	TAXA_TRIBE	11

MS_ColumnWidth	COLUMN	TAXA_TRIBE	1605
MS_DisplayControl	COLUMN	TAXA_TRIBE	109
MS_Format	COLUMN	TAXA_TRIBE	
MS_IMEMode	COLUMN	TAXA_TRIBE	0
MS_TextAlign	COLUMN	TAXA_TRIBE	0
MS_AggregateType	COLUMN	TAXONSHORT	-1
MS_ColumnHidden	COLUMN	TAXONSHORT	False
MS_ColumnOrder	COLUMN	TAXONSHORT	1
MS_ColumnWidth	COLUMN	TAXONSHORT	1665
MS_TextAlign	COLUMN	TAXONSHORT	0
MS_AggregateType	COLUMN	TSN	-1
MS_ColumnHidden	COLUMN	TSN	False
MS_ColumnOrder	COLUMN	TSN	2
MS_ColumnWidth	COLUMN	TSN	975
MS_TextAlign	COLUMN	TSN	0

Uses

dbo

[dbo].[tluLifeStageCodes]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluLifeStageCodes

This look-up table is used by the lab analyzing invertebrate samples to select the life stage of the specimens present in the sample. It can be updated if additional life stages are identified by the lab.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	3
Created	1:34:54 PM Friday, April 02, 2010
Last Modified	1:34:54 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	LIFESTAGECODE	nvarchar(255)	510	✗
	LIFESTAGEDESCRIPTION	nvarchar(255)	510	✓
	SOURCEDB	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	pk_tluLifeStageCodes	LIFESTAGECODE	✓

Uses

dbo

[dbo].[tluLittoralHabitat]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluLittoralHabitat

This look-up table contains the list of choices that can be used in the Dominant Habitat field of tblInvertebrateSamples or frmInvertCollection.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Heap	✓
Row Count	5
Created	1:35:34 PM Friday, April 02, 2010
Last Modified	1:35:34 PM Friday, April 02, 2010

Columns

Name	Data Type	Max Length (Bytes)	Allow Nulls
LITTORALHABITAT	nvarchar(50)	100	✓
DESCRIPTION	nvarchar(max)	max	✓
SOURCEDB	nvarchar(50)	100	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	DESCRIPTION	-1
MS_ColumnHidden	COLUMN	DESCRIPTION	False
MS_ColumnOrder	COLUMN	DESCRIPTION	0
MS_ColumnWidth	COLUMN	DESCRIPTION	13905
MS_TextAlign	COLUMN	DESCRIPTION	0
MS_AggregateType	COLUMN	LITTORALHABITAT	-1
MS_ColumnHidden	COLUMN	LITTORALHABITAT	False
MS_ColumnOrder	COLUMN	LITTORALHABITAT	0
MS_ColumnWidth	COLUMN	LITTORALHABITAT	-1
MS_TextAlign	COLUMN	LITTORALHABITAT	0
MS_AggregateType	COLUMN	SOURCEDB	-1
MS_ColumnHidden	COLUMN	SOURCEDB	False
MS_ColumnOrder	COLUMN	SOURCEDB	0
MS_ColumnWidth	COLUMN	SOURCEDB	-1
MS_TextAlign	COLUMN	SOURCEDB	0

Uses

dbo

[dbo].[tluLoggerModel]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluLoggerModel

This look-up table can be used to select logger type in the continuous monitoring tables and forms. It includes temperature and pressure loggers, as well as all types of Sonde multi-probes.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	7
Created	1:36:19 PM Friday, April 02, 2010
Last Modified	1:36:19 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	LoggerModelCode	nvarchar(50)	100	✗
	LoggerModel	nvarchar(50)	100	✗

Indexes

	Name	Columns	Unique
	PK_tluLoggerModel	LoggerModelCode	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	LoggerModel	-1
MS_ColumnHidden	COLUMN	LoggerModel	False
MS_ColumnOrder	COLUMN	LoggerModel	2
MS_ColumnWidth	COLUMN	LoggerModel	3495
MS_DisplayControl	COLUMN	LoggerModel	109
MS_Format	COLUMN	LoggerModel	
MS_IMEMode	COLUMN	LoggerModel	0
MS_TextAlign	COLUMN	LoggerModel	0
MS_AggregateType	COLUMN	LoggerModelCode	-1
MS_ColumnHidden	COLUMN	LoggerModelCode	False
MS_ColumnOrder	COLUMN	LoggerModelCode	1
MS_ColumnWidth	COLUMN	LoggerModelCode	3000
MS_DisplayControl	COLUMN	LoggerModelCode	109
MS_Format	COLUMN	LoggerModelCode	
MS_IMEMode	COLUMN	LoggerModelCode	0
MS_TextAlign	COLUMN	LoggerModelCode	0

Uses

dbo

[dbo].[tluLoggerType]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluLoggerType

This look-up table contains the different types of dataloggers, and can be used to select the appropriate logger type in the Continuous Monitoring tables and forms.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	5
Created	1:36:33 PM Friday, April 02, 2010
Last Modified	1:36:33 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	LoggerTypeCode	nvarchar(50)	100	✗
	LoggerType	nvarchar(50)	100	✗

Indexes

	Name	Columns	Unique
	PK_tluLoggerType	LoggerTypeCode	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	LoggerType	-1
MS_ColumnHidden	COLUMN	LoggerType	False
MS_ColumnOrder	COLUMN	LoggerType	0
MS_ColumnWidth	COLUMN	LoggerType	3450
MS_DisplayControl	COLUMN	LoggerType	109
MS_Format	COLUMN	LoggerType	
MS_IMEMode	COLUMN	LoggerType	0
MS_TextAlign	COLUMN	LoggerType	0
MS_AggregateType	COLUMN	LoggerTypeCode	-1
MS_ColumnHidden	COLUMN	LoggerTypeCode	False
MS_ColumnOrder	COLUMN	LoggerTypeCode	1
MS_ColumnWidth	COLUMN	LoggerTypeCode	2625
MS_DisplayControl	COLUMN	LoggerTypeCode	109
MS_Format	COLUMN	LoggerTypeCode	
MS_IMEMode	COLUMN	LoggerTypeCode	0
MS_TextAlign	COLUMN	LoggerTypeCode	0

Uses

dbo

[dbo].[tluLoonDetection]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluLoonDetection

This look-up table lists the different methods of identifying a loon species. It is referenced in tblLoon and frmLoon.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	10
Created	1:36:46 PM Friday, April 02, 2010
Last Modified	1:36:46 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	DETECTION_CODE	nvarchar(50)	100	✗
	DETECTION_TYPE	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	PK_tluLoonDetection	DETECTION_CODE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	DETECTION_CODE	-1
MS_ColumnHidden	COLUMN	DETECTION_CODE	False
MS_ColumnOrder	COLUMN	DETECTION_CODE	0
MS_ColumnWidth	COLUMN	DETECTION_CODE	2070
MS_DisplayControl	COLUMN	DETECTION_CODE	109
MS_Format	COLUMN	DETECTION_CODE	
MS_IMEMode	COLUMN	DETECTION_CODE	0
MS_TextAlign	COLUMN	DETECTION_CODE	0
MS_AggregateType	COLUMN	DETECTION_TYPE	-1
MS_ColumnHidden	COLUMN	DETECTION_TYPE	False
MS_ColumnOrder	COLUMN	DETECTION_TYPE	0
MS_ColumnWidth	COLUMN	DETECTION_TYPE	1995
MS_DisplayControl	COLUMN	DETECTION_TYPE	109
MS_Format	COLUMN	DETECTION_TYPE	
MS_IMEMode	COLUMN	DETECTION_TYPE	0
MS_TextAlign	COLUMN	DETECTION_TYPE	0

Uses

dbo

[dbo].[tluLoonSpecies]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluLoonSpecies

This look-up table lists the loon species present in Alaska, and is referenced in tblLoons and frmLoons.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	5
Created	1:36:57 PM Friday, April 02, 2010
Last Modified	1:36:57 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	LOON_SPECIES_CODE	nvarchar(50)	100	✗
	LOON_COMMON_NAME	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	PK_tluLoonSpecies	LOON_SPECIES_CODE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	LOON_COMMON_NAME	-1
MS_ColumnHidden	COLUMN	LOON_COMMON_NAME	False
MS_ColumnOrder	COLUMN	LOON_COMMON_NAME	0
MS_ColumnWidth	COLUMN	LOON_COMMON_NAME	2670
MS_DisplayControl	COLUMN	LOON_COMMON_NAME	109
MS_Format	COLUMN	LOON_COMMON_NAME	
MS_IMEMode	COLUMN	LOON_COMMON_NAME	0
MS_TextAlign	COLUMN	LOON_COMMON_NAME	0
MS_AggregateType	COLUMN	LOON_SPECIES_CODE	-1
MS_ColumnHidden	COLUMN	LOON_SPECIES_CODE	False
MS_ColumnOrder	COLUMN	LOON_SPECIES_CODE	0
MS_ColumnWidth	COLUMN	LOON_SPECIES_CODE	2400
MS_DisplayControl	COLUMN	LOON_SPECIES_CODE	109
MS_Format	COLUMN	LOON_SPECIES_CODE	
MS_IMEMode	COLUMN	LOON_SPECIES_CODE	0
MS_TextAlign	COLUMN	LOON_SPECIES_CODE	0

Uses

dbo

[dbo].[tluLoonVeg]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluLoonVeg

This look-up table lists the different veg codes that can be referenced to select the appropriate entry in tblLoons and frm-Loons.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	12
Created	1:37:12 PM Friday, April 02, 2010
Last Modified	1:37:12 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	VEG_CLASS_CODE	nvarchar(50)	100	✗
	VEG_CLASS	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	PK_tluLoonVeg	VEG_CLASS_CODE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	VEG_CLASS	-1
MS_ColumnHidden	COLUMN	VEG_CLASS	False
MS_ColumnOrder	COLUMN	VEG_CLASS	0
MS_ColumnWidth	COLUMN	VEG_CLASS	3135
MS_DisplayControl	COLUMN	VEG_CLASS	109
MS_Format	COLUMN	VEG_CLASS	
MS_IMEMode	COLUMN	VEG_CLASS	0
MS_TextAlign	COLUMN	VEG_CLASS	0
MS_AggregateType	COLUMN	VEG_CLASS_CODE	-1
MS_ColumnHidden	COLUMN	VEG_CLASS_CODE	False
MS_ColumnOrder	COLUMN	VEG_CLASS_CODE	0
MS_ColumnWidth	COLUMN	VEG_CLASS_CODE	2055
MS_DisplayControl	COLUMN	VEG_CLASS_CODE	109
MS_Format	COLUMN	VEG_CLASS_CODE	
MS_IMEMode	COLUMN	VEG_CLASS_CODE	0
MS_TextAlign	COLUMN	VEG_CLASS_CODE	0

Uses

dbo

[dbo].[tluObserver]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluObserver

This look-up table lists all the personnel who have participated in data collection for this project. This table can be referenced by any table or form where a drop-down box for observer would be beneficial, or it can just serve as a reference.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	19
Created	1:38:26 PM Friday, April 02, 2010
Last Modified	1:38:26 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls	Default
🔑	OBSINITS	nvarchar(10)	20	✘	
	LASTNAME	nvarchar(50)	100	✓	
	FIRSTNAME	nvarchar(50)	100	✓	
	MIDDLEINIT	nvarchar(5)	10	✓	
	SORTNUMBER	nvarchar(50)	100	✓	((99))
	AGENCY_TITLE	nvarchar(255)	510	✓	
	ADDRESS	nvarchar(255)	510	✓	
	ADDRESS2	nvarchar(255)	510	✓	
	CITY	nvarchar(50)	100	✓	
	STATE	nvarchar(50)	100	✓	
	ZIPCODE	nvarchar(50)	100	✓	
	EMAILADDRESS	nvarchar(50)	100	✓	
	HOMEPHONE	nvarchar(20)	40	✓	
	WORKPHONE	nchar(20)	40	✓	
	WORKEXTENSION	nvarchar(5)	10	✓	
	FAXNUMBER	nvarchar(20)	40	✓	
	NOTES	nvarchar(max)	max	✓	
	SOURCEDB	nvarchar(50)	100	✓	

Indexes

	Name	Columns	Unique
🔑	pk_tluObserver	OBSINITS	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	ADDRESS	-1
MS_ColumnHidden	COLUMN	ADDRESS	False
MS_ColumnOrder	COLUMN	ADDRESS	0
MS_ColumnWidth	COLUMN	ADDRESS	6705
MS_TextAlign	COLUMN	ADDRESS	0
MS_AggregateType	COLUMN	ADDRESS2	-1
MS_ColumnHidden	COLUMN	ADDRESS2	False
MS_ColumnOrder	COLUMN	ADDRESS2	0
MS_ColumnWidth	COLUMN	ADDRESS2	-1
MS_TextAlign	COLUMN	ADDRESS2	0
MS_AggregateType	COLUMN	AGENCY_TITLE	-1
MS_ColumnHidden	COLUMN	AGENCY_TITLE	False
MS_ColumnOrder	COLUMN	AGENCY_TITLE	0
MS_ColumnWidth	COLUMN	AGENCY_TITLE	-1
MS_TextAlign	COLUMN	AGENCY_TITLE	0
MS_AggregateType	COLUMN	CITY	-1
MS_ColumnHidden	COLUMN	CITY	False
MS_ColumnOrder	COLUMN	CITY	0
MS_ColumnWidth	COLUMN	CITY	-1
MS_TextAlign	COLUMN	CITY	0
MS_AggregateType	COLUMN	EMAILADDRESS	-1
MS_ColumnHidden	COLUMN	EMAILADDRESS	False
MS_ColumnOrder	COLUMN	EMAILADDRESS	0
MS_ColumnWidth	COLUMN	EMAILADDRESS	-1
MS_TextAlign	COLUMN	EMAILADDRESS	0
MS_AggregateType	COLUMN	FAXNUMBER	-1
MS_ColumnHidden	COLUMN	FAXNUMBER	False
MS_ColumnOrder	COLUMN	FAXNUMBER	0
MS_ColumnWidth	COLUMN	FAXNUMBER	-1

MS_TextAlign	COLUMN	FAXNUMBER	0
MS_AggregateType	COLUMN	FIRSTNAME	-1
MS_ColumnHidden	COLUMN	FIRSTNAME	False
MS_ColumnOrder	COLUMN	FIRSTNAME	0
MS_ColumnWidth	COLUMN	FIRSTNAME	-1
MS_TextAlign	COLUMN	FIRSTNAME	0
MS_AggregateType	COLUMN	HOMEPHONE	-1
MS_ColumnHidden	COLUMN	HOMEPHONE	False
MS_ColumnOrder	COLUMN	HOMEPHONE	0
MS_ColumnWidth	COLUMN	HOMEPHONE	-1
MS_TextAlign	COLUMN	HOMEPHONE	0
MS_AggregateType	COLUMN	LASTNAME	-1
MS_ColumnHidden	COLUMN	LASTNAME	False
MS_ColumnOrder	COLUMN	LASTNAME	0
MS_ColumnWidth	COLUMN	LASTNAME	-1
MS_TextAlign	COLUMN	LASTNAME	0
MS_AggregateType	COLUMN	MIDDLEINIT	-1
MS_ColumnHidden	COLUMN	MIDDLEINIT	False
MS_ColumnOrder	COLUMN	MIDDLEINIT	0
MS_ColumnWidth	COLUMN	MIDDLEINIT	-1
MS_TextAlign	COLUMN	MIDDLEINIT	0
MS_AggregateType	COLUMN	NOTES	-1
MS_ColumnHidden	COLUMN	NOTES	False
MS_ColumnOrder	COLUMN	NOTES	0
MS_ColumnWidth	COLUMN	NOTES	-1
MS_TextAlign	COLUMN	NOTES	0
MS_AggregateType	COLUMN	OBSINITS	-1
MS_ColumnHidden	COLUMN	OBSINITS	False
MS_ColumnOrder	COLUMN	OBSINITS	0
MS_ColumnWidth	COLUMN	OBSINITS	-1
MS_TextAlign	COLUMN	OBSINITS	0
MS_AggregateType	COLUMN	SORTNUMBER	-1
MS_ColumnHidden	COLUMN	SORTNUMBER	False
MS_ColumnOrder	COLUMN	SORTNUMBER	0
MS_ColumnWidth	COLUMN	SORTNUMBER	-1
MS_DisplayControl	COLUMN	SORTNUMBER	109
MS_Format	COLUMN	SORTNUMBER	
MS_IMEMode	COLUMN	SORTNUMBER	0
MS_TextAlign	COLUMN	SORTNUMBER	0
MS_AggregateType	COLUMN	SOURCEDB	-1
MS_ColumnHidden	COLUMN	SOURCEDB	False
MS_ColumnOrder	COLUMN	SOURCEDB	0

MS_ColumnWidth	COLUMN	SOURCEDB	-1
MS_TextAlign	COLUMN	SOURCEDB	0
MS_AggregateType	COLUMN	STATE	-1
MS_ColumnHidden	COLUMN	STATE	False
MS_ColumnOrder	COLUMN	STATE	0
MS_ColumnWidth	COLUMN	STATE	-1
MS_TextAlign	COLUMN	STATE	0
MS_AggregateType	COLUMN	WORKEXTENSION	-1
MS_ColumnHidden	COLUMN	WORKEXTENSION	False
MS_ColumnOrder	COLUMN	WORKEXTENSION	0
MS_ColumnWidth	COLUMN	WORKEXTENSION	-1
MS_TextAlign	COLUMN	WORKEXTENSION	0
MS_AggregateType	COLUMN	WORKPHONE	-1
MS_ColumnHidden	COLUMN	WORKPHONE	False
MS_ColumnOrder	COLUMN	WORKPHONE	0
MS_ColumnWidth	COLUMN	WORKPHONE	-1
MS_TextAlign	COLUMN	WORKPHONE	0
MS_AggregateType	COLUMN	ZIPCODE	-1
MS_ColumnHidden	COLUMN	ZIPCODE	False
MS_ColumnOrder	COLUMN	ZIPCODE	0
MS_ColumnWidth	COLUMN	ZIPCODE	-1
MS_TextAlign	COLUMN	ZIPCODE	0

Uses

dbo

[dbo].[tluParkCode]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluParkCode

This look-up table lists the park codes for the units covered by the scope of this project. It can be referenced by any table or form where it would be convenient to have a drop-down box for park code.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Heap	✓
Row Count	8
Created	2:37:13 PM Friday, April 02, 2010
Last Modified	2:37:13 PM Friday, April 02, 2010

Columns

Name	Data Type	Max Length (Bytes)	Allow Nulls
PARKCODE	nvarchar(10)	20	✓
PARKNAME	nvarchar(50)	100	✓
PARKTYPE	nvarchar(50)	100	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	PARKCODE	-1
MS_ColumnHidden	COLUMN	PARKCODE	False
MS_ColumnOrder	COLUMN	PARKCODE	1
MS_ColumnWidth	COLUMN	PARKCODE	-1
MS_TextAlign	COLUMN	PARKCODE	0
MS_AggregateType	COLUMN	PARKNAME	-1
MS_ColumnHidden	COLUMN	PARKNAME	False
MS_ColumnOrder	COLUMN	PARKNAME	0
MS_ColumnWidth	COLUMN	PARKNAME	4185
MS_TextAlign	COLUMN	PARKNAME	0
MS_AggregateType	COLUMN	PARKTYPE	-1
MS_ColumnHidden	COLUMN	PARKTYPE	False
MS_ColumnOrder	COLUMN	PARKTYPE	0
MS_ColumnWidth	COLUMN	PARKTYPE	3105
MS_TextAlign	COLUMN	PARKTYPE	0

Uses

dbo

[dbo].[tluPondClassGenesis]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluPondClassGenesis

This look-up table is used to select the Genesis code when entering data into tblPonds.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	6
Created	1:39:09 PM Friday, April 02, 2010
Last Modified	1:39:09 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	GENESIS	nvarchar(50)	100	✗
	DESCRIPTION	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	PK_tluPondClassGenesis	GENESIS	✓

Uses

dbo

[dbo].[tluPondClassSalinity]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluPondClassSalinity

This look-up table is used to select the Salinity code when entering data into tblPonds.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	3
Created	1:39:20 PM Friday, April 02, 2010
Last Modified	1:39:20 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	SALINITY	nvarchar(50)	100	✗
	DESCRIPTION	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	PK_tluPondClassSalinity	SALINITY	✓

Uses

dbo

[dbo].[tluPondClassShoreline]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluPondClassShoreline

This look-up table is used to select the Shoreline code when entering data into tblPonds.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	3
Created	1:39:33 PM Friday, April 02, 2010
Last Modified	1:39:33 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	SHORELINE	nvarchar(50)	100	✗
	DESCRIPTION	nvarchar(50)	100	✓
	SORTNUMBER	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	PK_tluPondClassShoreline	SHORELINE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			[tluPondClassShoreline].[SORTNUMBER]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	DESCRIPTION	-1
MS_ColumnHidden	COLUMN	DESCRIPTION	False
MS_ColumnOrder	COLUMN	DESCRIPTION	0
MS_ColumnWidth	COLUMN	DESCRIPTION	-1
MS_TextAlign	COLUMN	DESCRIPTION	0
MS_AggregateType	COLUMN	SHORELINE	-1
MS_ColumnHidden	COLUMN	SHORELINE	False
MS_ColumnOrder	COLUMN	SHORELINE	0
MS_ColumnWidth	COLUMN	SHORELINE	-1
MS_TextAlign	COLUMN	SHORELINE	0
MS_AggregateType	COLUMN	SORTNUMBER	-1
MS_ColumnHidden	COLUMN	SORTNUMBER	False
MS_ColumnOrder	COLUMN	SORTNUMBER	0
MS_ColumnWidth	COLUMN	SORTNUMBER	-1
MS_DisplayControl	COLUMN	SORTNUMBER	109
MS_Format	COLUMN	SORTNUMBER	
MS_IMEMode	COLUMN	SORTNUMBER	0
MS_TextAlign	COLUMN	SORTNUMBER	0

Uses

dbo

[dbo].[tluSubmergedVeg]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluSubmergedVeg

This look-up table is used to select the Submerged Vegetation Coverage code when entering data into tblEvents.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	5
Created	1:39:47 PM Friday, April 02, 2010
Last Modified	1:39:47 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	SUBMERGED_VEG_CODE *Code for submerged vegetation cover*	nvarchar(50)	100	✗
	SUBMERGED_VEG_DESC *Description of submerged vegetation cover*	nvarchar(50)	100	✓

Indexes

	Name	Columns	Unique
	PK_tluSubmergedVeg	SUBMERGED_VEG_CODE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	SUBMERGED_VEG_CODE	-1
MS_ColumnHidden	COLUMN	SUBMERGED_VEG_CODE	False
MS_ColumnOrder	COLUMN	SUBMERGED_VEG_CODE	0
MS_ColumnWidth	COLUMN	SUBMERGED_VEG_CODE	2655
MS_DisplayControl	COLUMN	SUBMERGED_VEG_CODE	109
MS_Format	COLUMN	SUBMERGED_VEG_CODE	
MS_IMEMode	COLUMN	SUBMERGED_VEG_CODE	0
MS_TextAlign	COLUMN	SUBMERGED_VEG_CODE	0
MS_AggregateType	COLUMN	SUBMERGED_VEG_DESC	-1
MS_ColumnHidden	COLUMN	SUBMERGED_VEG_DESC	False
MS_ColumnOrder	COLUMN	SUBMERGED_VEG_DESC	0
MS_ColumnWidth	COLUMN	SUBMERGED_VEG_DESC	3960
MS_DisplayControl	COLUMN	SUBMERGED_VEG_DESC	109
MS_Format	COLUMN	SUBMERGED_VEG_DESC	
MS_IMEMode	COLUMN	SUBMERGED_VEG_DESC	0
MS_TextAlign	COLUMN	SUBMERGED_VEG_DESC	0

Uses

dbo

[dbo].[tluVegTaxa]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluVegTaxa

This look-up table is a list of plant species, as generated by Carl Roland in the mid-2000s. It contains extensive information for many species. When a species is encountered in this project, a 1 is entered in the SHALLOW_LAKES field to generate lists.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	872
Created	11:44:48 AM Wednesday, April 28, 2010
Last Modified	11:44:49 AM Wednesday, April 28, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	SPECIES_CODE *The 6-letter code representing the species name*	nvarchar(50)	100	✗
	USDA_CODE *The code used by the USDA*	nvarchar(50)	100	✓
	SHALLOW_LAKES *Enter 1 if this species is encountered or expected to be encountered on the Shallow Lakes project.*	int	4	✓
	SH_LAKE_NAME *The simplified scientific name (just genus and species, no designations or initials)*	nvarchar(50)	100	✓
	COMMON_NAME *The common name for the species, if known.*	nvarchar(50)	100	✓
	ANALYSIS_CODE *The species code that will be used for analysis (i.e. moss for all different kinds of moss)*	nvarchar(50)	100	✓
	SH_LAKE_GROWTHFORM *The growth form of the species that will be used for analysis.*	nvarchar(50)	100	✓
	DIFF_PLANTS_DB	nvarchar(50)	100	✓
	TRANSECT_COVER_ELEMENT	nvarchar(50)	100	✓
	DURATION	nvarchar(50)	100	✓
	USDA_NAME	nvarchar(200)	400	✓
	ENDEM_CODE	nvarchar(50)	100	✓
	ENDEM	nvarchar(50)	100	✓
	ENDEM_TYPE	nvarchar(50)	100	✓
	FAMILY_NAME	nvarchar(50)	100	✓
	SPECIES_AUTHOR	nvarchar(50)	100	✓
	GENUS_NAME	nvarchar(50)	100	✓
	SPECIES_NAME	nvarchar(50)	100	✓
	VASC_AKNHP_S_RANK	nvarchar(50)	100	✓
	SCIENTIFIC_NAME	nvarchar(200)	400	✓
	VASC_AKNHP_G_RANK	nvarchar(50)	100	✓
	INFRA_AUTHOR	nvarchar(50)	100	✓
	INF_NAME	nvarchar(50)	100	✓

	INF_RANK	nvarchar(50)	100	✓
	GROWTH_FORM1	nvarchar(50)	100	✓
	GROWTH_FORM1_CODE	nvarchar(50)	100	✓
	GROWTH_FORM2_CODE	nvarchar(50)	100	✓
	GROWTH_FORM2	nvarchar(50)	100	✓
	RANGE_CATEGORY1	nvarchar(50)	100	✓
	VASCULAR_CODE	nvarchar(50)	100	✓
	COMPOSITE_SPECIES_CODE1	nvarchar(50)	100	✓
	COMPOSITE_SPECIES_CODE2	nvarchar(50)	100	✓
	COMPOSITE_CONSTITUENT_SPECIES1	nvarchar(255)	510	✓
	COMPOSITE_CONSTITUENT_SPECIES2	nvarchar(255)	510	✓

Indexes

	Name	Columns	Unique
	pk_ref_taxon	SPECIES_CODE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			(SHALLOW_LAKES Is Not Null)
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			[tluTaxon].[SPECIES_CODE], [tluTaxon].[SHALLOW_-LAKES]
MS_OrderByOn			True
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	ANALYSIS_CODE	-1
MS_ColumnHidden	COLUMN	ANALYSIS_CODE	False
MS_ColumnOrder	COLUMN	ANALYSIS_CODE	6
MS_ColumnWidth	COLUMN	ANALYSIS_CODE	-1
MS_DisplayControl	COLUMN	ANALYSIS_CODE	109
MS_Format	COLUMN	ANALYSIS_CODE	
MS_IMEMode	COLUMN	ANALYSIS_CODE	0
MS_TextAlign	COLUMN	ANALYSIS_CODE	0
MS_AggregateType	COLUMN	COMMON_NAME	-1
MS_ColumnHidden	COLUMN	COMMON_NAME	False
MS_ColumnOrder	COLUMN	COMMON_NAME	5
MS_ColumnWidth	COLUMN	COMMON_NAME	2400
MS_DisplayControl	COLUMN	COMMON_NAME	109
MS_Format	COLUMN	COMMON_NAME	
MS_IMEMode	COLUMN	COMMON_NAME	0
MS_TextAlign	COLUMN	COMMON_NAME	0
MS_AggregateType	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES1	-1
MS_ColumnHidden	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES1	False
MS_ColumnOrder	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES1	0
MS_ColumnWidth	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES1	-1
MS_TextAlign	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES1	0
MS_AggregateType	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES2	-1
MS_ColumnHidden	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES2	False

MS_ColumnOrder	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES2	0
MS_ColumnWidth	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES2	-1
MS_TextAlign	COLUMN	COMPOSITE_-CONSTITUENT_SPECIES2	0
MS_AggregateType	COLUMN	COMPOSITE_SPECIES_-CODE1	-1
MS_ColumnHidden	COLUMN	COMPOSITE_SPECIES_-CODE1	False
MS_ColumnOrder	COLUMN	COMPOSITE_SPECIES_-CODE1	0
MS_ColumnWidth	COLUMN	COMPOSITE_SPECIES_-CODE1	-1
MS_TextAlign	COLUMN	COMPOSITE_SPECIES_-CODE1	0
MS_AggregateType	COLUMN	COMPOSITE_SPECIES_-CODE2	-1
MS_ColumnHidden	COLUMN	COMPOSITE_SPECIES_-CODE2	False
MS_ColumnOrder	COLUMN	COMPOSITE_SPECIES_-CODE2	0
MS_ColumnWidth	COLUMN	COMPOSITE_SPECIES_-CODE2	-1
MS_TextAlign	COLUMN	COMPOSITE_SPECIES_-CODE2	0
MS_AggregateType	COLUMN	DIFF_PLANTS_DB	-1
MS_ColumnHidden	COLUMN	DIFF_PLANTS_DB	False
MS_ColumnOrder	COLUMN	DIFF_PLANTS_DB	9
MS_ColumnWidth	COLUMN	DIFF_PLANTS_DB	-1
MS_TextAlign	COLUMN	DIFF_PLANTS_DB	0
MS_AggregateType	COLUMN	DURATION	-1
MS_ColumnHidden	COLUMN	DURATION	False
MS_ColumnOrder	COLUMN	DURATION	11
MS_ColumnWidth	COLUMN	DURATION	-1
MS_TextAlign	COLUMN	DURATION	0
MS_AggregateType	COLUMN	ENDEM	-1
MS_ColumnHidden	COLUMN	ENDEM	False
MS_ColumnOrder	COLUMN	ENDEM	14
MS_ColumnWidth	COLUMN	ENDEM	-1
MS_TextAlign	COLUMN	ENDEM	0
MS_AggregateType	COLUMN	ENDEM_CODE	-1
MS_ColumnHidden	COLUMN	ENDEM_CODE	False
MS_ColumnOrder	COLUMN	ENDEM_CODE	13
MS_ColumnWidth	COLUMN	ENDEM_CODE	-1
MS_TextAlign	COLUMN	ENDEM_CODE	0
MS_AggregateType	COLUMN	ENDEM_TYPE	-1

MS_ColumnHidden	COLUMN	ENDEM_TYPE	False
MS_ColumnOrder	COLUMN	ENDEM_TYPE	15
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MS_TextAlign	COLUMN	ENDEM_TYPE	0
MS_AggregateType	COLUMN	FAMILY_NAME	-1
MS_ColumnHidden	COLUMN	FAMILY_NAME	False
MS_ColumnOrder	COLUMN	FAMILY_NAME	16
MS_ColumnWidth	COLUMN	FAMILY_NAME	-1
MS_TextAlign	COLUMN	FAMILY_NAME	0
MS_AggregateType	COLUMN	GENUS_NAME	-1
MS_ColumnHidden	COLUMN	GENUS_NAME	False
MS_ColumnOrder	COLUMN	GENUS_NAME	18
MS_ColumnWidth	COLUMN	GENUS_NAME	-1
MS_TextAlign	COLUMN	GENUS_NAME	0
MS_AggregateType	COLUMN	GROWTH_FORM1	-1
MS_ColumnHidden	COLUMN	GROWTH_FORM1	False
MS_ColumnOrder	COLUMN	GROWTH_FORM1	8
MS_ColumnWidth	COLUMN	GROWTH_FORM1	3105
MS_TextAlign	COLUMN	GROWTH_FORM1	0
MS_AggregateType	COLUMN	GROWTH_FORM1_CODE	-1
MS_ColumnHidden	COLUMN	GROWTH_FORM1_CODE	False
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MS_AggregateType	COLUMN	GROWTH_FORM2	-1
MS_ColumnHidden	COLUMN	GROWTH_FORM2	False
MS_ColumnOrder	COLUMN	GROWTH_FORM2	0
MS_ColumnWidth	COLUMN	GROWTH_FORM2	3075
MS_TextAlign	COLUMN	GROWTH_FORM2	0
MS_AggregateType	COLUMN	GROWTH_FORM2_CODE	-1
MS_ColumnHidden	COLUMN	GROWTH_FORM2_CODE	False
MS_ColumnOrder	COLUMN	GROWTH_FORM2_CODE	0
MS_ColumnWidth	COLUMN	GROWTH_FORM2_CODE	2640
MS_TextAlign	COLUMN	GROWTH_FORM2_CODE	0
MS_AggregateType	COLUMN	INF_NAME	-1
MS_ColumnHidden	COLUMN	INF_NAME	False
MS_ColumnOrder	COLUMN	INF_NAME	24
MS_ColumnWidth	COLUMN	INF_NAME	-1
MS_TextAlign	COLUMN	INF_NAME	0
MS_AggregateType	COLUMN	INF_RANK	-1
MS_ColumnHidden	COLUMN	INF_RANK	False
MS_ColumnOrder	COLUMN	INF_RANK	25

MS_ColumnWidth	COLUMN	INF_RANK	-1
MS_TextAlign	COLUMN	INF_RANK	0
MS_AggregateType	COLUMN	INFRA_AUTHOR	-1
MS_ColumnHidden	COLUMN	INFRA_AUTHOR	False
MS_ColumnOrder	COLUMN	INFRA_AUTHOR	23
MS_ColumnWidth	COLUMN	INFRA_AUTHOR	-1
MS_TextAlign	COLUMN	INFRA_AUTHOR	0
MS_AggregateType	COLUMN	RANGE_CATEGORY1	-1
MS_ColumnHidden	COLUMN	RANGE_CATEGORY1	False
MS_ColumnOrder	COLUMN	RANGE_CATEGORY1	0
MS_ColumnWidth	COLUMN	RANGE_CATEGORY1	-1
MS_TextAlign	COLUMN	RANGE_CATEGORY1	0
MS_AggregateType	COLUMN	SCIENTIFIC_NAME	-1
MS_ColumnHidden	COLUMN	SCIENTIFIC_NAME	False
MS_ColumnOrder	COLUMN	SCIENTIFIC_NAME	21
MS_ColumnWidth	COLUMN	SCIENTIFIC_NAME	5565
MS_TextAlign	COLUMN	SCIENTIFIC_NAME	0
MS_AggregateType	COLUMN	SH_LAKE_GROWTHFORM	-1
MS_AllowValueListEdits	COLUMN	SH_LAKE_GROWTHFORM	False
MS_ColumnHidden	COLUMN	SH_LAKE_GROWTHFORM	False
MS_ColumnOrder	COLUMN	SH_LAKE_GROWTHFORM	7
MS_ColumnWidth	COLUMN	SH_LAKE_GROWTHFORM	-1
MS_DisplayControl	COLUMN	SH_LAKE_GROWTHFORM	111
MS_Format	COLUMN	SH_LAKE_GROWTHFORM	
MS_IMEMode	COLUMN	SH_LAKE_GROWTHFORM	0
MS_ListItemsEditForm	COLUMN	SH_LAKE_GROWTHFORM	
MS_RowSource	COLUMN	SH_LAKE_GROWTHFORM	Moss;Lichen;Liverwort;Forb;Dwarf Shrub;Shrub;Horsetail;Graminoid;Aquatic
MS_RowSourceType	COLUMN	SH_LAKE_GROWTHFORM	Value List
MS_ShowOnlyRowSourceValues	COLUMN	SH_LAKE_GROWTHFORM	False
MS_TextAlign	COLUMN	SH_LAKE_GROWTHFORM	0
MS_AggregateType	COLUMN	SH_LAKE_NAME	-1
MS_ColumnHidden	COLUMN	SH_LAKE_NAME	False
MS_ColumnOrder	COLUMN	SH_LAKE_NAME	4
MS_ColumnWidth	COLUMN	SH_LAKE_NAME	2340
MS_DisplayControl	COLUMN	SH_LAKE_NAME	109
MS_Format	COLUMN	SH_LAKE_NAME	
MS_IMEMode	COLUMN	SH_LAKE_NAME	0
MS_TextAlign	COLUMN	SH_LAKE_NAME	0
MS_AggregateType	COLUMN	SHALLOW_LAKES	-1
MS_ColumnHidden	COLUMN	SHALLOW_LAKES	False

MS_ColumnOrder	COLUMN	SHALLOW_LAKES	3
MS_ColumnWidth	COLUMN	SHALLOW_LAKES	1410
MS_DisplayControl	COLUMN	SHALLOW_LAKES	109
MS_Format	COLUMN	SHALLOW_LAKES	
MS_IMEMode	COLUMN	SHALLOW_LAKES	0
MS_TextAlign	COLUMN	SHALLOW_LAKES	0
MS_AggregateType	COLUMN	SPECIES_AUTHOR	-1
MS_ColumnHidden	COLUMN	SPECIES_AUTHOR	False
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MS_ColumnHidden	COLUMN	SPECIES_CODE	False
MS_ColumnOrder	COLUMN	SPECIES_CODE	1
MS_ColumnWidth	COLUMN	SPECIES_CODE	3015
MS_TextAlign	COLUMN	SPECIES_CODE	0
MS_AggregateType	COLUMN	SPECIES_NAME	-1
MS_ColumnHidden	COLUMN	SPECIES_NAME	False
MS_ColumnOrder	COLUMN	SPECIES_NAME	19
MS_ColumnWidth	COLUMN	SPECIES_NAME	-1
MS_TextAlign	COLUMN	SPECIES_NAME	0
MS_AggregateType	COLUMN	TRANSECT_COVER_-ELEMENT	-1
MS_ColumnHidden	COLUMN	TRANSECT_COVER_-ELEMENT	False
MS_ColumnOrder	COLUMN	TRANSECT_COVER_-ELEMENT	10
MS_ColumnWidth	COLUMN	TRANSECT_COVER_-ELEMENT	3075
MS_TextAlign	COLUMN	TRANSECT_COVER_-ELEMENT	0
MS_AggregateType	COLUMN	USDA_CODE	-1
MS_ColumnHidden	COLUMN	USDA_CODE	False
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MS_ColumnWidth	COLUMN	USDA_CODE	-1
MS_TextAlign	COLUMN	USDA_CODE	0
MS_AggregateType	COLUMN	USDA_NAME	-1
MS_ColumnHidden	COLUMN	USDA_NAME	False
MS_ColumnOrder	COLUMN	USDA_NAME	12
MS_ColumnWidth	COLUMN	USDA_NAME	9690
MS_TextAlign	COLUMN	USDA_NAME	0
MS_AggregateType	COLUMN	VASC_AKNHP_G_RANK	-1
MS_ColumnHidden	COLUMN	VASC_AKNHP_G_RANK	False
MS_ColumnOrder	COLUMN	VASC_AKNHP_G_RANK	22

MS_ColumnWidth	COLUMN	VASC_AKNHP_G_RANK	-1
MS_TextAlign	COLUMN	VASC_AKNHP_G_RANK	0
MS_AggregateType	COLUMN	VASC_AKNHP_S_RANK	-1
MS_ColumnHidden	COLUMN	VASC_AKNHP_S_RANK	False
MS_ColumnOrder	COLUMN	VASC_AKNHP_S_RANK	20
MS_ColumnWidth	COLUMN	VASC_AKNHP_S_RANK	-1
MS_TextAlign	COLUMN	VASC_AKNHP_S_RANK	0
MS_AggregateType	COLUMN	VASCULAR_CODE	-1
MS_ColumnHidden	COLUMN	VASCULAR_CODE	False
MS_ColumnOrder	COLUMN	VASCULAR_CODE	0
MS_ColumnWidth	COLUMN	VASCULAR_CODE	-1
MS_TextAlign	COLUMN	VASCULAR_CODE	0

Uses

dbo

[dbo].[tluVerticalStrata]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluVerticalStrata

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	10
Created	1:41:27 PM Friday, April 02, 2010
Last Modified	1:41:27 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
	VERTICAL_STRATA_CODE	nvarchar(50)	100	✗
	STRATA_LOWER_BOUND	int	4	✓
	STRATA_UPPER_BOUND	int	4	✓
	VERTICAL_STRATA_DESC	nvarchar(255)	510	✓

Indexes

	Name	Columns	Unique
	pk_ref_vertical_strata	VERTICAL_STRATA_CODE	✓

Uses

dbo

[dbo].[tluViereckClass]

inpyugams08\sqlexpress > AK_ShallowLakes > Tables > dbo.tluViereckClass

This look-up table contains the Viereck Vegetation Class codes, and is referenced when entering the Viereck classification codes in tblEvents.

Properties

Property	Value
Collation	SQL_Latin1_General_CP1_CI_AS
Row Count	385
Created	1:42:29 PM Friday, April 02, 2010
Last Modified	1:42:30 PM Friday, April 02, 2010

Columns

	Name	Data Type	Max Length (Bytes)	Allow Nulls
🔑	VIERECK_CODE	nvarchar(50)	100	✗
	VIERECK_I_CODE	nvarchar(50)	100	✓
	VIERECK_II_CODE	nvarchar(50)	100	✓
	VIERECK_III_CODE	nvarchar(50)	100	✓
	VIERECK_IV_CODE	nvarchar(50)	100	✓
	VIERECK_V_CODE	nvarchar(50)	100	✓
	LEVEL_I_NAME	nvarchar(50)	100	✓
	LEVEL_II_NAME	nvarchar(50)	100	✓
	LEVEL_III_NAME	nvarchar(50)	100	✓
	LEVEL_IV_NAME	nvarchar(100)	200	✓
	LEVEL_V_NAME	nvarchar(200)	400	✓
	VIERECK_DESC	nvarchar(255)	510	✓

Indexes

	Name	Columns	Unique
🔑	pk_ref_viereck_class	VIERECK_CODE	✓

Extended Properties

Name	Level 2 Type	Level 2 Name	Value
MS_DefaultView			2
MS_Filter			
MS_FilterOnLoad			False
MS_HideNewField			False
MS_OrderBy			
MS_OrderByOn			False
MS_OrderByOnLoad			True
MS_Orientation			0
MS_TableMaxRecords			10000
MS_TotalsRow			False
MS_AggregateType	COLUMN	LEVEL_I_NAME	-1
MS_ColumnHidden	COLUMN	LEVEL_I_NAME	False
MS_ColumnOrder	COLUMN	LEVEL_I_NAME	0
MS_ColumnWidth	COLUMN	LEVEL_I_NAME	-1
MS_TextAlign	COLUMN	LEVEL_I_NAME	0
MS_AggregateType	COLUMN	LEVEL_II_NAME	-1
MS_ColumnHidden	COLUMN	LEVEL_II_NAME	False
MS_ColumnOrder	COLUMN	LEVEL_II_NAME	0
MS_ColumnWidth	COLUMN	LEVEL_II_NAME	-1
MS_TextAlign	COLUMN	LEVEL_II_NAME	0
MS_AggregateType	COLUMN	LEVEL_III_NAME	-1
MS_ColumnHidden	COLUMN	LEVEL_III_NAME	False
MS_ColumnOrder	COLUMN	LEVEL_III_NAME	0
MS_ColumnWidth	COLUMN	LEVEL_III_NAME	-1
MS_TextAlign	COLUMN	LEVEL_III_NAME	0
MS_AggregateType	COLUMN	LEVEL_IV_NAME	-1
MS_ColumnHidden	COLUMN	LEVEL_IV_NAME	False
MS_ColumnOrder	COLUMN	LEVEL_IV_NAME	0
MS_ColumnWidth	COLUMN	LEVEL_IV_NAME	-1
MS_TextAlign	COLUMN	LEVEL_IV_NAME	0
MS_AggregateType	COLUMN	LEVEL_V_NAME	-1
MS_ColumnHidden	COLUMN	LEVEL_V_NAME	False
MS_ColumnOrder	COLUMN	LEVEL_V_NAME	0
MS_ColumnWidth	COLUMN	LEVEL_V_NAME	-1
MS_TextAlign	COLUMN	LEVEL_V_NAME	0
MS_AggregateType	COLUMN	VIERECK_CODE	-1
MS_ColumnHidden	COLUMN	VIERECK_CODE	False
MS_ColumnOrder	COLUMN	VIERECK_CODE	0
MS_ColumnWidth	COLUMN	VIERECK_CODE	-1

MS_TextAlign	COLUMN	VIERECK_CODE	0
MS_AggregateType	COLUMN	VIERECK_DESC	-1
MS_ColumnHidden	COLUMN	VIERECK_DESC	False
MS_ColumnOrder	COLUMN	VIERECK_DESC	0
MS_ColumnWidth	COLUMN	VIERECK_DESC	-1
MS_TextAlign	COLUMN	VIERECK_DESC	0
MS_AggregateType	COLUMN	VIERECK_I_CODE	-1
MS_ColumnHidden	COLUMN	VIERECK_I_CODE	False
MS_ColumnOrder	COLUMN	VIERECK_I_CODE	0
MS_ColumnWidth	COLUMN	VIERECK_I_CODE	-1
MS_TextAlign	COLUMN	VIERECK_I_CODE	0
MS_AggregateType	COLUMN	VIERECK_II_CODE	-1
MS_ColumnHidden	COLUMN	VIERECK_II_CODE	False
MS_ColumnOrder	COLUMN	VIERECK_II_CODE	0
MS_ColumnWidth	COLUMN	VIERECK_II_CODE	-1
MS_TextAlign	COLUMN	VIERECK_II_CODE	0
MS_AggregateType	COLUMN	VIERECK_III_CODE	-1
MS_ColumnHidden	COLUMN	VIERECK_III_CODE	False
MS_ColumnOrder	COLUMN	VIERECK_III_CODE	0
MS_ColumnWidth	COLUMN	VIERECK_III_CODE	-1
MS_TextAlign	COLUMN	VIERECK_III_CODE	0
MS_AggregateType	COLUMN	VIERECK_IV_CODE	-1
MS_ColumnHidden	COLUMN	VIERECK_IV_CODE	False
MS_ColumnOrder	COLUMN	VIERECK_IV_CODE	0
MS_ColumnWidth	COLUMN	VIERECK_IV_CODE	-1
MS_TextAlign	COLUMN	VIERECK_IV_CODE	0
MS_AggregateType	COLUMN	VIERECK_V_CODE	-1
MS_ColumnHidden	COLUMN	VIERECK_V_CODE	False
MS_ColumnOrder	COLUMN	VIERECK_V_CODE	0
MS_ColumnWidth	COLUMN	VIERECK_V_CODE	3165
MS_TextAlign	COLUMN	VIERECK_V_CODE	0

Uses

dbo

Alkalinity

DOC316.53.01166

Phenolphthalein and Total Alkalinity

Method 8203

10 to 4000 mg/L as $CaCO_3$

Digital Titrator

Scope and Application: For water, wastewater and seawater.

Test preparation

Before starting the test:

Four drops of Bromcresol Green-Methyl Red Indicator Solution[1] can be substituted for the Bromcresol Green-Methyl Red Indicator Powder Pillow.
Four drops of Phenolphthalein Indicator Solution[1] can be substituted for the Phenolphthalein Indicator Powder Pillow.
For added convenience when stirring, use the TitraStir® stirring apparatus[1].
meq/L Alkalinity = mg/L as $CaCO_3 \div 50$

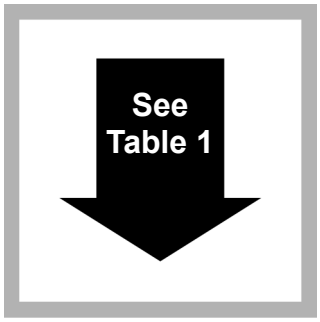
[1] See *Optional reagents and apparatus*.

Collect the following items:

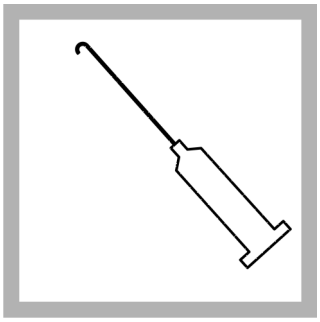
Description	Quantity
Bromcresol Green-Methyl Red Indicator Powder Pillow	1 pillow
Phenolphthalein Indicator Powder Pillow	1 pillow
Sulfuric acid titration cartridge (see *Range-specific information*)	1 cartridge
Digital titrator	1
Delivery tube for digital titrator	1
Graduated cylinder	1
Erlenmeyer flask, 250-mL	1

See *Consumables and replacement items* for reorder information.

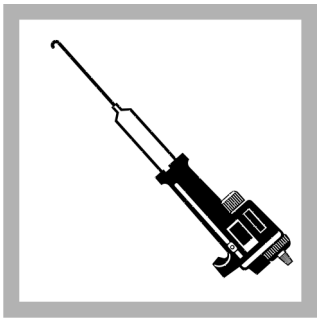
Alkalinity



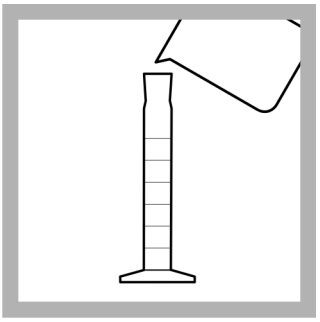
1. Select a sample volume and titration cartridge from the *Range-specific information* table.



2. Insert a clean delivery tube into the titration cartridge. Attach the cartridge to the titrator.



3. Turn the delivery knob to eject air and a few drops of titrant. Reset the counter to zero and wipe the tip.

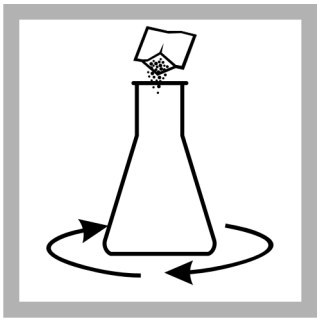


4. Use a graduated cylinder or pipet to measure the sample volume from the *Range-specific information* table.

Alkalinity (continued)

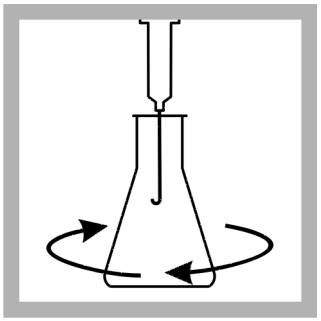


5. Transfer the sample into a clean, 250-mL Erlenmeyer flask. If the sample volume is less than 100 mL, dilute to approximately 100 mL with deionized water.



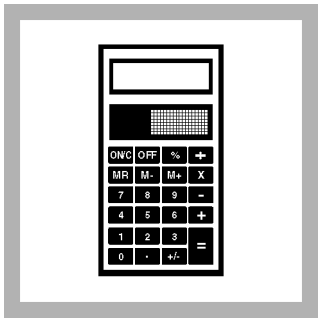
6. Add the contents of one Phenolphthalein Indicator Powder Pillow. Swirl to mix.

If the solution turns pink, proceed to step 7. If the solution is colorless, the Phenolphthalein (P) alkalinity is zero. Proceed to step 9.



7. Place the delivery tube into the solution and swirl the flask. Turn the knob on the titrator to add titrant to the solution. Continue to swirl the flask and add titrant until the color changes from pink to colorless.

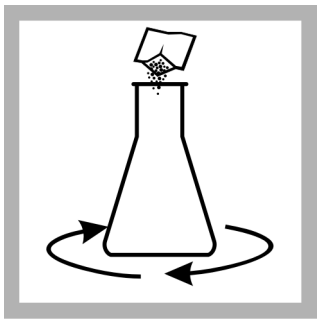
Write down the number of digits displayed on the counter.



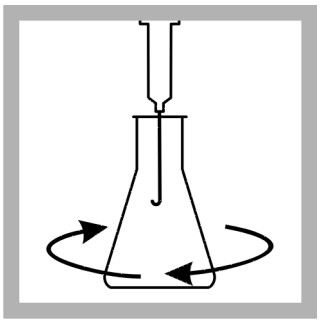
8. Use the multiplier in the *Range-specific information* table to calculate the concentration:

digits x multiplier = mg/L as $CaCO_3$ P alkalinity

Example: 100 mL of sample was titrated with the 0.1600 N cartridge and 250 digits were used to reach the endpoint. The concentration is 250 x 0.1 = 25 mg/L as $CaCO_3$



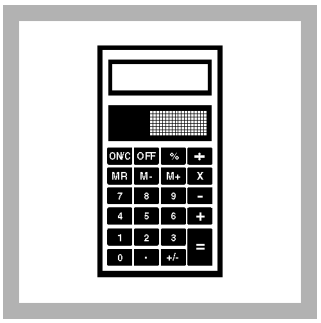
9. Add the contents of one Bromcresol Green-Methyl Red Indicator Powder Pillow. Swirl to mix.



10. Continue the titration with sulfuric acid to a light pink color.

Write down the number of digits displayed on the counter.

Note: A pH meter may be used to titrate to a specific pH as required by sample composition. See the *End point pH* table.



11. Use the multiplier in the *Range-specific information* table to calculate the concentration:

digits x multiplier = mg/L as $CaCO_3$ total alkalinity

Example: 100 mL of sample was titrated with the 0.1600 N cartridge and 250 digits were used to reach the endpoint. The concentration is 250 x 0.1 = 25 mg/L as $CaCO_3$

Table 1 Range-specific information

Range (mg/L as $CaCO_3$)	Sample volume (mL)	Titration cartridge (N H_2SO_4)	Multiplier
10–40	100	0.1600	0.1
40–160	25	0.1600	0.4
100–400	100	1.600	1.0
200–800	50	1.600	2.0
500–2000	20	1.600	5.0
1000–4000	10	1.600	10.0

Table 2 End point pH

Sample composition	Total alkalinity	Phenolphthalein alkalinity
Alkalinity about 30 mg/L	pH 4.9	pH 8.3
Alkalinity about 150 mg/L	pH 4.6	pH 8.3
Alkalinity about 500 mg/L	pH 4.3	pH 8.3
Silicates or phosphates present	pH 4.5	pH 8.3
Industrial wastes or complex system	pH 4.5	pH 8.3
Routine or Automated Analyses	pH 4.5	pH 8.3

Interferences

Interfering substances lists substances that can interfere with this test.

Table 3 Interfering substances

Interfering substance	Interference level
Chlorine	Chlorine at levels above 3.5 mg/L may cause a yellow-brown color when the Bromcresol Green-Methyl Red Powder Pillow is added. Add one drop of 0.1 N Sodium Thiosulfate to the sample to remove chlorine before starting the test.
Color or turbidity	Color or turbidity can mask the color change of the end point. Use a pH meter instead of the color indicators and titrate to a pH of 8.3 for phenolphthalein acidity. For total alkalinity see *End point pH* for the correct end point pH.

Sample collection, preservation and storage

- Collect samples in clean plastic or glass bottles. Fill completely and cap tightly.
- Prevent excessive agitation or prolonged exposure to air. Complete the test procedure as soon as possible after collection for best accuracy.
- The sample can be stored for at least 24 hours if cooled to 4 °C (39 °F) or below.
- Warm to room temperature before the test is started.

Alkalinity relationship table

Total alkalinity primarily includes hydroxide, carbonate and bicarbonate alkalinities. The concentration of these alkalinities in a sample may be determined when the phenolphthalein and total alkalinities are known (see *Alkalinity relationships*).

To use the table follow these steps:

a. Does the phenolphthalein alkalinity equal zero? If yes, use Row 1.

b. Does the phenolphthalein alkalinity equal total alkalinity? If yes, use Row 2.

c. Divide the total alkalinity by 2 to give one-half the total alkalinity.

d. Select Row 3, 4 or 5 based on comparing the result of step c (one-half total alkalinity) with the total alkalinity.

e. Perform the required calculations in the appropriate row, if any.

f. Check your results. The sum of the three alkalinity types will equal the phenolphthalein alkalinity.

For example:
A sample has 170 mg/L as $CaCO_3$ phenolphthalein alkalinity and 250 mg/L as $CaCO_3$ total alkalinity. What is the concentration of hydroxide, carbonate and bicarbonate alkalinities?

The phenolphthalein alkalinity does not equal 0 (it is 170 mg/L), see step a.

The phenolphthalein alkalinity does not equal total alkalinity (170 mg/L vs. 250 mg/L), see step b.

One-half of the total alkalinity (250 g/L) equals 125 mg/L. Because the phenolphthalein alkalinity (170 mg/L) is greater than one-half the total alkalinity (125 mg/L), select row 5.

The hydroxide alkalinity is equal to:
2 x 170 = 340

340 – 250 = 90 mg/L hydroxide alkalinity

The carbonate alkalinity is equal to:
250 – 170 = 80

80 x 2 = 160 mg/L carbonate alkalinity

The bicarbonate alkalinity equals 0 mg/L.
Check: (See step f)

90 mg/L hydroxide alkalinity + 160 mg/L carbonate alkalinity + 0 mg/L bicarbonate alkalinity = 250 mg/L

The above answer is correct; the sum of each type equals the total alkalinity.

Table 4 Alkalinity relationships

Row	Sample result	Hydroxide alkalinity equals:	Carbonate alkalinity equals:	Bicarbonate alkalinity equals:
1	Phenolphthalein Alkalinity = 0	0	0	Total Alkalinity
2	Phenolphthalein Alkalinity equal to Total Alkalinity	Total Alkalinity	0	0
3	Phenolphthalein Alkalinity less than one-half of Total Alkalinity	0	Phenolphthalein Alkalinity times 2	Total Alkalinity minus two times Phenolphthalein Alkalinity
4	Phenolphthalein Alkalinity equal to one-half of Total Alkalinity	0	Total Alkalinity	0
5	Phenolphthalein Alkalinity greater than one-half of Total Alkalinity	2 times Phenolphthalein Alkalinity minus Total Alkalinity	2 times the difference between Total and Phenolphthalein Alkalinity	0

Accuracy check

End point confirmation
Use a buffer pillow with the same pH as the end point with the indicator to make sure the end point color is accurate.

- Phenolphthalein alkalinity—Add 50 mL of deionized water to a flask. Add one pH 8.3 buffer powder pillow and one Phenolphthalein Indicator Powder Pillow and swirl to mix. Use this solution for comparison during the titration with the sample.
- Total alkalinity—Add 50 mL of deionized water to a flask. Add one pH 4.5 buffer powder pillow and one Bromcresol Green-Methyl Red Indicator Powder Pillow and swirl to mix. Use this solution for comparison during the titration with the sample.

Standard additions method (sample spike)
Required for accuracy check:

- Alkalinity Voluette® Ampule Standard Solution, 0.500 N
- Ampule breaker
- TenSette Pipet, 0.1–1.0 mL and Pipet Tips

1. Open the standard solution ampule.
2. Use the TenSette Pipet to add 0.1 mL of the standard to the titrated sample. Swirl to mix.
3. Titrate the spiked sample to the end point. Write down the amount of titrant that was used to reach the end point.
4. Repeat steps 2 and 3, using two more additions of 0.1 mL. Titrate to the end point after each addition.
5. Each 0.1 mL of standard that was added will use approximately 25 digits of the 1.600 N titration cartridge or 250 digits of the 0.1600 N titration cartridge to reach the endpoint. If more or less titrant was used, there may be an interference (see *Interferences*) or the concentration of the titrant has changed.

Summary of method

The sample is titrated with sulfuric acid to a colorimetric end point corresponding to a specific pH. Phenolphthalein alkalinity is determined by titration to a pH of 8.3, as evidenced by the color change of phenolphthalein indicator and indicates the total hydroxide and one half the carbonate present. M (methyl orange) or T (total) alkalinity is determined by titration to a pH between 4.3 and 4.9 and includes all carbonate, bicarbonate and hydroxide. Alternatively, total alkalinity end points may be determined by using a pH meter and titrating to the specific pH required for the sample composition.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Alkalinity Reagent Set (approximately 100 tests)			2271900
(1) Bromcresol Green-Methyl Red Powder Pillows	1 pillow	100/pkg	94399
(1) Phenolphthalein Indicator Powder Pillows	1 pillow	100/pkg	94299
(1) Sulfuric Acid Titration Cartridge, 0.1600 N	varies	each	1438801
(1) Sulfuric Acid Titration Cartridge, 1.600 N	varies	each	1438901

Required apparatus

Description	Quantity/Test	Unit	Catalog number
Digital Titrator		each	1690001
Flask, Erlenmeyer, graduated, 250-mL	1	each	50546
Graduated cylinder—select one or more based on range:			
Cylinder, graduated, 10-mL	1	each	50838
Cylinder, graduated, 25-mL	1	each	50840
Cylinder, graduated, 50-mL	1	each	50841
Cylinder, graduated, 100-mL	1	each	50842

Recommended standards

Description	Unit	Catalog number
Alkalinity Standard Solution, Voluette® Ampule 0.500 N Na_2CO_3, 10-mL	16/pkg	1427810

Optional reagents and apparatus

Description	Unit	Catalog number
Buffer Powder Pillows, pH 4.5	25/pkg	89568
Buffer Powder Pillows, pH 8.3	25/pkg	89868
Stir bar, octagonal 28.6 mm x 7.9 mm	each	2095352
TenSette Pipet, 0.1 to 1.0 mL	each	1970001
Water, deionized	500 mL	27249
Pipet, volumetric, Class A, 10 mL	each	1451538
Pipet, volumetric, Class A, 20 mL	each	1451520
Pipet Filler, safety bulb	each	1465100
Bottles, sampling, poly, 500 mL	each	2087079
Bromphenol Green-Methyl Red indicator solution	100 mL MDB	2329232
Phenolphthalein Indicator solution, 5 g/L	100 mL MDB	16232
pH meter	each	—
TitraStir stir plate, 115 Vac	each	1940000
TitraStir stir plate, 230 Vac	each	1940010

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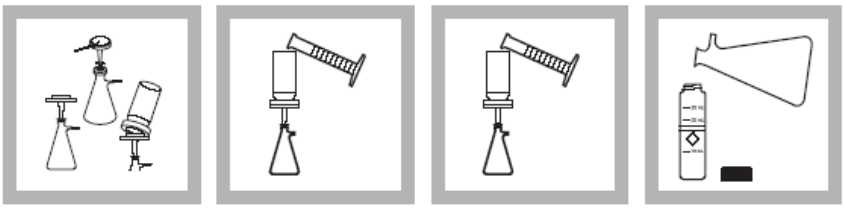
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Hach Method 8025

Pentec Environmental 889300



1. 2. 3. 4.

1. Assemble the filtering apparatus (membrane filter, filter holder, filter flask, and aspirator).

2. Rinse the filter by pouring about 50 mL of deionized water through the filter. Discard the rinse water.

3. Pour sample through the filter. Keep this for Step 4.

4. Pour collected water into the appropriate, prelabeled sample container.

Pack List (for 2 packs)

Pack 1

Chest Waders/Boots
Raingear/Gloves

Clipboard with datasheets
Pencils with spare lead
Sharpies

YSI
Tablet
2 spare Tablet stylus
Datasheets with clipboard
Trimble GPS
Trimble GPS stylus
Garmin GPS
Camera with spare batteries

Sampling Bottles (500 mL/3 per lake)
Sampling Bottles (CH4, DOC, O18)
Sampling Bottles (1 L amber/3 per lake)

Monuments
Rubber Mallet

Stadia Rod
Optical Level
Tripod

Pack Top – 1st Aid Kit:
Bandaids
Gauze pads & tape
ACE wrap
Neosporin
Alcohol wipes
Triangle Bandage
Gloves

Pack 2

Alpacka Raft
Paddle
Life Preserver
Barrel Pump and Hose
Chest Waders/Boots
Raingear/Gloves

Pencils with spare lead
Sharpies

Avalanche probe
Secchi Disk
3 - 50 m tape measures
30 m tape measure
Speed Tech

Sieve
Net
White tray
Water bottle
Squirt bottle
Funnel
Invert bottles
Invert lables
Grease pens

Battery Bag:
4 C batteries (Sonde computer)
8 AA batteries (Sonde unit)
2 AA batteries (Garmin)
2 Tablet batteries
9V battery (Speed Tech)

Pack towel

Pack Top – Survival Kit:

Sunscreen	Boat Patch Kit
Bug Spray	Aquaseal
Lighter	Super Glue
Mirror	Screwdriver
Compass	Flagging
Notebook	Duct Tape
Cord	Space Blanket

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
U.S. Department of the Interior

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