C0410002, Incoming
#5445

Canyon Fuel
Company, LLC
A Subsidiary of Bowie Resource Holdings, LLC

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May 3, 2017

Permit Supervisor, Utah Coal Regulatory Program
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
PO Box 145801
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Re: Revision to M&RP to Add Greens Hollow Lease Tract, Sufco Mine, Canyon Fuel Company, LLC, Permit Number C/041/0002

Dear Sirs:

Please find enclosed with this letter a revised version of the PHC (Appendix 7-28). Due to some technical difficulties not realized until after the PHC was submitted, it has been completed with previously missing drawings and the text corrected including misspellings, repeat sentences, etc.

Also included is Plate 7-10 to satisfy a request for clarification of the location of operational water monitoring sites. A map similar to Plate 7-10 is provided in the PHC.

If you have questions or need addition information please contact Vicky Miller at (435)286-4481.

CANYON FUEL COMPANY, SUFCO Mine

Vicky A Miller for

John D. Byars
General Manager

Encl.
cc: DOGM Correspondence File

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Canyon Fuel Company, LLC
Mine: Sufco Mine **Permit Number:** C/041/0002
Title: Revisions to M&RP to Add Greens Hollow Lease Tract

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Appendix 7-28 - Probable Hydrologic Consequences - Greens Hollow Tract*
☒ Add	☐ Replace	☐ Remove	Plate 7-10 Operational Hydrologic Monitoring Stations
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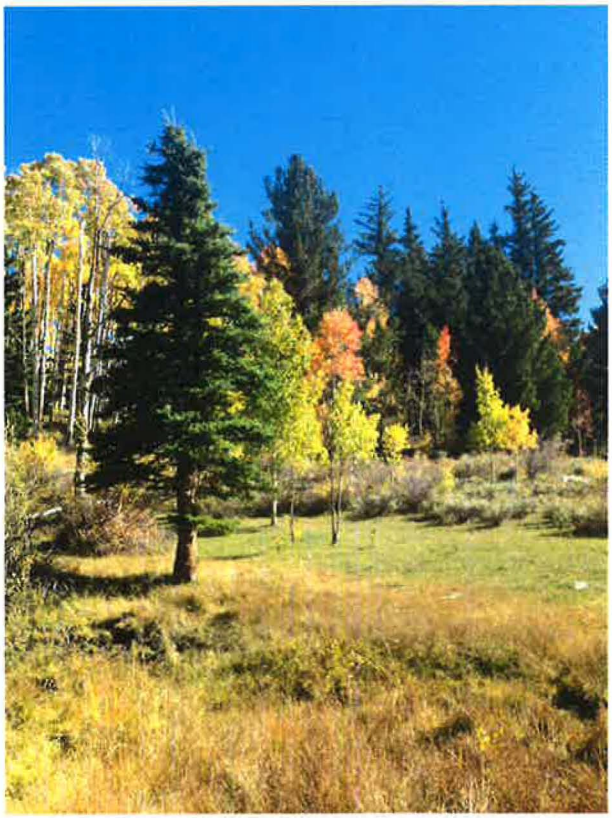
Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**
May 2, 2017 * Several Typos were corrected in the PHC and figures were revised. This version is considered the final for this first Greens Hollow submittal.	

Investigation of Groundwater And Surface-Water Systems in The Greens Hollow Tract Area; Probable Hydrologic Consequences of Coal Mining

29 April 2017

Canyon Fuel Company, LLC
Sufco Mine
Salina, Utah



PETERSEN HYDROLOGIC
CONSULTANTS IN HYDROGEOLOGY

Investigation of Groundwater And Surface-Water Systems in The Greens Hollow Tract Area; Probable Hydrologic Consequences of Coal Mining

29 April 2017

Canyon Fuel Company, LLC
Sufco Mine
Salina, Utah

Prepared by:

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Attachment A	Discharge hydrographs and plots of temperature, pH, specific conductance, and the Palmer Hydrologic Drought Index for springs in the Greens Hollow Tract area.
Attachment B	Discharge hydrographs and plots of temperature, pH, specific conductance, and the Palmer Hydrologic Drought Index for streams in the Greens Hollow Tract area.
Attachment C	Water level hydrographs for monitoring wells.

1.0 INTRODUCTION

The Canyon Fuel Company, LLC (CFC) Sufco Mine surface facilities are located approximately 25 miles east of Salina, Utah and about 9 miles west of Emery, Utah in the Wasatch Plateau coal mining district (Figures 1 and 2). The mine produces bituminous coal and has been in operation since 1941. Coal mining operations at the Sufco Mine are carried out using longwall mining and continuous miner techniques. Continuous mining techniques are primarily utilized to construct the development entries for the longwall panels.

CFC has recently been awarded the rights to mine in the Federal Greens Hollow Tract (UTU-84102), which is contiguous with the existing Sufco Mine permit area (Figure 1). It is proposed that the existing underground Sufco Mine workings be extended into the Greens Hollow Tract. Access to the Greens Hollow Tract will be made using the existing mine portals and surface facilities in Convulsion Canyon.

Canyon Fuel is seeking to obtain a permit from the Utah Division of Oil, Gas and Mining (DOGM) to conduct mining and reclamation activities in the Greens Hollow Tract. This report contains a description of groundwater and surface-water systems in the Greens Hollow Tract and a description of the probable hydrologic consequences of coal mining in the Greens Hollow Tract and adjacent areas as required by Utah Coal Mining rule R645-301-728. This

report is written in support of Chapter 7 (Hydrology) of the Mining and Reclamation Plan (MRP) for the Sufco Mine.

2.0 METHODS OF INVESTIGATION

The hydrology and hydrogeology of the Greens Hollow Tract and adjacent areas has been evaluated based on an analysis of: 1) solute and isotopic compositions of groundwaters and surface waters, 2) surface water and groundwater discharge data, 3) piezometric data, and 4) geologic information. Specific methods of investigation are described below.

Maps and reports

Existing published and unpublished hydrologic, hydrogeologic, and geologic maps were obtained and reviewed. Several investigations of the hydrogeology and hydrology of the Sufco Mine permit and adjacent areas have been completed prior to this investigation. The USGS, in cooperation with the BLM (Thiros and Cordy, 1991), described the hydrology and potential effects of mining in the Quitchupah and Pines Tract. Mayo and Associates (1997) described surface water and groundwater systems and mining-related hydrologic impacts in the adjacent existing SUFCO Mine permit area. The US Forest Service (1999) completed a Final Environmental Impact Statement and Record of Decision (2011) fcr the Greens Hollow Tract. The US Forest Service completed a supplemental Environmental Impact Statement in 2014. Petersen Hydrologic (2009) characterized groundwater and surface-water systems and

evaluated the effects of subsidence of Castlegate Sandstone springs and streams in the East Fork of Box Canyon Creek drainage.

Collection of water quality and flow data

Beginning in 2001, a spring and seep survey and baseline monitoring program was performed in the Greens Hollow Tract and adjacent areas by Cirrus Ecological Solutions, LC (Cirrus) of Logan, Utah. These investigations were performed for the Manti-LaSal National Forest in conjunction with NEPA analysis for the Greens Hollow Tract. As part of these activities, discharge rates and field water quality parameters were measured (including water temperature, pH, specific conductance, turbidity, and dissolved oxygen). Spring and seep locations were determined in the field using hand-held GPS units. Baseline monitoring for laboratory water quality parameters was performed by Cirrus personnel at selected spring and stream monitoring stations through the second quarter of 2004. Details of the Cirrus monitoring activities are included in the Technical Report for Groundwater and Surface Water for the Greens Hollow Tract (USFS, 2005).

Monitoring of springs, seeps, and streams located in and around the Greens Hollow Tract has been performed by Petersen Hydrologic, LLC through 2016. The specific methods of study utilized by Petersen Hydrologic personnel to collect groundwater and surface-water quantity and quality data in the Greens Hollow Tract area are described below.

Discharge Measurements

Discharge measurements for springs were typically performed using a calibrated container and a stopwatch. Generally, spring discharge measurements were performed by damming and diverting the spring discharge through a pipe. Using an appropriately sized container, time-to-fill measurements were typically performed at least 3 times at each location. An average time-to-fill value was used to calculate the reported discharge measurement. In a few instances where the discharge from a spring was diffuse and the discharge rate was very low, discharge rates were approximated (i.e. providing "less than" values).

Discharge measurements on streams were typically performed using a Marsh-McBirney brand electromagnetic current velocity meter and wading rod using methods described by the United States Geological Survey (1995). In instances on Muddy Creek where stream discharges exceeded rates where streams could safely be waded, surface-water discharge velocities were sometimes measured by timing the passage of a floating object as it passed through a specified distance of the stream course.

Discharge Temperature Measurements

Temperature measurements were performed using a Taylor brand electronic digital thermometer. Temperature measurements on streams were performed in actively flowing, shaded areas where possible. Discharge temperature measurements at springs were performed as close to the spring discharge locations as possible.

Specific Conductance Measurements

Specific conductance measurements were performed using an Extech brand model EC400 conductivity meter or a Hanna brand conductivity meter, both with automatic temperature compensation. The instruments were regularly calibrated using traceable ASTM conductivity standard solutions.

pH Measurements

pH Measurements were performed using an Oakton brand Acorn 6 model electronic pH meter with automatic temperature compensation, an Oakton model pH Testr 30 with automatic temperature compensation, or a Hanna brand pHep 5 pH meter with automatic temperature compensation. The instruments were regularly calibrated using traceable ASTM pH standard solutions.

Water Quality Laboratory Measurements

Water quality laboratory analyses were performed by SGS Minerals Services of Huntington, Utah and Chemtech-Ford Analytical Laboratories of Sandy, Utah.

Dissolved Oxygen

Dissolved oxygen measurements were performed using a YSI brand Model 55 dissolved oxygen meter. The meter utilizes a replaceable membrane and was regularly calibrated.

Collection and analysis of isotopic data

Water samples from the Greens Hollow Tract and the surrounding Sufco Mine permit area were collected by Cirrus Ecological Solutions personnel during low-flow conditions in 2001 for stable and unstable isotopic analysis. Samples for radiocarbon were analyzed using Accelerator Mass Spectrometry (AMS) by Geochron Laboratories of Cambridge, Massachusetts. Tritium analyses were performed using direct counting methods by Geochron Laboratories (with error of +/- 2.7 TU). Stable isotopic carbon-13, deuterium, and oxygen-18 analyses were also performed by Geochron Laboratories.

Groundwater samples were also collected from the Greens Hollow Tract and adjacent areas by Petersen Hydrologic, LLC and Mayo and Associates, LC personnel. Samples were also collected from the underground Sufco Mine workings adjacent to the proposed Greens Hollow Tract mining areas. Isotopic samples were collected in appropriate, tightly sealed HDPE or glass sample bottles. Radiocarbon analyses on these samples were performed by Geochron Laboratories and the BYU Geology Department Isotopic Laboratory using either Conventional methods, or by AMS. Tritium analyses for the Mayo and Associates and Petersen Hydrologic samples were performed by the Tritium Laboratory at the University of Miami, Florida and BYU Geology Department Isotopic Laboratory using electrolytic enrichment and low level counting methods (with error of +/- 0.1 TU). Stable isotopic δ^2H and $\delta^{18}O$ analyses were performed by Mountain Mass Spectrometry of Evergreen, Colorado.

Groundwater mean residence times were determined using methods described by Pearson and Hanshaw (1970), Fontes (1980), and Mookes (1980).

Data compilation

Data used in this study were obtained from several sources. Water quality and water quantity data were downloaded electronically from the DOGM on-line hydrology database located at http://ogm.utah.gov/coal/edi/wqdb.htm. Additional data were compiled from electronic media provided by the Manti-LaSal National Forest. Data were also obtained in paper-copy and electronic format laboratory reports from the Sufco Mine. The data were compiled into a coherent electronic database for analysis. Hydrologic monitoring site details are presented in Table 1. A compilation of baseline monitoring data from the Greens Hollow Tract and adjacent area is presented in Table 2.

Data analysis

Geochemical, isotopic, discharge rate, and other data were analyzed by graphical and statistical methods. Solute compositions were graphically analyzed using Stiff (1951) diagrams. Mineral saturation indices were calculated using the computer code WATEQF (Plummer et. al, 1976).

3.0 PHYSIOGRAPHIC SETTING

The Greens Hollow Tract is situated in the Wasatch Plateau region of central Utah. Important physiographic features in the tract area include the deep Muddy Creek and Cowboy Creek canyon areas that form the approximate northern and northeastern boundary

of the area. North of the tract area, the land surface rises precipitously towards Heliotrope and Ferron Mountains, with maximum elevations on those peaks of 11,130 feet and 10,678 feet, respectively. The northwestern portion of the tract is bordered by the generally north-sloping upland areas that drain toward the South Fork of Muddy Creek. The southern portions of the tract area include the eastward and southward sloping flanks of White Mountain that drain to the North Fork of Quitchupah Creek. To the west, White Mountain rises precipitously to elevations exceeding 10,800 feet. In the southeast portion of the tract area, Big Ridge is a prominent east-west trending ridge that rises to more than 9,200 feet and separates the Muddy Creek drainage to the north from the Quitchupah Creek drainage to the south. In the northern portions of the tract area are broad expanses of gently sloping plateaus of generally low relief that are vegetated primarily with grasses and sage brush. These relatively smooth features are dissected abruptly by the deeply incised, steep walled Muddy Creek Canyon, Greens Canyon, and the North and South Forks of Quitchupah Canyon. The east-west trending Greens Hollow Creek and Cowboy Creek drainages cut across the central portions of the Greens Hollow Tract, dividing the northern from the southern portions of the tract area.

Topographic elevations within the delineated Greens Hollow Tract range from about 7,440 feet in the bottom of Muddy Creek canyon along the eastern margins of the tract, to about 9,720 feet where Big Ridge merges into the flanks of White Mountain along the western margin of the tract. Total surface relief in the tract is about 2,280 feet.

The upland plateau area rolls gently and is vegetated primarily with sagebrush, grasslands, and isolated stands of Ponderosa Pines. The mountainous regions are vegetated primarily with conifer and aspen forests interspersed with sagebrush and grasslands. Vegetation on the sheer rock cliff faces in the deep canyons is sparse. The narrow canyon bottoms are commonly more heavily vegetated with bushes and grasses.

4.0 CLIMATE

Precipitation in the vicinity of the Sufco Mine area is dependent on elevation. Annual precipitation in the vicinity ranges from 12 inches in the lower elevations to more than 20 inches in the higher elevations. Localized thunderstorms occur from July through November and contribute about half of the total annual precipitation (Thiros and Cordy, 1991). Mean monthly temperatures measured at the Emery 15 SW weather station, located about seven miles southeast of the study area, are below freezing from November to March. Snow depths measured between 1945 and 1985 at the Blacks Forks snow course, located about six miles northwest of the study area at an elevation of 9,200 feet, averaged 44 inches, with a water content of 14.4 inches (Whaley and Lytton, 1979). Historic precipitation data from the NOAA Salina 24E weather station, which has been maintained at the Sufco Mine surface facilities area since 1984, is presented in Table 3.

Climatic conditions in the study area have varied substantially during the period of baseline monitoring at the Greens Hollow Tract (2001 – 2016). This is illustrated in a plot of the

Palmer Hydrologic Drought Index (PHDI) for Utah Region 4 (Figure 3). The PHDI is a monthly value generated by the National Climatic Data Center using a variety of hydrologic parameters that indicates wet and dry spells. The PHDI is calculated from several hydrologic parameters including precipitation, temperature, evapotranspiration, soil water recharge, soil water loss, and runoff. Consequently, it is a useful tool for evaluating the relationship between climate and groundwater and surface water discharge data. It is apparent in Figure 3 that from late-2000 through mid-2001 the region was experiencing a period of mild to moderate wetness. Beginning in mid-2001 the region began to transition to a notable period of drought that persisted until late-2004. The region then rapidly transitioned to a period of extreme wetness that peaked in mid-2005. The four-year period from 2006 through 2009 was characterized by generally dry conditions with mild to moderate drought prevailing. By mid-2010 the region was transitioning to a period of extreme wetness that peaked in mid-2011 and continued through the end of 2011. By early 2012, the region had returned to dry conditions with varying drought intensity. Other than a five-month period during the winter of 2015-2016 when conditions were mildly wet, the region has recently experienced a prolonged period of dryness. During the fifty-seven month period from early 2012 through the end of 2016, fifty one of those months had negative PHDI values (Figure 3).

5.0 GEOLOGY

Four Cretaceous- to Tertiary-age bedrock formations crop out in the Greens Hollow Tract. These include, in descending order, the North Horn Formation, Price River Formation,

Castlegate Sandstone, and the Blackhawk Formation. The Flagstaff Limestone is present on mountain tops adjacent to the Greens Hollow Tract. The Star Point Sandstone and Masuk Member of the Mancos Shale are present beneath the Blackhawk Formation within the tract area. Deposits of Quaternary alluvium are also present within and adjacent to the Greens Hollow Tract. These geologic formations are shown on a geologic map in Figure 4, in cross-section on Figure 4a, and on a stratigraphic column in Figure 5. These geologic formations are described below.

Quaternary deposits

The most significant quaternary deposits in and adjacent to the Greens Hollow Tract area include landslide deposits and stream alluvium. Landslide deposits are most common along steep slopes that are underlain by the North Horn Formation, which is known to be prone to slope failure and slumping regionally. A large landslide deposit is mapped along the steep margins of White Mountain immediately west of the Greens Hollow Tract and also on the steep slopes north of Muddy Creek (Figure 4). Quaternary alluvium is present locally throughout the tract. Significant alluvial deposits are present along the major stream valleys. The quaternary alluvial deposits consist of clays, silts, sands, gravels, and boulders derived from the erosion of the geologic strata in the area.

Flagstaff Limestone

Although not present within the Greens Hollow Tract boundary, the Flagstaff Limestone is present immediately east of the tract where it forms the conspicuous white cap rock on White Mountain and the surrounding high mountain peaks. The Flagstaff Limestone consists of

freshwater limestone with some interbedded sandstone, shale, and volcanic ash. The formation is commonly light gray to white in color where it is exposed in the mountainous regions that surround the Greens Hollow Tract.

North Horn Formation

The North Horn Formation consists of variegated (mainly shades of red) shales with minor sandstone, conglomerate, and freshwater limestone (Doelling, 1972). It is estimated to be about 1,490 feet thick in the study area, although no drilling in the area has penetrated both the upper and lower contacts of the formation. The lower contact of the formation is transitional with the underlying Price River Formation. The formation is vulnerable to mass movement, slope failures, and landslides (USFS, 2005).

Price River Formation

The Price River Formation consists of gray to white gritty sandstone, interbedded with shale and conglomerate deposited in a fluvial environment. The unit forms ledges and slopes below the North Horn Formation due to interbedding of resistant sandstones with less resistant shales and claystones. The Price River Formation is present at or near the surface over most of the broad gently sloping plateau surfaces below the adjacent mountainous regions. The formation is reported to be approximately 550 feet thick in the existing Sufco permit area (Figure 4a).

While individual fluvial sandstones (paleochannels) in the Price River Formation are capable of transmitting water, groundwater is typically not transmitted over great vertical or

horizontal distances in the formation. This is because of the lenticular geometry of the sandstone units and the interbedded low-permeability shales and claystone layers present in the formation.

Castlegate Sandstone

The Castlegate Sandstone is present disconformably beneath the overlying Price River Formation. The Castlegate Sandstone is a cliff-forming unit that comprises the rim rocks and near-vertical walls of the deeply incised canyons in the northern and northeastern portions of the Greens Hollow Tract and adjacent area (Figure 4). The Castlegate Sandstone is also present at the surface along the cliffs of the North Fork of Quitchupah Canyon area immediately southeast of the tract (Figure 4). Commonly, the sandstone is directly exposed or covered by only a thin soil veneer on the plateau along the rims of the canyons. The Castlegate Sandstone, which is about 200 feet thick in the study and adjacent area, is predominately massively bedded, coarse-grained sandstone with some interbeds of shale, siltstone, and conglomerate. Pervasive silica and carbonate cement makes the formation well indurated and brittle. The Castlegate Sandstone was formed in a braided fluvial depositional system.

Blackhawk Formation

The Blackhawk Formation consists of lenticular, discontinuous beds of sandstone, siltstone, mudstone, shale, and coal. Within the Greens Hollow Tract, the Blackhawk Formation is exposed in the bottom of Muddy Creek Canyon along the northern and northeastern portions

of the tract. In areas adjacent to the Greens Hollow Tract, the Blackhawk is exposed in the bottoms of the North and South Forks of Quitchupah Creek and also Box Canyon.

Most of the coal production in the Greens Hollow Tract will occur in the Upper Hiawatha Seam of the Blackhawk Formation. Some mining (mostly development entries) will also occur in the Lower Hiawatha Seam. The Upper Hiawatha Coal seam is underlain in the region by a sequence of shaley lagoonal deposits, ranging in thickness from 2 to 29 feet, which includes the Lower Hiawatha Coal Seam (Mayo and Associates, 1997).

In the Sufco Mine area, the upper 500 feet of the formation generally has massive, fine- to medium-grained, cliff-forming sandstone units (Thiros and Cordy, 1991). The number and thicknesses of sandstone units decreases toward the base of the unit. The lower 300 feet of the formation contains thinly-bedded sandstone and shale. The thickness of the Blackhawk Formation in the region is about 800 feet.

Star Point Sandstone

The upper Star Point Sandstone consists of three massive sandstone layers, the uppermost of which intertongues with the Blackhawk Formation (Thiros and Cordy, 1991). The Star Point does not crop out in the Greens Hollow Tract, but it is exposed in the bottom of Muddy Creek Canyon near the confluence with Box Canyon and in regions south and east of the tract along the margins of the Wasatch Plateau escarpment. The Star Point Sandstone is a tan to gray, fine- to medium- grained, friable, usually well-sorted sandstone containing minor

thin interbeds of siltstone or claystone. The lower Star Point Sandstone is an upward prograding sequence that intertongues with the underlying Masuk Member of the Mancos Shale. The thickness of the Star Point Sandstone is about 200 feet in the region.

Mancos Shale, Masuk Member

The Masuk Member of the Mancos Shale is 500 to 600 feet thick in the Muddy Creek Canyon area. It does not crop out in the Greens Hollow Tract, but is visible regionally along the margins of the Wasatch Plateau escarpment. It consists of blue-gray fissile claystone or silty claystone which weathers light blue-gray to light tan. The unit contains thin calcareous sandy or silty interbeds that increase in frequency toward the top of the unit. The member forms the lower slopes of Muddy Creek Canyon and the surrounding lowlands. It forms steep, barren, easily eroded slopes with occasional ledges of more resistant fine-grained sandstone, siltstone, or sandy claystone.

Structure

Major faulting has not been identified in the Greens Hollow Tract. However, small displacement faults with apparent vertical displacement of about three feet or less have been encountered in the Sufco Mine. Rarely, some faults with somewhat greater displacements have also been encountered within the mine. The faults in the Sufco Mine area most commonly strike approximately N10° to 15°W and are inclined nearly vertical. Joints are both parallel and normal to the prevailing fault trend. Both minor faults and joints likely exist in the Greens Hollow Tract area. Joints in the Castlegate Sandstone are common. The

surface traces of these joints are up to a 1,000 feet in length and are spaced about 16 to 33 feet apart.

In the Acord Lakes area along the western margins of the Sufco Mine lease, an approximately north-south trending normal fault has been mapped along the eastern edge of the valley that has created a closed basin with at least 200 feet of vertical offset (Thiros and Cordy, 1991). This structural feature is likely responsible for the impoundment of water that creates Acord Lakes (i.e. in the absence of the fault uplift, the surface water would have drained eastward into Convulsion Canyon). The Joes Valley Fault system, which has a displacement of several hundreds of feet, trends along the eastern margins of the Sufco Mine permit area and is visible in outcrop in the Muddy Creek Canyon area.

Rock units in the study area strike roughly 40°E and dip 1 to 2° (about 250 feet per mile) to the northwest. Local dips of the coal seam may range up to 10 degrees in areas where underlying paleochannels caused significant differential compaction.

6.0 PRESENTATION OF DATA

Baseline hydrologic monitoring location details are listed on Table 1. Information presented in Table 1 includes monitoring site geographic coordinates, elevations, associated geologic formations, monitoring periods, baseline monitoring parameters, and information on water usage. Monitoring locations are plotted on Figure 2. Discharge and water-quality data for

springs and streams in the study area, including field and laboratory water quality measurements are presented in Table 2a (major ion chemical compositions), and Table 2b (trace constituents). Discharge hydrographs for springs in the study area are shown on Attachment A. Discharge hydrographs for streams are shown on Attachment B. The information plotted on Attachments A and B also includes plots of temperature, pH, specific conductance, and the Palmer Hydrologic Drought Index. A geologic map of the Greens Hollow Tract and surrounding area, that also includes spring and stream monitoring locations, is presented in Figure 4. A southeast-northwest geologic cross-section through the tract area is presented in Figure 4a. A stratigraphic column is presented in Figure 5. Average discharge and solute compositions and mineral saturation indices are listed in Table 5. Stiff diagrams depicting the solute compositions of streams and springs are presented in Figure 6. A map showing the surface water drainages in the Greens Hollow Tract and adjacent areas is presented in Figure 7. Stable and unstable isotopic compositions and groundwater mean residence times for springs and in-mine locations are presented in Table 6.

7.0 GROUNDWATER AND SURFACE-WATER GEOCHEMISTRY

Stiff diagrams depicting the solute chemical composition of groundwaters and surface waters in the Greens Hollow Tract area are shown on Figure 7. Stiff diagrams are a useful analytical tool that allows the graphical representation of water solute compositions. The shape of the Stiff diagram is a reflection of the geochemical type, while the size of the diagram is related to the total dissolved solids concentration of the water.

Groundwaters discharging from springs and flowing in streams in and adjacent to the Greens Hollow Tract commonly acquire their solute compositions through a series of well-documented chemical reactions. These are summarized below.

Carbon dioxide gas is produced naturally in the soil at concentrations greatly exceeding atmospheric concentrations by root-zone respiration and also by the decay of organic matter. Recharge water (rain and snow melt), upon entering the soil mantle, reacts with CO_2 to produce carbonic acid according to:

$$CO_2 + H_2O = H_2CO_3 \text{ (carbonic acid)} \qquad \text{(Equation 1)}$$

The produced carbonic acid subsequently dissociates into hydrogen ions (acid) and bicarbonate according to:

$$H_2CO_3 = H^+ + HCO_3^- \qquad \text{(Equation 2)}$$

The H^+ produced from Equation 2 reacts with carbonate minerals that are pervasive in the rocks of the Wasatch Plateau coal field, yielding calcium and magnesium ions and additional bicarbonate ions to the water according to:

$$CaCO_3 \text{ (calcite)} + H^+ = Ca^{2+} + HCO_3^- \qquad \text{(Equation 3)}$$

and

$$CaMg(CO_3)_2 \text{ (dolomite)} + 2H^+ = Ca^{2+} + Mg^{2+} + 2\ HCO_3^- \qquad \text{(Equation 4)}$$

Because of the limited solubility of calcite and dolomite in the absence of an additional source of CO_2, waters acquiring their solute compositions through the geochemical

evolutionary pathway described in Equations 1 through 4 typically have relatively low TDS concentrations.

Groundwaters from formations containing soluble evaporite minerals often acquire a different solute geochemical type, and dissolved solids concentrations that are sometimes appreciably greater than that typically resulting from geochemical evolutionary pathway as described by equations 1-4 above. Surface waters flowing over sediments containing soluble evaporite minerals may also acquire elevated TDS concentrations and changed solute geochemical type. The geochemical reactions often responsible for these changes in chemical composition include:

$$CaSO_4 \cdot 2H_2O_{(gypsum)} = Ca^{2+} + SO_4^{2-} + 2H_2O \qquad \text{(Equation 5)}$$

$$NaCl_{(halite)} = Na^{+} + Cl^{-} \qquad \text{(Equation 6)}$$

Waters rich in Ca^{2+} resulting from the dissolution of gypsum (Equation 5) may undergo ion exchange on clay minerals, resulting in an increase in Na^{+} concentrations at the expense of exchanged Ca^{2+} ions according to:

$$Ca^{2+} + \text{Na-clay} = 2Na^{+} + \text{Ca-Clay} \qquad \text{(Equation 7)}$$

Ion exchange may also occur on zeolite minerals such as the sodium zeolite analcime according to:

$$2NaAlSi_2O_6 \cdot H_2O + Ca^{2+} = Ca(AlSi_2O6)_2 \cdot H_2O + 2Na^{+} \qquad \text{(Equation 8)}$$

Ratios of chloride to sodium (Table 5) indicate that most of the sodium contained in groundwaters and surface waters is likely acquired through ion exchange reactions described in Equations 7 and 8 above. This is evident in the fact that the sodium concentrations (expressed as milliequivalents per liter) greatly exceed the chloride concentrations in both groundwaters and surface waters (Table 5). If halite dissolution (Equation 6) was the primary source, it would be anticipated that the ratios of chloride to sodium would be near unity.

It is apparent in the Stiff diagrams plotted in Figure 6 and from the solute chemical compositions listed in Table 5 that the solute geochemical types of groundwaters vary appreciably over the Greens Hollow Tract and adjacent area. Chemical variability is present spatially within individual geologic formations (Table 5). This observation suggests the likelihood that groundwaters discharging to springs in the tract area are sourced by local type groundwater systems that are highly influenced by variability in the local hydrogeochemical regime. If the springs were discharging from large-scale, regional type groundwater system (i.e. appreciable flow over long distances with groundwater flow potentially through multiple stratigraphic units) , it would seem likely that groundwater discharging from various locations sourced by the regional system would have a more homogeneous and uniform composition. The notion of local groundwater flow conditions at the springs (i.e. shallow groundwater flow with groundwater recharge and groundwater discharge locations being near each other) is also supported by the active-zone characteristics of the spring discharges,

including appreciable tritium contents and rapid response to seasonal and climatic recharge variability.

8.0 ISOTOPE GEOCHEMISTRY

Radiocarbon (^{14}C) and tritium (^{3}H) isotopic information have been used together in this investigation to determine groundwater mean residence times.

8.1 Carbon-14

Carbon-14 analyses have been performed on 12 springs in the Greens Hollow Tract study area (Table 6). Additionally, carbon-14 analyses have been performed on groundwater samples from several underground inflow locations in the Sufco Mine (Mayo and Associates, 1997, 1999; Petersen Hydrologic, 2005, 2016). In considering the radiocarbon "age" of groundwater it is important to consider that groundwater arriving at groundwater discharge points (i.e. springs or wells) rarely travels via pure piston flow (i.e. pipe-like flow conditions where all flowpaths are the same length with equal travel times along flowpaths). Rather, it is not uncommon for the water molecules discharging at springs or wells to have migrated to the discharge point from several different recharge locations, each having recharged at different times. Consequently, the term "mean groundwater residence time", which is the average age of all of the water molecules sampled, is commonly used when evaluating the age of groundwater.

The radiocarbon (^{14}C) content of a groundwater is used to calculate the number of years that have elapsed since the groundwater became isolated from soil-zone gasses and near-surface groundwaters. Groundwaters with radiocarbon activities greater than about 50 pmC in carbonate-rich terrains are usually indicative of modern groundwater. Groundwaters with radiocarbon activities significantly greater than about 50 pmC can indicate the presence of anthropogenic carbon that is typically associated with atmospheric thermonuclear weapons testing, which also suggests a modern origin.

Based on the known half-life of radiocarbon (approximately 5,570 years), it is possible to calculate the time since a groundwater became isolated from soil-zone CO_2 gas and shallow recharge sources. However, estimating the radiocarbon age of groundwaters is not as straightforward as estimating the age of dead organic matter. This is because groundwater acquires carbon from numerous sources, each of which must be accounted for in calculating a groundwater age. These sources may include "live" carbon from biogenic production of CO_2 in the soil zone, "dead" carbon from the dissolution of carbonate minerals in the soil zone, and the addition of both "live" and "dead" carbon by other processes. In the Wasatch Plateau region, groundwater commonly acquires its carbon through the series of chemical reactions described below.

The partial pressure of CO_2 in the soil zone, which is largely derived through root-zone respiration, greatly exceeds that of the atmosphere. The CO_2 reacts with water to produce carbonic acid according to:

$$CO_2 + H_2O = H_2CO_3$$

Carbonic acid dissociates to produce acid (H^+) and bicarbonate according to:

$$H_2CO_3 = H^+ + HCO_3^-$$

In western coal mines, where carbonate rocks are pervasive, the acid produced from the above equation rapidly reacts with carbonate minerals, which releases additional bicarbonate and calcium and/or magnesium ions according to:

$$CaCO_{3\,(calcite)} + H^+ = Ca^{2+} + HCO_3^-$$

Or

$$CaMg(CO_3)_{2\,(dolomite)} + 2H^+ = Ca^{2+} + Mg^{2+} + 2HCO_3^-$$

Thus, groundwater that follows this evolutionary pathway will acquire 50% of its carbon from soil-zone CO_2 and 50% of its carbon from the dissolution of carbonate minerals near the recharge zone. Because soil-zone CO_2 typically has a $\delta^{13}C$ value between about –18 and –27 ‰, most groundwaters that follow this geochemical evolutionary pathway have a $\delta^{13}C$ value in the range of approximately -9 to -13 ‰ (Mayo and Associates, 1999). The fact that the $\delta^{13}C$ values for most radiocarbon samples analyzed in this investigation are in or near this range supports the conclusion that groundwaters in the study area likely follow this geochemical evolutionary pathway. Where the dissolved inorganic carbon $\delta^{13}C$ falls appreciably outside of this range, other factors in the water's carbon evolutionary pathway must be considered to determine a groundwater mean residence time.

Like tritium, radiocarbon can also be used to determine whether groundwater has a component of recent anthropogenic (human induced) carbon. As a result of atmospheric thermonuclear weapons testing, atmospheric ^{14}C levels increased dramatically above background levels. ^{14}C levels reached a peak of approximately two times background levels (200 pmC) in 1963. Thus, groundwaters with ^{14}C contents significantly greater than about 50 percent modern carbon (pmC) have a component of carbon with an activity significantly greater than 100 pmC. Groundwater that acquires its carbon through the dissolution of carbonate minerals in the presence of soil-zone CO_2 should have an A_o near 50 pmC (50% "live" soil-zone carbon with ≈ 100 pmC, and 50% "dead" carbonate mineral carbon with ≈ 0 pmC). As a result of above-ground thermonuclear testing, the ^{14}C activity of the atmosphere increased significantly above 100 pmC (with the modern 100 pmC standard being based on the 1950 radiocarbon activity; Clark and Fritz, 1997). Thus, it possible for a groundwater that recharged after about 1950 to have a ^{14}C activity greater than 50 pmC. For this reason, groundwater age dating models that do not take this into account may not correctly determine the actual residence time of the groundwater, sometimes even calculating a recharge date in the future (Mayo and Associates, 1999).

As indicated in Table 6, all springs analyzed for carbon-14 composition in the Greens Hollow Tract study area have modern radiocarbon ages and most contain appreciable anthropogenic carbon. In contrast, all groundwaters analyzed for radiocarbon content in the underground Sufco Mine workings in the study area are of ancient origin, with mean residence times ranging from about 4,000 to 15,000 years (Table 6).

It should be noted that the radiocarbon ages determined for groundwater from springs in the Greens Hollow Tract as reported in the Groundwater Technical Report for the U.S. Forest Service are substantially different from those reported in Table 6 (see Technical Report for the Environmental Impact Statement for the Greens Hollow Tract; 2005) . The groundwater ages reported in the Technical Report are generally much older than those determined in this investigation. We suspect that this is because the carbon history and geochemical evolutionary pathways of groundwaters in the study area were apparently not incorporated into the calculation of groundwater ages in the investigation (i.e., all the carbon in the water was apparently assumed to have been derived from "live" sources, while not considering the dilution of ^{14}C from "dead" sources in the recharge zone). Consequently, while the groundwater ages (uncorrected) of springs in the Greens Hollow Tract were determined to range from 0 to 3,830 years in the Technical Report, all spring waters in the Greens Hollow Tract area (as calculated by Petersen Hydrologic) were determined in this investigation to be modern in origin based on radiocarbon compositions.

Groundwater has been sampled from the Sufco Mine underground workings previously and also as part of this investigation. The underground sampling locations include mining areas underlying the Quitchupah area, Box Canyon area, Big Ridge area, and locations adjacent to proposed mining areas in the Greens Hollow Tract. Radiocarbon compositions and groundwater mean residence times ("ages") for these samples are listed in Table 6. It is evident from the information in Table 6 that the groundwaters intercepted during mining operations at the Sufco Mine are of ancient origin, with radiocarbon mean residence times ranging from about 4,000 to 15,000 years.

8.2 Tritium (3H)

Tritium is a radioactive isotope of hydrogen that is commonly used in groundwater investigations to identify recharge components that are less than about 50 years old. In previous decades, the presence of appreciable tritium concentrations has been used to identify groundwaters that recharged prior to or after the advent of atmospheric thermonuclear weapons testing. During the period from 1952-1962, large quantities of tritium were released into the atmosphere as a result of atmospheric thermonuclear weapons testing. After peaking in 1962, in 1963 a Soviet-American atmospheric nuclear weapons test ban treaty went into effect, which reduced in rapid declines in the atmospheric tritium concentrations. It is noted, however, that minor amounts of tritium continued to be released to the atmosphere as a result of minor French and Chinese testing until 1980 (Clark and Fritz, 1997). Tritium, whose half-life is 12.43 years, forms naturally in the upper stratosphere by the interaction of ^{14}N with cosmic ray neutrons. Tritium is rapidly incorporated into water molecules and is removed from the atmosphere by precipitation. As several decades have now past since the cessation of atmospheric thermonuclear weapons testing, the tritium concentrations in the atmosphere have now largely declined to near natural cosmogenic background levels as a result of radioactive decay. In continental regions, current tritium concentrations are on the order of 5 – 15 TU (Clark and Fritz, 1997). Similar (or somewhat lower) tritium concentrations have been routinely measured in streams and lakes in the Wasatch Plateau coal district of central Utah in recent years. Consequently, tritium concentrations in groundwaters and surface waters are now generally evaluated in the context of the natural cosmogenic production of tritium (background levels) rather than the

identification of a thermonuclear weapons peak in groundwater as was done in previous decades.

Tritium has been widely utilized in the hydrogeologic community using both qualitative and quantitative dating approaches (Clark and Fritz, 1997). However, in this investigation, tritium has been used only as a qualitative tool to determine whether a modern component of recharge (< ~50 years old) is present or whether the groundwater has been isolated from the surface for at least the 50 year period. No attempt to calculate an absolute "age" of groundwater has been attempted using tritium content. This is primarily because of uncertainties determining the initial tritium input level of the recharge water source(s).

Tritium concentrations in groundwaters sampled from 12 of the 13 springs analyzed for tritium content in the Greens Hollow Tract study area range from 2.8 to 14.6 TU (Table 6), indicating modern recharge components at each of these springs. Groundwater sampled from spring M-SP18 contained no tritium (Table 6), potentially indicating that the groundwater system that supports discharge at the spring has been isolated from the surface for at least approximately 50 years. However, because the tritium analysis for this sample was performed using direct counting methods (with an error range of +/- 2.7 TU), the interpretation of the measured low tritium result is somewhat ambiguous. The modern radiocarbon age and anthropogenic ^{14}C content in spring M-SP18 (Table 6) considered together with the assumed absence of tritium, may suggest a mean groundwater residence time on the order of about 50 years.

The appreciable tritium concentrations measured in the groundwater from all but one of the 13 springs, considered together with the modern radiocarbon mean residence times and the presence of anthropogenic ^{14}C in the springs, are supportive of a determination of modern groundwater flow. This also indicates that the springs are from active-zone groundwater systems in the Greens Hollow Tract area.

The lack of appreciable concentrations of tritium, combined with the radiocarbon mean residence times of several thousands of years in the groundwaters sampled within the Sufco Mine underground workings is supportive of a determination of ancient groundwater with no communication with the overlying surface for at least 50 years or more. Accordingly, the deep in-mine groundwaters are classified as being from inactive-zone groundwater systems.

The finding that the springs in the Greens Hollow Tract area discharge modern water, primarily from shallow groundwater systems, while the groundwater encountered in the underground mine workings is many thousands of years old and is not in communication with shallow groundwaters, is consistent with conditions noted elsewhere in the Wasatch Plateau coal district (Mayo et. al 2003).

9.0 DESCRIPTION OF GROUNDWATER SYSTEMS

Baseline information quantifying seasonal variation in water quality and water quality in the groundwater resources in the Greens Hollow Tract and adjacent areas is presented in Table 2.

Monitoring site locations are shown on Figure 2 and monitoring site details are listed on Table 1.

Groundwater in the Greens Hollow Tract naturally discharges from springs and seeps from the North Horn Formation, Price River Formation, and the Castlegate Sandstone. Groundwater discharge from the Blackhawk Formation and Star Point Sandstone occurs in surrounding regions at the Sufco Mine permit area. Additionally, groundwater discharges from the Blackhawk Formation in the Sufco Mine underground workings in response to human activities (i.e. the creation of mine voids and the pumping of accumulated groundwater from the mine workings to the surface).

Discharge hydrographs for selected springs in the Greens Hollow Tract and surrounding areas are presented in Attachment A. Discharge hydrographs for selected streams in the Greens Hollow Tract and surrounding areas are presented in Attachment B. Also plotted in Attachments A and B are water discharge temperatures, specific conductance values, and, for reference, plots of the Palmer Hydrologic Drought Index. Water level hydrographs for wells in the study area are presented in Attachment C.

Groundwater has been encountered in the Sufco Mine in moderate quantities in sandstone channels in the mine roof. These groundwater inflows are commonly short-lived and do not exhibit seasonal or climatic variability in discharge rates (Personal communication, Mark Bunnell, 2017; Mayo and Associates, 1997, 1999). Groundwater sometimes also discharges

from fault zones that are intercepted by the mine workings. Groundwater inflows into the mine through the mine floor are not common.

The following discussion of the characteristics is based in large measure on concepts described by Maye et al. (2003). In 2003, Mayo et al. (2003) authored a peer-reviewed professional paper that presented the findings of a comprehensive, multi-year investigation of groundwater flow patterns in the mountainous terrain of Utah's Wasatch Plateau and Book Cliffs coal mining districts. This investigation describes a conceptual model of active and inactive groundwater flow regimes in the Utah coal mining districts that is directly applicable to groundwater flow regimes in the Sufco Mine and adjacent area. The Mayo investigation was based on analysis of a large volume of geologic, hydrogeologic, and hydrologic data from the study area. This included analysis of discharge data from 123 springs for which long-term discharge data were available, 1,930 sets of major ion water sample analyses, Carbon-14 and tritium analyses from 132 sampling locations, and δ^2H and $\delta^{18}O$ analyses from 329 sampling locations. Much of the hydrologic data as well as information on historical mining practices discussed in the Mayo investigation was obtained specifically from the Sufco Mine area.

Groundwater systems in the Sufco Mine are associated with one of two fundamental types of groundwater flow regime. These two regimes are described by a fairly simple conceptual model that includes "active" and "inactive" groundwater flow regimes (Mayo et. al, 2003). The operation of these two regimes is fundamentally a consequence of the vertical and horizontal heterogeneity and discontinuity rock strata in the region. A discussion of the

active- and inactive-zone groundwater regimes in the Greens Hollow Tract at the Sufco Mine is presented below.

9.1 Active-Zone Groundwater Systems

Active zone groundwater systems are characterized as having good hydraulic communication with groundwater or surface-water recharge sources and having active groundwater flow from recharge to discharge areas. Thus, they are dependent on annual recharge events and are affected by short-term climatic variability. The elevated tritium concentrations measured at 12 of the 13 spring monitoring sites (which are indicative of groundwaters that are less than about 50 years old) and the modern radiocarbon ages of all spring waters sampled in the study area indicate these springs discharge from active-zone groundwater systems (Table 6).

Discharge hydrographs for springs in the study area are presented in Attachment A. It is apparent in the spring hydrographs of Attachment A and the discharge data presented in Table 2a that most springs exhibit seasonal variations in discharge rates and also respond to short-term climatic variability. This supports the conclusion that these springs discharge from active-zone groundwater systems, and are not related to the deep, inactive-zone groundwater systems that are encountered in the underground workings of the Sufco coal mine (discussed below).

It is noted that the discharge hydrograph for spring M-SP18 (which contained no tritium when sampled) shows pronounced responses to climatic variability, with the response to seasonal recharge being muted or non-existent (See Attachment A). Such conditions are

suggestive of good hydraulic communication with active recharge sources, but perhaps longer groundwater flow paths which buffer the seasonal response. Similar conditions are observed at spring M-SP10. A relatively large storage capacity relative to the spring discharge rates in the groundwater systems that support these springs may also buffer the discharge from the springs.

Active-zone groundwater systems exist in the Greens Hollow Tract area primarily where 1) there is adequate precipitation to facilitate groundwater recharge, 2) there is sufficient storage capacity in the near surface soils, porous rock units, and/or shallow, fractured bedrock horizons to sustain groundwater discharge for significant periods, and 3) there is a competent, impermeable perching layer present in the subsurface that prohibits the downward migration of groundwater. Downward migration of active-zone groundwaters into deeper horizons is prevented by the presence of low permeability bedrock horizons that are widely present in the North Horn and Price River Formations in the study area, creating perched groundwater conditions. The perched groundwater systems, being constrained largely by surface topography, are usually of limited aerial extent. (i.e., groundwater discharge locations are commonly near recharge locations).

9.2 Inactive-Zone Groundwater Systems

Inactive-zone groundwater systems are characterized by old groundwater (commonly from about 2,000 to 19,000 years in the Wasatch Plateau coal mining district) and a general lack of hydraulic communication with the ground surface or active recharge sources (Mayo et. al, 2003). This condition is the result of the lack of recharge potential to deeper groundwater

systems, either vertically or horizontally, because of 1) the abundance of low-permeability rocks in the rock sequence, and 2) the lenticular, discontinuous nature of the interbedded more permeable horizons that limits the extent of potential groundwater movement. Inactive-zone groundwater systems are not influenced by either annual recharge events or by short-term climatic variability. This is evidenced by the lack of seasonal or climatic discharge responses of groundwater inflows into the Sufco Mine. Rather, groundwater inflows encountered in the Sufco Mine typically drain rapidly after first being encountered (Personal communication, Mark Bunnell, 2017). All groundwater inflows into the Sufco Mine have been from inactive-zone systems, as evidenced by the radiocarbon ages of the waters and the lack of tritium in in-mine groundwaters (Table 6), and the lack of seasonal or climatic response in discharge rates.

Inactive-zone groundwaters in the Blackhawk Formation in the study area are not part of a regionally continuous aquifer. Groundwater in the inactive zone occurs primarily in isolated partitions created by the discontinuous nature of bedrock hydrostratigraphic horizons. Because these partitions are isolated both vertically and horizontally by low-permeable strata, lateral migration of groundwater in the deep Blackhawk Formation is limited. Historically, mining operations in the Sufco Mine have encountered groundwater in some portions of the mine, while other nearby locations have been dry. This condition demonstrates the limited groundwater recharge potential and the limited potential for lateral groundwater migration in the lenticular rock bodies of the Blackhawk Formation.

The groundwater flow characteristics within individual geologic formations present in the Greens Hollow Tract are summarized in the following section.

Quaternary Alluvium

Groundwater is likely present in the Quaternary alluvial deposits that exist in the bottoms of the major surface-water drainage in the Greens Hollow Tract and adjacent areas. Where the alluvial deposits are comprised of permeable sediments (sands and gravels), the shallow alluvial groundwater is commonly in good hydraulic communication with overlying surface waters. In areas where the alluvial deposits are comprised mostly of low permeability clays and silts that are common in alluvial sediments derived from erosion of the North Horn and Price River Formations (such as that identified in the South Fork of Quitchupah Creek; Petersen Hydrologic, 2012), surface streams are sometimes perched above the underlying low-permeability sediments.

North Horn Formation

Because of the pervasiveness of low-permeability shale horizons in the North Horn Formation, the potential for vertical migration of groundwater through the formation into deeper strata is low. Consequently, groundwater recharge through the North Horn Formation to the underlying Price River Formation is minimal.

Groundwater flow in the North Horn generally occurs as shallow flow within sandstone paleochannels in the unit. Locally, groundwater flow in the minor limestone units may also support groundwater flow to springs and seeps. Recharge to the sandstone paleochannel

systems likely occurs where the up-dip ends of the sandstones are present at or near the surface in recharge areas. Groundwater then flows laterally through the sandstone channels under perched conditions until the unit intersects the land surface in down-gradient areas, forming a spring. Because of the pervasiveness of low-permeability shales in the formation that encase the sandstone members both vertically and horizontally, groundwater flow directions are largely constrained by the sinuous geometry of the sandstone paleochannels. In other words, the groundwater in the North Horn does not widely flow throughout the formation, but rather areas of appreciable groundwater flow to springs and seeps are concentrated only within the sandstone channels. The potential for groundwater flow through sandstone channels is enhanced locally by bedrock fracturing. Thus, areas of groundwater flow in the North Horn Formation are limited to perched, local, partitioned groundwater systems that are generally not mappable. Groundwater aquifers (i.e. zones of continuous saturation over broad lateral extents that are capable of yielding water to wells) are generally not present in the North Horn Formation.

Price River Formation

Groundwater discharge from the Price River Formation in the Greens Hollow Tract is meager (Table 2a). Baseflow discharge rates at the three springs identified in the Price River Formation in the Greens Hollow Tract are usually less than one gallon per minute at each of these springs (Table 2a). This condition is likely the result of the pervasive presence of low-permeability shales in the formation which impedes the potential for groundwater flow in the formation. Additionally, where the Price River Formation is overlain by the North Horn Formation, the potential for vertical recharge from the overlying formation to the underlying

Price River Formation is low because of the poor vertical groundwater transmitting properties of the overlying North Horn Formation.

Mayo and Associates (1997) noted that boreholes penetrating the Price River Formation in the Sufco Mine lease area have not encountered water in this unit. Mayo and Associates attributed the general lack of groundwater recharge in the Price River Formation to the combined factors of low precipitation, evapotranspiration of soil-zone moisture, and the presence of near-surface clayey horizons.

The presence of the Price River Formation at the land surface over significant portions of the Greens Hollow Tract and adjacent areas (Figure 4) limits the potential for groundwater recharge to underlying strata regionally.

In the Greens Hollow Tract and adjacent existing Sufco Mine area, groundwaters from the Price River Formation often contain higher concentrations of dissolved salts than do groundwaters from the overlying North Horn Formation (Table 5). This is likely due to the increased presence of soluble minerals in the formation.

Castlegate Sandstone

The Castlegate Sandstone is a massive, cliff-forming sandstone unit. In many locations, the intergranular spaces in the sandstone are filled with calcite or silica cement, which decreases the primary porosity and permeability of the formation. Consequently, groundwater flow in the Castlegate Sandstone in the study area occurs primarily thorough fracture and joint

systems and along bedding planes. Although some of the sandstone rocks in the Castlegate are sufficiently permeable to transmit appreciable groundwater, groundwater flow through the pore spaces in the formation is limited. This is due primarily to the presence of low-permeability mudstone drapes and bounding layers that are interbedded in the formation. Near cliff exposures and in stream bottoms, the Castlegate Sandstone sometimes becomes friable due to the dissolution of the carbonate cement and the unit is more capable of supporting shallow, active groundwater systems.

Near-vertical jointing in the Castlegate Sandstone is pervasive and readily observable where the formation is exposed at the surface in the region (notably in the Pines Tract area east of the Greens Hollow Tract). Groundwater flow commonly occurs along the joints and fractures, and also locally along bedding planes where permeable strata are sometimes underlain by the thin clay or shale perching layers that exist locally in the formation. The direction of bedding plain groundwater flow in the area is controlled by the local dip of the stratigraphic bedding horizons (which is generally toward the north-northwest in the Greens Hollow Tract). Because of the discontinuous nature of the shale layers, and the fact that individual permeable sandstone strata are not continuous over significant distances, long, regional-type flow systems generally do not develop in the Castlegate Sandstone. Rather, Castlegate Sandstone groundwater systems, where they exist, are typically local in nature with small to moderate quantities of groundwater commonly being discharged.

Where the Price River Formation, which generally does not support vertical migration of fluids, is present above the Castlegate Sandstone, the potential for recharge to the Castlegate

Sandstone is minimal. This conclusion is supported by the observation that there are only three Castlegate Sandstone springs and the identified combined discharge from the Castlegate Sandstone is meager in the Greens Hollow Tract (See Tables 2a and 5). Accordingly, recharge to the Castlegate Sandstone commonly likely occurs where the formation is directly exposed at the surface, or where it is covered only by a thin covering of sandy sediments (as is the case in the Pines Tract area to the east of the Greens Hollow Tract). In the Greens Hollow Tract and adjacent area, the Castlegate Sandstone is exposed along the rims of the deeply incised canyons (which include the North Fork of Quitchupah, South Fork of Quitchupah, Box, and Muddy Creek Canyons), but the total surface area of the exposure is small (Figure 4). Thus the potential for recharge to the Castlegate Sandstone within the Greens Hollow Tract is not appreciable. The Castlegate Sandstone is underlain by the Blackhawk Formation, which acts as a basal confining layer, preventing appreciable vertical migration of groundwater from the unit into deeper strata. Consequently, it is common regionally for springs to originate near the base of the Castlegate Sandstone (Thiros and Cordy, 1991), or occasionally where thin shaley perching interbeds within the Castlegate Sandstone intersect the land surface.

Blackhawk Formation

Because of the presence of interbedded low-permeability units in the Blackhawk Formation and the vertical and lateral discontinuity of sandstone horizons, the potential for vertical and horizontal movement of groundwater within the Blackhawk Formation is limited. For this reason, it is observed that groundwater flow in the formation occurs primarily through sandstone paleochannels, or occasionally through faults and fractures, while regional

migration of groundwater across lithologies (either vertically or horizontally) is minimal. The direction of groundwater flow within permeable sandstone channels is largely constrained by the geometry of the sinuous sandstone paleochannel structures and also by the structural dip of the strata. Because of the lenticular nature of the permeable strata in the Blackhawk Formation (both at a micro and macro scale), and the fact that individual sandstone channels often interpenetrate and are truncated, regional type groundwater flow regimes typically do not form in the formation.

The Blackhawk Formation is known to contain swelling clays that tend to naturally heal mining-induced fractures in the formation. Well drilling reports and laboratory analysis of samples indicate that the claystone layers in the Blackhawk Formation contain swelling clays which plastically deform when fractured (Mayo and Associates, 1997). Chempet Research Corporation (1989) found that Blackhawk Formation claystone layers contain up to 58% montmorillonite.

Effects of subsidence-related fracturing in the Blackhawk Formation

In an attempt to substantiate the conclusion that subsidence-related fracturing has not induced the downward movement of modern, overlying groundwaters into the Sufco Mine, an investigation was performed by Mayo and Associates (1997) during which a sample of groundwater which drains an old, sealed longwall gob area was collected and analyzed for ^{3}H and ^{14}C. As described by Mayo and Associates, the sample site (1L 8E seals) was specifically chosen because it underlies a region which is known to have undergone substantial ground subsidence, and the rocks at the surface contain abundant subsidence-

related fractures. Mining ceased in this area in 1989, and the outflow from this area has steadily decreased since that time. If groundwaters from shallow, overlying active-zone systems (which contain abundant anthropogenic carbon and tritium) were being intercepted by subsidence fractures and flowing downward into the mine, we would expect to find some of the modern water in this sample. Mayo and Associates found that this was not the case. The groundwater had a mean ^{14}C age of 13,000 years, and contained no tritium (0.00 T.U.). The fact that the discharge from this and other abandoned longwall areas consistently decrease with time also suggests that there is not good hydraulic communication between groundwater systems immediately overlying the mine and overlying shallow groundwaters.

Water level hydrographs for wells completed in the Blackhawk Formation at the Sufco Mine area demonstrate that water levels in these deep groundwater systems do not respond to seasonal recharge or climatic variability (Mayo and Associates, 1997; Petersen Hydrologic 2010). These conditions suggest isolation from shallow, seasonal recharge sources and are consistent with the deep Blackhawk Formation being part of the inactive-groundwater system in the region. However, as mining occurs in areas in close proximity to the locations of deep monitoring wells, as anticipated water levels in the wells commonly respond to the mining activity. This condition is not unanticipated, as the ancient, inactive-zone groundwater that is intercepted by the mine workings is pumped from mining areas, resulting in decreased hydraulic head on the groundwater system near the wells. It is noted that the deep, inactive groundwater system monitored at monitoring well 01-8-1 (located on Big Ridge as shown on Figure 2) responded appreciably to the effects of mining in the vicinity (see Attachment C). It is noteworthy that spring discharges on Big Ridge, which are derived from shallow, active-

zone groundwater systems, continued to occur after mining in the area was complete, further demonstrating the lack of hydraulic communication between the deep, inactive-zone groundwaters encountered in the underground mine workings and the shallow, active-zone systems that support springs and seeps.

In the general sense, groundwater flow in the Blackhawk Formation is in the down-dip direction, with local flow directions being largely constrained by the geometry of the sinusoidal sandstone paleochannels through which groundwater may flow. Groundwater flow may also occur along linear, relatively narrow damaged zones associated with faulting. Consequently, because of the discontinuous, isolated nature of saturated strata in the mine, and the localized perched groundwater conditions, it is not possible to create a meaningful potentiometric surface map of the Blackhawk Formation in the vicinity of the Sufco Mine.

Star Point Sandstone

Groundwater flow in the Star Point Sandstone regionally occurs primarily through joints, fractures, and faults. Appreciable groundwater flow through unfractured Star Point Sandstone bedrock is generally not observed (Bills, 2000).

No springs associated with the Star Point Sandstone have been identified in the Greens Hollow Tract and adjacent area. However, springs discharging from the Star Point Sandstone are present in Convulsion Canyon near the Sufco Mine surface facilities, located about five miles south of the Greens Hollow Tract. Discharge from one of these springs (Sufco 047) is used for a water supply for the Sufco Mine surface facilities. Sufco 047

discharges from a fracture zone in the south-facing Star Point Sandstone cliff below the mine surface facilities. Discharge from this spring is collected in a buried collection system and stored in a storage tank for use as the mine surface facilities water supply. It is interesting to note that the average discharge temperature from Sufco 047 is 26.3° C, which is substantially elevated relative to the mean annual air temperature in the region. It is considered most likely that the elevated discharge temperature at this spring is a result of interactions with bedrock strata that have locally been heated as a result of coal burn near the outcrops. The measured carbon-14 content of Sufco 047 (25.27 pmC) indicates a mean groundwater residence time of approximately 7,300 years (Mayo and Associates, 1997). The tritium concentration at spring Sufco 047 (0.1 to 0.2 TU), which is near the lower laboratory detection limit, indicates that this spring does not have an appreciable modern recharge component (within the past approximately 50 years). This finding is consistent with the old radiocarbon mean residence time determined with the carbon-14 analysis.

Masuk Member of the Mancos Shale

The Masuk Member of the Mancos Shale is composed primarily of fine-grained marine sedimentary deposits (claystones and shales). Consequently, the Mancos has poor water-transmitting properties. No springs associated with the Mancos Shale have been identified in the Greens Hollow Tract and adjacent area. The Mancos Shale is continuous regionally and the shales of the formation likely form a basement in the Sufco Mine area that prevents vertical migration of groundwater into deeper strata.

The Mancos Shale is also known regionally to contain appreciable quantities of soluble minerals. Consequently, groundwater that interacts with the unit typically acquires elevated TDS concentrations through the dissolution of these minerals.

10.0 DESCRIPTION OF SURFACE-WATER SYSTEMS

Baseline information quantifying seasonal variation in water quality and water quality in the surface-water resources in the Greens Hollow Tract and adjacent areas is presented in Table 1. Monitoring site locations are shown on Figure 2 and monitoring site details are listed on Table 1. Discharge hydrographs for streams, together with plots of temperature, pH and specific conductance are presented in Attachment B.

Surface-water drainages in the Greens Hollow Tract and adjacent areas are shown on Figure 8. All surface waters draining from the Greens Hollow Tract are tributary to the Muddy Creek drainage. Muddy Creek flows from its headwaters near the Greens Hollow Tract towards the southeast where it combines with the Freemont River to form the Dirty Devil River near the town of Hanksville, Utah. The Dirty Devil then flows southward to its confluence with the Colorado River near the upper extent of Lake Powell.

Although no land area within the Greens Hollow Tract drains to the Skutumpah Creek drainage, lands located southwest of the tract drain to Skutumpah Creek. Skutumpah Creek is a tributary to Salina Creek, which flows to the Sevier River just west of the town of Salina,

Utah. The Sevier River flows into Sevier Lake in the lowest part of the Sevier Desert in Millard County, Utah. Sevier Lake has been mostly dry during recorded history with no lake outflow.

The primary surface water sub-drainages in the Greens Hollow Tract are described below.

Muddy Creek Drainage

Surface-water drainage from most of the Greens Hollow Tract, including the central and northern portions of the tract, flows into Muddy Creek. Sub-drainages in the tract include the Cowboy Creek drainage, the Greens Hollow drainage, the South Fork of Muddy Creek drainage, and a series of unnamed drainages along the northern margin of the tract that drain directly to Muddy Creek.

The Cowboy Creek sub-drainage includes lands north of Big Ridge and south of the adjacent Greens Hollow drainage to the north. The watercourse extends from its headwaters along the northern end of White Mountain eastward for a distance of about three and a half miles across the North Horn and Price River Formations. The stream channel then flows into the Castlegate Sandstone escarpment and down the steep-walled canyon across the Blackhawk Formation to its confluence with Muddy Creek (Figure 8). Long-term monitoring of the stream has occurred since 2001 at site M-STR04 (Table 2). A summary of monitoring data collected at surface-water sites by Cirrus for the period 2001-2004 is presented in Table 4. Recent monitoring data at M-STR04 indicate that the Cowboy Creek where it enters the Castlegate Sandstone gorge has usually been dry. Discharge was observed at M-STR04 on

only one occasion in the previous five years of monitoring, with a flow of 2.25 gpm on that occasion in June of 2015 (Table 2). A stream gain/loss study of the Cowboy Creek drainage was performed by Cirrus Ecological Solutions in September of 2001 (USFS, 2005). Maps and data showing the results of their study are available in the 2005 Groundwater and Surface Water Technical Report (USFS, 2005). Cirrus found that flow was present from the headwaters to regions about mid-way through the stream's traverse through the Price River Formation. Below that point, the stream was dry as the stream channel crossed the Castlegate Sandstone until about 300 feet above monitoring station M-STR05, where water entered the channel from beneath a rock outcrop associated with the Blackhawk Formation. Below that point, the steam lost flow, and then gained flow from M-STR05 to M-STR02 all along the Blackhawk Formation with flow disappearing below M-STR02.

The Greens Hollow sub-drainage extends from the steep slopes on the northwestern flanks of White Mountain in the North Horn Formation, and eastward for a distance of about two and a half miles, where the watercourse enters the Castlegate Sandstone gorge near monitoring site M-STR06 (Figure 2). The stream channel crosses the Castlegate Sandstone for a distance of about 0.5 miles to the confluence with Cowboy Creek in Greens Canyon. Cirrus (USFS, 2005) reports that the only inflows to Greens Hollow Creek during their 2001 survey was from springs M-SP04, M-SP05, and M-SP06. Above these locations, the stream channel was dry. These same conditions were observed by the author during quarterly monitoring site visits during 2015 and 2016. Cirrus noted in their gain/loss study that the stream continued to flow from this location to below monitoring site M-STR06. Below that point, the watercourse was dry to the confluence with Cowboy Creek in Greens Canyon. It has been

noted during recent monitoring (2015 and 2016) that the stream at M-STR06 was dry on 5 of the six quarterly monitoring events during this period. The stream was flowing at a low rate (0.636 gpm) during the 26 June 2015 monitoring event (Table 2a).

The Cirrus study showed losses for both Cowboy Creek and Greens Hollow creek in the Blackhawk Formation and Castlegate Sandstone (USFS, 2005). Greens Hollow did not flow in the Blackhawk Formation. Cowboy Creek and Greens Canyon had both gains and losses in the Blackhawk Formation. Cirrus noted that the results of their gain/loss study might not be representative of the gains and losses that may occur during other seasons or other years.

Box Canyon Creek is a tributary drainage to Muddy Creek that is situated a considerable distance east of the Greens Hollow Tract boundary. Box Canyon is mostly isolated from the Greens Hollow Tract by the upland Big Ridge area and also by the deeply incised Greens Canyon. Consequently, groundwater and surface-water systems in Box Canyon should not be influenced by proposed mining activities in the Greens Hollow Tract.

Discharge in Muddy Creek is substantial. The long-term average annual flow rate (1952-2012) at the USGS gauging station near Emery, Utah (station 09330500) is 37.5 cfs (USFS, 2005). The surface area drained by Muddy Creek at station 09330500 is 105 square miles. The headwaters of Muddy Creek are situated north of the Greens Hollow Tract in the upland area bounded by White Mountain, Heliotropoe Mountain, and Ferron Mountain. During the springtime snowmelt runoff event, discharge in Muddy Creek usually peaks in the late springtime (May or June) coincident with the peak of the springtime snowmelt runoff with

discharge rates exceeding 100 cfs. During wet climatic cycles, discharge in Muddy Creek during the springtime runoff has exceeded 500 cfs. During the late summer and fall monsoon season, large discharge rates of several hundred cfs also occur occasionally. During baseflow conditions, discharges of less than 10 cfs in Muddy Creek are not uncommon. It should be noted that there are several water storage reservoirs in the Muddy Creek headwaters area (USFS, 2005). The timing of water releases from these reservoirs can affect the discharge rates occurring in Muddy Creek below the headwaters area.

Historic discharge rates have been measured by the USGS at station 09330500 since 1910. Field and laboratory water quality parameters have also been analyzed periodically on water samples from Muddy Creek by the USGS.

Water quantity and water quality in the South Fork of Quitchupah was monitored by Cirrus personnel at station M-STR08 from 2002-2004 (Tables 2a, 2b). Water quantity and water quality measurements have been performed on behalf of the Sufco Mine at various monitoring stations on Muddy Creek since 1997.

Petersen Hydrologic 2015 Gain/Loss Study on Muddy Creek

A gain/loss study of Muddy Creek was performed by Petersen Hydrologic during low-flow conditions on 28-29 October 2015. The results of the study, including discharge measurement locations and measurement results, are presented in Table 7 and also plotted on Figure 9. Field water quality parameters, including temperature, pH, and specific

conductance, were measured at each of the stream monitoring stations. The water quality information is also provided in Table 7.

The purpose of the study was to determine whether Muddy Creek gains or loses appreciably as the creek flows past the Greens Hollow Tract and downstream to the USGS gauging station near Emery, Utah. Over this reach of Muddy Creek, the stream crosses the Blackhawk Formation, Star Point Sandstone, and Mancos Shale. It is acknowledged that because of the appreciable flow in Muddy Creek and the inherent margin of error associated with conventional discharge measurement techniques, small gains or losses in the stream would not be detected in this gain/loss study.

Discharge measurements were performed using the velocity-area method as described in United States Geological Survey Circular (1995). The measurements were performed using a Marsh-McBirney model 2000 electromagnetic current velocity meter. Based on our professional experience and the prevailing stream conditions we estimate that the discharge measurements are accurate to within about 5 to 10 percent of actual values. It should be noted that the gain/loss study was performed over a two day period of time. Considerable effort was taken to select a time for the performance of the test when optimal weather conditions would prevail in the drainage. The dates chosen for the performance of the study (28-29 October 2015) were selected after monitoring weather forecasts that predicated a precipitation-free window at that time that would include the two testing days as well as several precipitation-free days prior to the test. The testing dates were also selected based on predicted air temperatures in the area to ensure that air temperatures would remain above

freezing to minimize the potential influence of freeze/thaw conditions in the watercourse during the test. Unfortunately, some intermittent light to moderate intensity rain fell during the period of the test, which could possibly have influenced the discharge rates in the creek. However, it is our opinion that the effects of the intermittent light to moderate precipitation likely did not excessively influence the discharge rates in the Muddy Creek drainage.

Discharge rates measured at Muddy Creek gauging Station #1 and Station #2 were 4,320 gpm and 4,580 gpm, respectively. These two discharge measurements vary by 5.7 percent, which is within the estimated margin of error for the utilized measurement technique. Accordingly, there is no statistically significant indication of a gain or loss of flow in this reach of Muddy Creek. Between Muddy Creek Station #2 and Station #3, measured inflows from side tributaries 2a, 2b, and 2c, totaling 775 gpm, entered Muddy Creek. Thus, if there was no loss or gain of flow in this reach, the total flow in Muddy Creek anticipated to arrive at Muddy Creek Station #3 is 4,580 gpm plus 775 gpm, or 5,355 gpm. The discharge measured at Muddy Creek Station #3 was 5,350 gpm, which is very close to the 5,355 gpm projected discharge at Station #3. Accordingly, there is no statistical indication of a gain or loss in the discharge in Muddy Creek in this reach of the watercourse. The measured discharge at Muddy Creek Station #4 was 4,890 gpm. The discharge measurements for Station #3 and Station #4 vary by 9.4 percent, which is within the projected statistical error of these measurements, although it is near the upper limit of the error range. It is possible that the difference in the measured discharge rates between these two stations is a reflection of the intermittent light to moderate precipitation that was occurring in the drainage at that time. The first occurrence of rain in the drainage on 29 October 2015 occurred as monitoring at

Station #4 commenced. The discharge measurement performed at Station #3 occurred about four hours later in the day as the light to moderate rain in the drainage had been ongoing. It is noteworthy that, based on 20 years of monitoring flows under seasonal conditions in Muddy Creek at Station #3 (Pines 405) and Station #4 (Pines 406b), appreciable gains or losses of discharge in the creek as it flows between these two stations has generally not been noted.

The results of the water quality measurements performed coincident with the discharge measurements do not indicate any unanticipated changes in the water quality parameters that might be indicative of appreciable groundwater/surface water interactions (gains of water with varying water quality).

Quitchupah Creek Drainage

The southern portions of the Greens Hollow Tract and adjacent area are within the Quitchupah Creek drainage (Figure 8). Quitchupah Creek flows into Muddy Creek approximately 15 miles southeast of the Greens Hollow Tract near the Interstate 70 crossing of Muddy Creek. Most of the Greens Hollow Tract area within the Quitchupah Creek drainage is within the North Fork of Quitchupah Creek drainage. A small area in the extreme southern portion of the Greens Hollow Tract is within the South Fork of Quitchupah Creek drainage. Lands adjacent to the southern portions of the Greens Hollow Tract are also within the South Fork of Quitchupah Creek surface water drainage.

Long-term monitoring of the North Fork of Quitchupah Creek (1979-2016) has taken place at monitoring site Sufco 007 (Figure 2). Long term monitoring of the South Fork of Quitchupah Creek (1979-2016) has taken place at monitoring site Sufco 006. Additionally, supplemental monitoring at site Sufco 006A on the South Fork of Quitchupah has been performed since 2010. Monitoring at station Sufco 006B occurs a short distance below the long-term Sufco 006 station.

The North Fork of Quitchupah Creek drainage extends from its headwaters area on the White Mountain within the Flagstaff Limestone eastward across entire thicknesses of the North Horn Formation and the Price River Formation to monitoring station Sufco 007 which at the lower (eastern) margin of the Greens Hollow Tract boundary. A short distance further to the east, the stream flows into the steep-walled North Fork of Quitchupah Creek gorge.

Discharge measured at Sufco 007 on the North Fork is a function of seasonal and climatic variability. Yearly discharge peaks are readily apparent in the discharge hydrograph for the South Fork (Attachment B). The yearly discharge peaks typically occur during the second quarter monitoring event (usually in May or June) in response to the annual snowmelt event. The minimum flow monitored during a year typically occurs during the 4th quarter monitoring event (usually in October or November) as seasonal water is gradually drained over the summer and fall months.

The peak and baseflow discharge rates in the North Fork of Quitchupah Creek increased markedly in response to significantly wet periods that occurred in the early 1980s, the late

1990s, and the mid-2000s (Attachment B). Peak and baseflow discharge rates were low in the creek during the early 1990s and early 2000s in response to regional drought conditions that prevailed during these times.

The South Fork of Quitchupah Creek extends mostly in the area adjacent to the Greens Hollow Tract from its headwaters region in the North Horn Formation along the western flanks of White Mountain in a southeasterly direction for a distance of about 2.5 miles to monitoring site Sufco 006. Monitoring site Sufco 006 is situated a short distance above the contact between the Price River Formation and the underlying Castlegate Sandstone (Figure 4). To the east of Sufco 006 the drainage enters the deep, steep-walled South Fork of Quitchupah Canyon gorge where the stream course initially flows across the Castlegate Sandstone and then in the lower reaches of the canyon it flows across the Blackhawk Formation that is present in the bottom of the canyon (Figure 4).

Discharge rates measured in the South Fork of Quitchupah Creek at Sufco 006 are usually less than those flowing at the same time in the North Fork of Quitchupah Creek (Table 2a). Discharge in the South Fork is a function of seasonal and climatic variability. Yearly discharge peaks are readily apparent in the discharge hydrograph for the South Fork (Attachment B). The yearly discharge peaks typically occur during the second quarter monitoring event (usually in May or June) in response to the annual snowmelt event. The minimum flow monitored during a year typically occurs during the 4th quarter monitoring event (usually in October or November) as seasonal water is gradually drained over the summer and fall months.

The peak and baseflow discharge rates in the South Fork increased markedly in response to significantly wet periods that occurred in the early 1980s, the late 1990s, and the mid-2000s (Attachment B). Peak and baseflow discharge rates were low in the creek during the early 1990s and early 2000s in response to regional drought conditions that prevailed during these times. Discharge is sometimes completely absent in the South Fork of Quitchupah Creek at monitoring site Sufco 007 during the fall and winter months. The periodic lack of substantial discharge in the creek during the fall and winter is likely due to a combination of factors including 1) diversion of the water in upstream locations at the crude stream diversion (discussed below), and 2) the influence of climatic variability (drought conditions).

It is noted that the Skutumpah Creek drainage is present to the southwest of the Greens Hollow Tract (Figure 2). No portion of the Skutumpah Creek drainage is present within the Greens Hollow Tract. However, it is noteworthy that the quantities of surface water flowing in Skutumpah Creek and the South Fork of Quitchupah Creek are influenced by a crude stream diversion. The crude undeveloped surface diversion on the South Fork of Quitchupah Creek that diverts surface water to the Skutumpah drainage is present in the south-central portion of Section 15, T21S, R4E (Figure 8). Historical information on the magnitude of water diverted from the South Fork to Skutumpah Creek at this location is not available. Additionally, a United States Forest Service diversion for stock watering use is present higher in the drainage.

Surface waters in both the North Fork and the South Fork of Quitchupah Creek as monitored at Sufco 007 and Sufco 006, respectively, are generally of the no-dominant cation – bicarbonate geochemical type. Sodium, Calcium, and Magnesium are all present in appreciable quantities. The variability of the TDS concentrations of surface waters in the North Fork and South Fork is likely attributable to 1) diluting effects of seasonal low-TDS snowmelt waters, and 2) the dissolution of soluble minerals commonly known to occur in the Price River Formation (Petersen Hydrologic, 2010).

A gain/loss investigation of the South Fork of Quitchupah Creek was performed on 1 June 2012. At the time of this survey, discharge in the South Fork was essentially absent. The absence of flow was likely attributable to the combination of the effects of the prevailing drought conditions, and also to likely diversions of water at up-gradient locations. Because of the lack of water in the stream channel at that time, observations of areas potentially contributing baseflow to the stream channel could readily be observed. It was noted during that survey that a meager discharge of less than 1 gpm was present at monitoring site 006A. Discharges of less than 1 gpm were intermittently present in the reach between 006A and Sufco 006 (which was considered likely to represent the re-emergence of water originating at upstream locations as alluvial seepage into the creek where it was forced to the surface as a result of the alluvial geometry).

11.0 PROBABLE HYDROLOGIC CONSEQUENCES DETERMINATION

The following section describes the Determination of Probable Hydrologic Consequences of Coal Mining in the Greens Hollow Tract.

728.100 Quality and quantity of surface water and groundwater under seasonal flow conditions

Information on Quantity and quality of surface-water and groundwater under seasonal flow conditions in the Greens Hollow Tract and surrounding areas is presented in Tables 2a and 2b. Additional information on groundwater and surface-water quality and quantity in and around the Greens Hollow Tract has been submitted electronically to the Utah Division of Oil, Gas and Mining through the on-line coal water quality database, which is freely accessible and located at: http://ogm.utah.gov/coal/edi/wqdb.htm.

Discharge hydrographs for springs and seeps in the Greens Hollow Tract and adjacent areas are presented in Attachment A. Discharge hydrographs for streams in the Greens Hollow Tract and adjacent areas are presented in Attachment B. Also included in Attachments A and B are plots of temperature, pH, and specific conductance in addition to a plot of the Palmer Hydrologic Drought Index.

728.200 Baseline hydrologic information

Spring and seep surveys were conducted at the Greens Hollow Tract by Cirrus Ecological Solutions, LC for the U.S. Forest Service beginning in 2001. As part of the spring and seep surveys, groundwater and surface-water discharge rates and field water- quality parameters, including water temperature, pH, specific conductivity, were measured. Spring and seep locations were determined in the field using hand-held GPS receivers.

Baseline monitoring of selected springs and streams, including laboratory water quality analyses, were performed in the Greens Hollow Tract and surrounding areas during both high-flow and low-flow conditions from 2002 to 2004. The results of baseline monitoring at the Greens Hollow Tract and adjacent areas are listed in Tables 2a and 2b.

Additional monitoring of springs, streams, and wells was performed previously by the United States Geologic Survey (Thiros and Cordy, 1991) as part of a hydrologic reconnaissance of the Quitchupah and Pines areas. Additional baseline hydrologic data for the Greens Hollow Tract area have been submitted electronically to the Division of Oil, Gas and Mining Coal Water Quality Database, which are available on line at:

http://ogm.utah.gov/coal/edi/wqdb.htm.

728.310 Whether adverse impacts may occur to the hydrologic balance

The hydrologic balance is the sum of the flow interactions between surface waters and groundwaters and between various groundwater flow systems. This section describes the potential for adverse impacts to the hydrologic balance as a result of coal mining activities in the Greens Hollow Tract and adjacent area.

For reasons described in previous sections of this report, the potential for the establishment of hydrodynamic communication between the shallow, active-zone groundwater systems that support spring and seep discharges in the Greens Hollow Tract and the deep, inactive-zone groundwater systems that will likely be encountered in the underground mine workings of the Sufco Mine is considered remote. Accordingly, while the deep inactive-zone groundwaters held primarily in sandstone paleochannels immediately overlying the mined coal seam will be dewatered through mining activities, it is considered highly unlikely that surface waters or shallow groundwaters could migrate from the near surface into the underlying mine workings where the depth of cover exceeds 800 feet (which includes all proposed mining areas in the Greens Hollow Tract).

Active-zone groundwater systems in near-surface sediments and strata in the Price River and North Horn Formations, where overburden thicknesses are greater than about 800 feet should not be impacted by mining operations. This conclusion is based on the following lines of evidence:

1) The Price River and North Horn Formations are known to contain abundant, relatively thick shale and claystone layers. These low-permeability layers

inhibit the vertical migration of groundwater into deeper strata. Additionally, the Mesa Verde Group shales and claystones in the region are known to contain hydrophyllic clays which are of low permeability and swell when wetted to effectively seal subsidence cracking. Clays in the North Horn and Price River Formations have been determined to contain about 24 percent smectite clay which swells when wetted effectively sealing fractures and stopping the downward flow of water (DOGM, 2005).

2) While surface cracking in these formations (which typically extend less than about 50 feet below the land surface) can occur as a result of subsidence, the presence of uncompromised shale or claystone layers beneath the subsidence cracked zone prevents further downward migration of groundwater into deeper formations. Additionally, unconsolidated soils and weathered shales and clays are known to be present in North Horn- and Price River-derived sediments regionally. In areas where these formations are present near the surface and where tension cracking may occur, the tension cracks would likely remain open for only short periods of time. This is because the weathered or unconsolidated clayey or shaley sediments derived from these formations are typically plastic in nature and of low-permeability. These materials, through infilling or in-place swelling, tend to rapidly heal all but the largest tension cracks, minimizing impacts to local groundwater flow regimes. That this is the case is supported by decades of previous experience in the Wasatch Plateau and Book Cliffs coal districts of Utah, where literally hundreds of springs discharging from these formations have been undermined without

perceptible or quantifiable impacts occurring to groundwater and surface-water quality or quantity.

It should be noted that, while the downward migration of shallow groundwater into deeper geologic formations is unlikely to occur, the potential exists for the moving of groundwater discharge locations at the surface. Occasionally, where near-surface tension cracking is extensive, spring discharge locations may be moved to locations a few to several tens of feet topographically lower than the original spring discharge location. For example, if a low-permeability perching layer upon which groundwater was flowing toward a spring were to be compromised as a result of extensive tension cracking, the discharge previously flowing to the spring could be rerouted through the fractured perching layer downward until a lower uncompromised perching layer was present. Under this scenario, the post-mining discharge location for the spring would likely occur where the lower perching layer first intersected the ground surface in a down-dip location.

In considering the proposed coal mining activities in the Greens Hollow Tract, it is informative to consider the response of Castlegate Sandstone groundwater systems to previous coal mining activities in the Pines Tract at the Sufco Mine. At the Pines Tract area, the Castlegate Sandstone is exposed at or near the surface over large portions of the tract. The pre-existing joints and fractures in the brittle sandstone bedrock are apparent in the field are clearly visible in aerial imagery from the area. The thin soil that covers the Castlegate Sandstone bedrock in some locations generally consists predominantly of loose, clean sand, which is likely permeable. The potential for groundwater recharge through the

exposed fractured Castlegate Sandstone bedrock is substantial. The potential for lateral perched groundwater flow through the fractured shallow sandstone is also appreciable in the gently sloping topography of the Pines Tract. Field observations of spring discharge mechanisms in the Pines area suggest that the springs discharge from fractured sandstone horizons, commonly where a thin (a few inches thick) clay-rich parting that is interbedded within the sandstone perches horizontal groundwater flow. Groundwater flows along the bedding plane/perching layer down-dip until the flowpath intersects the canyon wall forming a spring. When longwall mining occurred in the Pines Tract area beneath the springs and subsidence of the land surface occurred, discharges to the surface at some of the spring locations ceased. Based on site observations, it is apparent that discharges at these springs ceased when the existing joints dilated and/or additional fractures formed in response to subsidence. It is considered likely that the thin, clay-rich layers that perched the groundwater flow to the spring were also compromised with the subsidence fracturing. With the perching layer compromised, the shallow, perched groundwater that previously flowed to the spring likely migrated into deeper strata until encountering impermeable layers within the underlying Blackhawk Formation and causing the groundwater to discharge at a new or existing discharge point.

Thus, it is evident that important factors contributing to the responses of the Castlegate Sandstone springs to mining in the Pines Tract included:

- The brittle, jointed characteristics of the near-surface Castlegate Sandstone framework at the Pines Tract

- The shallow depths of groundwater flow in the Castlegate Sandstone – within the depths below the surface to which near-surface subsidence fractures typically propagate
- The fact that the thin, clayey perching layers interbedded in the brittle sandstone could be compromised by the subsidence-related near-surface ground movement.
- Recharge to the Castlegate Sandstone occurred where the sandstone was at or very near the surface under perched conditions.

In considering the proposed mining at the Greens Hollow Tract, it is important to note that the hydrogeologic conditions described above for the Pines Tract areas are fundamentally different from those anticipated in proposed Greens Hollow Tract mining areas.

The Price River Formation and North Horn Formation are present at the surface in almost all of the proposed mining area at the Greens Hollow Tract. Groundwater flow in these formations occurs primarily in sandstone units that are interbedded with thick sequences of low-permeability shale that generally deform plastically rather than in a brittle manner in response to subsidence mining. Additionally, swelling clays have been identified in the overburden that swell when wetted (USFS, 2014). Accordingly, impacts to groundwater systems in these formations such as those that occurred in the Pines Tract are not anticipated for the Greens Hollow Tract. Rather, it is anticipated that groundwater flow conditions within the Price River Formation and North Horn Formation will generally be maintained

during mining, as has been the previous experience elsewhere in mining operations at the Sufco Mine and other mining operations in the Wasatch Plateau coal mining district.

Additionally, in order to protect hydrologic resources along perennial stream courses, the least stipulations for the Greens Hollow Lease specify the use of non-subsidence (full-support) mining methods in areas within the lease where the Castlegate Sandstone is exposed at the surface or covered by less than 50 feet of Price River Formation or North Horn Formation sediments. Within the Greens Hollow Tract, these specified areas include portions of the lower Cowboy Creek, lower Greens Hollow, and Muddy Creek drainages. Consequently, longwall mining and accompanying subsidence in areas where the Castlegate Sandstone is exposed at or near the surface – as was the case in portions of the Pines Tract – is not proposed for the Greens Hollow Tract.

It is noteworthy that while the discharge locations of some springs were moved as a result of subsidence of the drainage, several other springs in and around the subsided areas of the East Fork of Box Canyon were not affected by the undermining of the drainage. This observation suggests that the movement of some spring discharge locations was a likely a local-scale phenomenon and apparently not a regional change in the Castlegate Sandstone groundwater system in the drainage.

Mine workings in the Greens Hollow Tract will likely intercept primarily ancient, perched groundwater systems in sandstone channels in the mine roof. Groundwater inflows along fault zones that may be intercepted by the mine workings in the Greens Hollow Tract may

also occur. Although it is never possible to predict with certainty the nature and magnitude of groundwater inflows that will be intercepted in a new coal mining area, based on the similarity of the geologic and hydrogeologic conditions at the Greens Hollow Tract to adjacent mining areas at the existing Sufco mine, it is considered likely that groundwater inflows in the Greens Hollow Tract will be short lived and of magnitudes similar to those encountered previously in the Sufco Mine. Mining operations will dewater these ancient, perched groundwater systems. However, because these systems are not in good hydraulic communication with the ground surface or shallow overlying active-zone groundwater systems, dewatering of the deep perched systems will likely have no impact on overlying groundwater or surface water regimes.

As discussed previously, inactive-zone groundwater systems in the Blackhawk Formation occur in isolated partitions that are not in good hydraulic communication with the land surface or shallow overlying active-zone groundwater systems that support springs and seeps. Therefore, it is likely that the groundwater that will be intercepted in the Blackhawk Formation in the Greens Hollow Tract will be groundwater being removed from storage. Because inactive-zone groundwater systems are not in hydraulic communication with the land surface or shallow, active-zone groundwater systems, groundwater being removed from the Blackhawk Formation is likely not being replenished to any appreciable extent by recharge from adjacent or overlying groundwater systems or from infiltration of surface waters.

At any coal mine, subsidence-related interruption and deformation of strata above longwall-mined areas has the potential to alter the pre-mining groundwater flow conditions. The potential for this impact to affect groundwater and surface-water resources in the Greens Hollow Tract is low. Subsidence of the land surface overlying coal mining areas is a commonly observed phenomenon in the Utah coal mining environment. Surface subsidence can occur where the rock strata overlying mined-out areas sags into the voids left by the extraction of the coal. The United States Mine Safety and Health Administration (MSHA 2009) describes zones of disturbance of geologic strata over mine workings. These zones include:

- Floor heave – Upward thrust of the floor in the mine working area.
- Caved zone – Caving of the overburden directly over a mine void and bulking of the caved material leading to support of overlying strata generally extending to a height of 3 to 10 times the extraction thickness. Assuming an extraction thickness of 10 feet, the caved zone would extend from 30 to 100 feet above the mining interval.
- Fractured zone – A zone of vertical fracturing and bed separations. Overburden in this zone moves vertically in large blocks along existing joints and new vertical fractures. Typically this zone extends no more than 24 times the extraction thickness above the mine, but can reach 30 times the extraction thickness. Assuming an extraction thickness of 10 feet, the Fractured Zone would be anticipated to extend no more than 240 feet above the mine, possibly reaching 300 feet above the mine level.
- Main roof – This zone, which is sometimes subdivided into the Dilated Zone and the Constrained Zone, is an area of no significant increase in vertical hydraulic

conductivity. This zone has been characterized as extending above the Fractured Zone up to 60 times the extraction thickness. Assuming a coal extraction thickness of 10 feet, the Main roof zone would extend for 600 feet above the mine level.

- Surface zone – Surface cracks are typically present in this zone and are generally limited to areas placed in tension by subsidence. Cracks can be created in dry clayey soil and joints can open in massive sandstones. Such cracks can extend downward to a depth of 50 feet.

Similarly, in order to estimate the height overlying mining areas to which subsidence-induced fracturing may extend, and to project minimum overburden thickness required to protect hydrologic resources, the Society for Mining, Metallurgy, and Exploration (SME, 2011) has developed empirical relationships between the thickness of the extracted coal seam and the upward fracture propagation distances (see SME Chapter 10.6, "Mine Subsidence"). Utilizing these relationships, the Mining Engineers Handbook recommends that a minimum vertical distance between the mine and an overlying water body with the potential for causing catastrophic damage should be a minimum of 60 times the coal mining height. The same minimum vertical separation distance is recommended for protection of aquifers overlying total extraction mining areas. Based on these considerations, it is considered unlikely that impacts to groundwater aquifers, springs, seeps and streams will occur as a result of upwardly propagating fracturing in areas where the overburden exceeds 600 feet. Because mining in the Greens Hollow Tract will occur in areas where the overburden exceeds 800 feet, subsidence-related impacts to shallow groundwater systems that support springs and

provide baseflow to streams are not anticipated. The presence of a thick zone of unfractured, low-permeability bedrock prevents the downward migration of active-zone groundwaters into the deeper subsurface. Sealing of subsidence cracks by clays in the Blackhawk Formation is expected to minimize long-term effects of subsidence on the hydrologic systems (DOGM, 2013).

Previous experience at the Sufco Mine suggests that the surface tension fractures commonly extend to about 50 feet or less below the land surface. Thus, in the Greens Hollow Tract, a sequence of several hundred feet of unfractured rocks will likely exist between the bottom of the shallow tension cracks near the surface and the top of the fractured zone above longwall mined regions. This sequence of low-permeability rock prevents the downward migration of active-zone groundwaters into the deeper subsurface. The presence of hydrophyllic clays in the fine-grained rocks of the Sufco Mine area effectively seal fractures that may form in the subsurface, preventing appreciable downward migration of groundwater.

Impacts to groundwater systems in the Star Point Sandstone, which underlie the coal seams to be mined in the Blackhawk Formation, are not anticipated. Springs discharging from the Star Point Sandstone (spring Sufco 047 and groundwater seepage areas related to Sufco 047A) are associated with fractures in the sandstone bedrock that are stratigraphically lower than the Upper Hiawatha Coal seam to be mined. As discussed previously, the Upper Hiawatha Coal seam is underlain by shaley lagoonal sediments that include the Lower Hiawatha Coal seam, which would isolate the Upper Hiawatha coal seam from the underlying Star Point Sandstone. Mayo and Associates (1997) indicate that there is no

known or suspected hydrologic connection between in-mine groundwaters and groundwaters discharging from the Star Point Sandstone. We concur with this conclusion.

In summary, based on the characterization of groundwater and surface-water systems presented above, and on the proposed mining plan, no significant impacts to the overall hydrologic balance are anticipated as a result of mining in the Greens Hollow Tract.

It is noted that discharge from a spring located on the adjacent Pines area of the Sufco Mine permit area appears to have been impacted by mining operations at the Sufco Mine. This spring (Pines 303) discharges from a sandstone channel that overlies the mined coal seam by only 100 feet. The decreased discharge from this spring is likely attributable to the interception of the sandstone paleochannel that supports the spring by the underground Sufco Mine workings. It should be noted that the potential for this occurrence was discussed in the Pines Tract EIS (1999) prior to coal mining in the Pines Tract. Because there are no springs that discharge from sandstone channels in the Blackhawk Formation stratigraphically near the coal seams in the Greens Hollow Tract area, this potential impact to springs should not occur in the Greens Hollow Tract area.

Tension cracking of the substrate of a perennial stream has the potential to temporarily divert surface waters. The potential for loss of surface waters to deeper groundwater systems through downward migration of water through subsidence fractures in the Greens Hollow Tract area is considered minimal. This is because, as discussed previously, the thick perching layers underlying perennial streams would not likely be compromised as a result of

tension fracturing. This is the case for two reasons. First, the hydraulic conductivites of underlying bedrock formations are low and permeable horizons are lenticular and discontinuous. Thus, the underlying bedrock is not capable of accepting appreciable quantities of stream leakage, and rejected recharge occurs. Second, the presence of swelling clays in the bedrock formations in the Greens Hollow Tract area causes the rapid healing of tension cracks in fine-grained bedrock lithologies. Surface cracks in stream substrates that occur in more brittle sandstones would be filled with clay-rich sediment transported from the North Horn and Price River Formations by the streams in the Greens Hollow Tract area. Because, as discussed previously, active-zone groundwater systems will likely not be impacted by subsidence fracturing, the potential for diminution of baseflow in perennial streams is considered remote. Thus, the overall potential for detrimental effects resulting from subsidence fracturing beneath perennial streams in the Greens Hollow Tract area is believed to be low.

728.320 Whether acid-forming or toxic-forming materials are present that could result in the contamination of surface water or groundwater supplies

Acid- and toxic-forming materials in soil and rock disturbed by mining have to potential to impact groundwater and surface water quality. Mine discharge water from the Sufco Mine is routinely monitored for indicators of increased acidity (iron, manganese, and pH) and toxic materials. Although the concentrations of iron in mine discharge water are occasionally elevated relative to springs in the region, mine discharge waters rarely exceed permitted discharge limits.

No new topsoil or waste rock piles are planned as a consequence of mining in the Greens Hollow Tract and no impact from acid- or toxic-forming materials is anticipated.

With the exception of modest quantities of pyrite or similar sulfide minerals, no significant quantities of any acid- or toxic-forming materials are believed to be present in the Greens Hollow Tract area. Iron pyrite, marcasite, and other iron sulfide minerals are common in western coal mines. The oxidation of pyrite and marcasite, when exposed to water and oxygen, releases H^+ ions (acid) into the mine water. The acid produced from pyrite and marcasite oxidation temporarily lowers the pH of the water. However, the acid produced from pyrite oxidation is rapidly consumed by reactions with the carbonate minerals which are pervasive in the rocks associated with the coal fields of the Wasatch Plateau. Thus, acid mine discharge does not occur. The iron released into the water from pyrite and marcasite oxidation is readily precipitated as iron-hydroxide when it contacts oxygenated water.

Thus, the potential for acid-forming or toxic-forming materials to result in contamination of surface-water or groundwater supplies is believed to be negligible.

728.331 What impact the proposed coal mining and reclamation operation will have on sediment yield from the disturbed areas

The sediment load of streams can be impacted by increased sediment yield from disturbed areas and from land that has undergone subsidence. Canyon Fuel Company has implemented

a rigorous sediment control program that is designed to minimize the sediment yield from disturbed areas. This includes the use of sediment control fences, re-vegetation of previously disturbed areas, and the diversion of surface waters around disturbed areas. Runoff from disturbed areas is collected near its source and diverted into sediment control ponds for retention and settlement of suspended solids before it is discharged to natural drainages. Because the Greens Hollow Tract will be accessed through the existing Sufco Mine, the potential for additional impacts at the disturbed surface facilities resulting from coal mining in the Greens Hollow Tract is minimal.

Where differential subsidence of the land surface occurs in stream drainages, there is the potential for the temporary increase of sediment yield in these drainages. This potential impact is primarily the result of subsidence-induced gradient changes along areas of differential subsidence. However, this effect is generally expected to be short lived. This is because the channel substrate in areas of increased stream gradients is down-cut while sediment is being deposited in areas of decreased stream gradients and the stream gradually returns to equilibrium with its channel substrate.

728.332 What impact the proposed coal mining and reclamation operation will have on acidity, total suspended and dissolved solids and other important water quality parameters of local impact

As discussed previously, impacts to the active-zone groundwater systems that support springs and seeps and provide baseflow to streams in the Greens Hollow Tract and adjacent area are

not anticipated. Thus, detrimental impacts to important water quality parameters such as acidity, total suspended solids, and total dissolved solids in creeks and springs in the Greens Hollow Tract area are generally considered unlikely.

It should be noted that in the event that subsidence fracturing of bedrock horizons beneath a stream or near the discharge location of a spring occurs, there is a potential of a modest, temporary increase in TDS concentration. This increase could result if the bedrock horizons fractured contained pyrite or other sulfide minerals. When subsidence-fractured rock surfaces expose pyrite in an aqueous, oxygen-rich environment, sulfide mineral oxidation may occur. Under such circumstances, some solutes, primarily sulfate, bicarbonate, calcium, and magnesium, can increase. Such reactions typically do not occur in deep groundwater environments because of the lack of available oxygen in these systems. Because the pyrite is consumed by the oxidation reaction, the reaction ceases when all the freshly exposed pyrite is oxidized.

Such an occurrence was noted in a short reach of the East Fork of Box Canyon after the stream was undermined in 2003-2004 (Petersen Hydrologic, 2004). In that instance, the TDS concentration of water increased in the creek by 66 mg/l from 325 to 374 mg/l. When the stream reach was again visited in the spring of 2005, it was apparent that the oxidation reaction in the creek had ceased. The iron hydroxide deposits that had precipitated in the stream channel as a result of pyrite oxidation had been scoured from the channel and conditions in the stream appeared normal.

Fuels, greases, and oils are stored and used in the Sufco Mine permit area. There is the potential for spillage of these substances during equipment maintenance and operations, during filling of storage tanks and vehicle tanks, and from leakage from potentially leaking storage tanks. However, because the Greens Hollow Tract will be accessed through the existing Sufco Mine, the potential for increased releases of these materials as a result of mining activities in the Greens Hollow Tract above is considered minimal.

The Sufco Mine has previously implemented a rigorous spill prevention plan that is designed to minimize the potential for spillage of these substances and to ensure that any potential spills that may occur are promptly cleaned-up. This plan will continue to be followed during mining in the Greens Hollow Tract. Because the Greens Hollow Tract reserves will be accessed from the permitted existing surface facilities area (including equipment maintenance and fueling areas and chemical storage areas), there should be no additional potential for spillage as a result of mining in the Greens Hollow Tract.

The discharge of Sufco Mine water to surface water drainages will have an impact on the water quality of receiving waters. The nature and magnitude of this impact is related to the relative quality of the receiving water and the mine discharge water. If the mine discharge water is of poorer quality than the receiving water, then the quality of the receiving water will be degraded proportionally. If the mine discharge water is of better quality than the receiving water, the quality of the receiving water will be improved. Historically, the discharge water from the Sufco Mine has generally been of relatively good quality and has usually met the beneficial use standards of the receiving water (DOGM, 2016).

Based on the fact that the geologic conditions at the Greens Hollow Tract are generally similar to those in the adjacent existing Sufco Mine permit area, it is anticipated that the character of groundwater inflows in terms of both quality and quantity will likely be similar to those that occur in the existing Sufco Mine. Consequently, no impacts to important water quality parameters above those that may occur at the existing Sufco Mine area are anticipated as a result of mining in the Greens Hollow Tract. The discharge of Sufco Mine water will be regulated under a UPDES permit issued from the Utah Division of Water Quality.

728.333 What impact the proposed coal mining and reclamation operation will have on flooding or streamflow alteration

There are no known geologic features in the Greens Hollow Tract area that are substantively different than those that have been encountered elsewhere in the Sufco Mine (Personal communication, Mark Bunnell, 2017). Mining practices to be utilized in mining the Greens Hollow Tract will also be similar to those currently implemented at the Sufco Mine. Accordingly, it is anticipated that discharge rates from the Sufco Mine during mining in the Greens Hollow Tract will likely be of similar magnitude to those that are currently occurring. Thus, no significant increase to the flooding or streamflow alteration potential of Sufco Mine discharge water to Quitchupah Creek is anticipated above that currently occurring as a result of mining in the Greens Hollow Tract.

728.334 What impact the proposed coal mining and reclamation operation will have on groundwater and surface-water availability

It has been demonstrated that the active-zone groundwater systems that support springs and seeps in the Greens Hollow Tract area are isolated from the inactive-zone groundwater systems that will be encountered during mining in the Greens Hollow Tract. As noted above, were Castlegate Sandstone springs or their groundwater flowpath areas in the Greens Hollow Tract (such as Spring M-SP87) to be directly undermined and subsided, there is the potential for diminished discharge from these springs. However, no Castlegate Sandstone springs are to be undermined in the proposed mining plan. Also discussed previously, the potential for impacts to springs and seeps in the overlying Price River and North Horn Formations is considered minimal. Therefore, the availability of these groundwaters and surface waters will likely not be impacted.

Current mining operations have made available several hundreds of gallons per minute of mine discharge water that has previously been unavailable for use. It is anticipated that as mining progresses in the Greens Hollow Tract, additional groundwater inflows into the mine workings will occur and discharge of groundwater to the Quitchupah Creek surface-water drainage will likely continue. It should be noted that the discharge of mine water at current discharge rates would likely not be sustained over a long period of time. Historically, discharge rates from individual inactive-zone mine inflows decline over time. This is because the inactive-zone groundwater is being removed from storage and is not being actively recharged. Rather, the rate of discharge from the mine is best correlated with the

rate at which the mine workings are advanced into new mining areas, and not to the total cumulative footprint of the mine workings (Mayo and Associates, 1997). It should not be assumed that the groundwater discharging from the mine will be a long-term source of water.

It should be noted that discharge in spring Pines 303, which discharges from a sandstone channel only 100 feet above the mined coal seam in lower Box Canyon, was diminished coincident with mining in the Sufco Mine. This condition is likely related to the interception and draining of the sandstone channel that supports Pines 303 by the Sufco Mine workings. The potential for this occurrence was discussed in the Pines Tract EIS (1999). Because there are no springs that discharge from sandstone channels in the Blackhawk Formation stratigraphically near the coal seams in the Greens Hollow Tract area, this potential impact to springs should not occur in the Greens Hollow Tract area.

728.350 Whether the underground coal mining and reclamation activities may result in contamination, diminution or interruption of State-appropriated water

It has been demonstrated that the active-zone groundwater systems that support springs and seeps and provide baseflow to perennial streams in the Greens Hollow Tract area are isolated from the inactive-zone groundwater systems that will be encountered during mining activities. Accordingly, the potential for contamination, diminution, or interruption of groundwater systems resulting from draining of active-zone groundwaters into deep horizons (or the mine workings) is considered remote. Inactive-zone groundwater systems that will likely be encountered during mining in the Greens Hollow Tract include primarily perched

systems associated with sandstone channels in the Blackhawk Formation beneath the Greens Hollow Tract. While deep, inactive-zone Blackhawk Formation groundwater systems will be intercepted and dewatered during mining activities, there are no known uses or State appropriations of these waters.

Potential for Trans-Basin Diversion

The deep, inactive-zone groundwater systems that will be intercepted in the Greens Hollow Tract are generally not in strong hydraulic communication with shallow active-zone groundwater systems. Consequently, while flow paths of surface-water systems and shallow, active-zone groundwater systems are usually constrained in large measure by surface topography (i.e. drainage basins), the deep, inactive-zone groundwater systems that will likely be intercepted during mining operations in the Greens Hollow Tract (away from shallow, near-surface outcrop areas) operate independently of the surface topography. Consequently, the removal of deep, inactive-zone groundwaters intercepted in the underground mine environment likely does not result in and quantifiable diminution of waters from the overlying surface water drainage basin (i.e. trans-basin diversion). Rather, the pumping of the ancient, inactive-zone groundwaters intercepted in the mine workings to surface drainages likely makes water resources available to downstream water users that otherwise would not be available for use.

12.0 Recommended Monitoring Plan

The recommended monitoring plans for groundwater and surface-water in the Greens Hollow Tract are presented in Tables 8, 9, 10, and 11. Recommended hydrologic monitoring protocols are listed in Table 8. Groundwater and surface-water monitoring sites recommended for hydrologic monitoring are presented in Table 9. Recommended field and laboratory water quality parameters for groundwaters and surface-waters are presented for groundwaters and surface waters in Tables 10 and 11, respectively.

These recommended monitoring plans for groundwaters and surface-waters are designed to verify that mining-related activities do not adversely impact groundwater or surface-water resources in the tract area, and to quantify impacts to water quantity and water quality in the event that impacts do occur. Additionally, the plan is designed to collect data to document that the active-zone springs and streams at the surface in the Greens Hollow Tract area operate independently of the deep, inactive-zone groundwater systems encountered in the Sufco Mine. The proposed monitoring sites are shown in Figure 9. The monitoring plan is summarized in below.

Springs

We recommend the monitoring of 26 springs in the Greens Hollow Tract and adjacent area. This includes springs that discharge from the North Horn Formation, Price River Formation, and Castlegate Sandstone and are distributed over the area where spring discharge occurs. Of the 26 springs recommended for operational monitoring, seven are currently part of the existing Sufco Water Monitoring Plan. These springs are listed here for clarity regarding the

specific springs recommended for monitoring in connection with mining activities at the Greens Hollow Tract.

Both discharge and laboratory solute water-quality data from the springs proposed for monitoring have been collected during baseline monitoring activities from 2001 – 2004. Because the baseline discharge and water quality characteristics of these springs have been adequately characterized, we do not recommend monitoring for laboratory water quality parameters at these springs. We do recommend routine monitoring of these springs for discharge and field water-quality parameters.

Streams

We recommend the regular monitoring of Cowboy Creek at site M-STR04. It is noted that this has previously been added to the Sufco Mine monitoring plan. M-STR04 is located on Cowboy Creek downstream of the Greens Hollow Tract. As surface waters from a large portion of the Greens Hollow Tract area drain into Cowboy Creek, monitoring of discharge rates at this site can provide useful data on potential impacts to discharge rates in the Cowboy Creek drainage above M-STR04. Similarly, potential cumulative impacts to water quality in the drainage can be evaluated at this site. Thus, we also recommend the regular monitoring of M-STR04 for field water-quality parameters.

We recommend the regular monitoring of Greens Hollow Creek at monitoring site M-STR06. This station is located on Greens Hollow Creek immediately upstream of the

drainage entering the steep-walled Castlegate Sandstone canyon. We recommend the monitoring of discharge and field water quality parameters at this site.

We recommend the monitoring of Muddy Creek at site U-Mud. U-Mud is located immediately below the confluence of the North and South Forks of Muddy Creek above proposed mining areas in the Greens Hollow Tract. We recommend the monitoring of discharge and field water quality parameters at this site. It should be noted that commonly during the second quarter monitoring event, and particularly during wet climatic cycles, the discharge rates in Muddy Creek can be high (sometimes exceeding several hundred cubic feet per second). When the stream flow is considered by the monitoring personnel to be in an unsafe condition to wade to perform the discharge measurement, the flow may be determined using alternate methods. Typically, this may be performed by measuring the time it takes for a partially submerged object to float over a known distance and using this information to calculate an average stream velocity.

We recommend the monitoring of Muddy Creek below the Greens Hollow Tract area at monitoring site Pines 405. This is a previously established monitoring site on Muddy Creek with 20 years of monitoring data previously collected. We recommend that Pines 405 be monitored for discharge and field water quality parameters.

We recommend the monitoring of Sufco 006 (South Fork of Quitchupah Creek) and Sufco 007 (North Fork of Quitchupah Creek). These sites have been monitored by Sufco since

1979 and are currently part of Sufco's approved monitoring plan. We recommend that Sufco 006 and Sufco 007 be monitored for field and laboratory water quality parameters.

In contemplating future mining in the Greens Hollow Tract, it is acknowledged that additional hydrologic data from surface streams will be useful in determining impacts in specific mining areas. Accordingly, we recommend that one year of quarterly monitoring at selected stream sites above and below proposed mining areas be collected prior to the commencement of longwall mining in the area. We recommend that the monitoring continue on a quarterly basis during the period of active mining and continuing for one year after the mining in the area is completed. The specific locations of these future monitoring locations will be determined as a final mining plan is developed for respective mining areas.

Using the Groundwater and Surface-Water Monitoring Programs

The monitoring plans for groundwaters and surface-waters for the Greens Hollow Tract may be used to provide verification that mining-related impacts to groundwater and surface-water systems do not occur, and to determine the magnitude and character of potential impacts if they do occur. Comparisons between monitoring data (for the parameter of interest or concern) collected during baseline pre-mining conditions should be made with monitoring data (for the same parameter or interest of concern) collected during the operational and/or reclamation phase of mining to determine impacts. When changes to monitored parameters subsequent to mining in an area are observed in the monitoring data, an analysis of all data should be performed to determine the cause(s) of the change in the hydrologic condition. In utilizing the monitoring data to detect or quantify potential mining-related impacts, it is

necessary to evaluate all factors relevant to the prevailing hydrologic conditions together with the monitoring data. This is because other factors, which are not related to the mining activity, may cause changes in the prevailing hydrologic conditions. In particular, climatic variability (which may result in increased or decreased groundwater and surface-water flow rates, changes in water levels in wells, and changes in water quality) should be carefully evaluated together with the monitoring data. Other factors that may influence coal mine hydrology include grazing practices, land use, range condition, and potential effects associated with other industrial or mining activity in the area. A convenient and useful means of evaluating regional climatic data is through the use of the Palmer Hydrologic Drought Index (PHDI). The PHDI is a monthly value that indicates the severity of wet and dry spells that is generated by the National Climatic Data Center and available on-line at http://www1.ncdc.noaa.gov/pub/data/cirs/drd964x.phdi.txt.

The use of Stiff (1951) diagrams is a useful technique that is frequently used to analyze and compare groundwater and surface-water quality characteristics from various sources. Information required to create Stiff diagrams is available from the Division of Oil, Gas and Mining Coal Water Quality Database, which is freely accessible at: http://ogm.utah.gov/coal/edi/wqdb.htm. Additional information on coal mining hydrology and potential mining-related impacts, which can be used to assist in the evaluation of monitoring data and potential mining-related impacts, is provided on the Utah Division of Oil, Gas and Mining web page at http://ogm.utah.gov/coal/water/default.htm.

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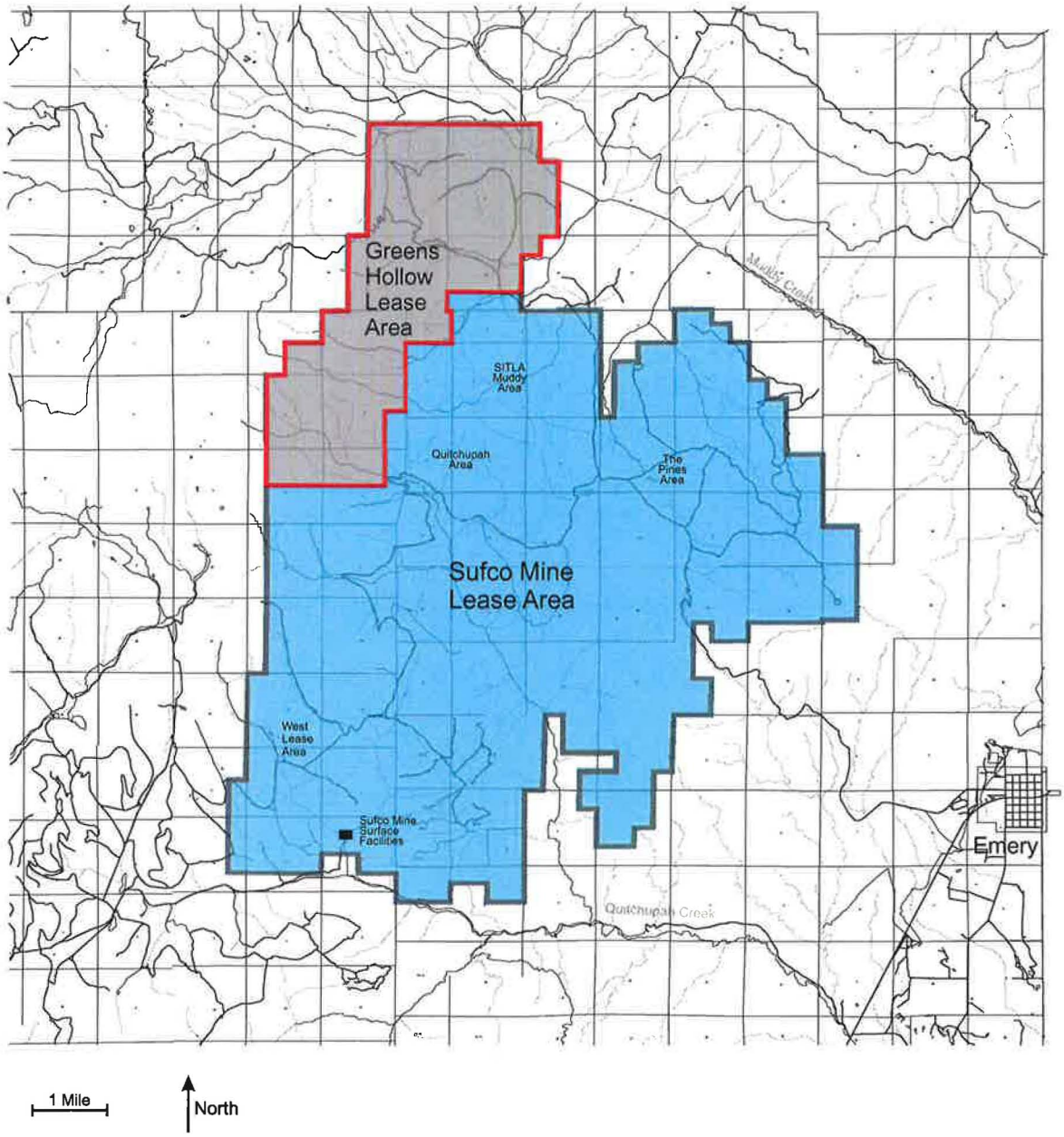
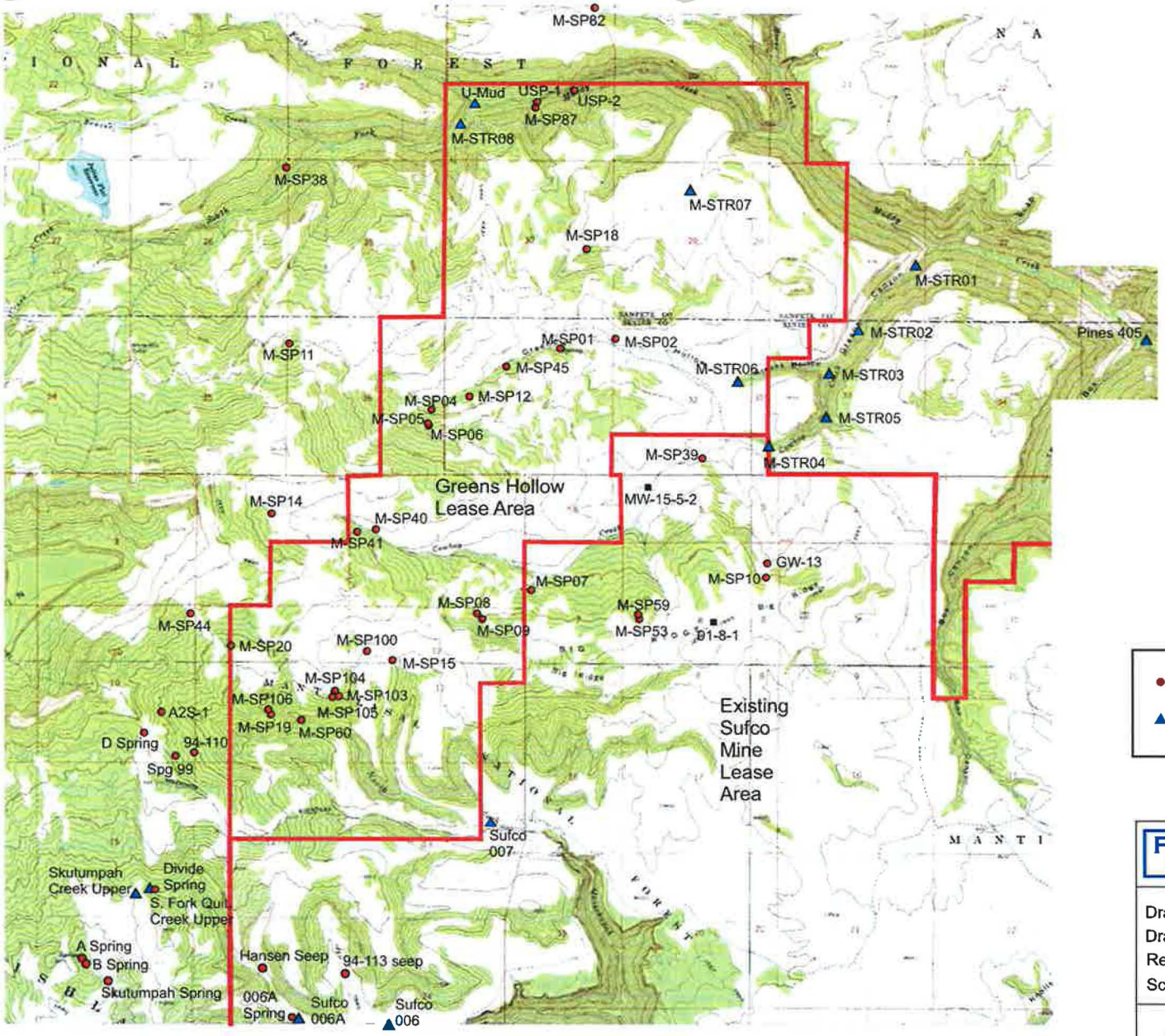


Figure 1 Location of Sufco Mine and Greens Hollow Lease area.



1927 North American Datum. UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Heliotrope Mountain, UT; Flagstaff Peak, UT; Acord Lakes, UT; Emery West, UT

- Spring baseline monitoring station
- Stream baseline monitoring station

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Drawing date: 21 Apr 2017
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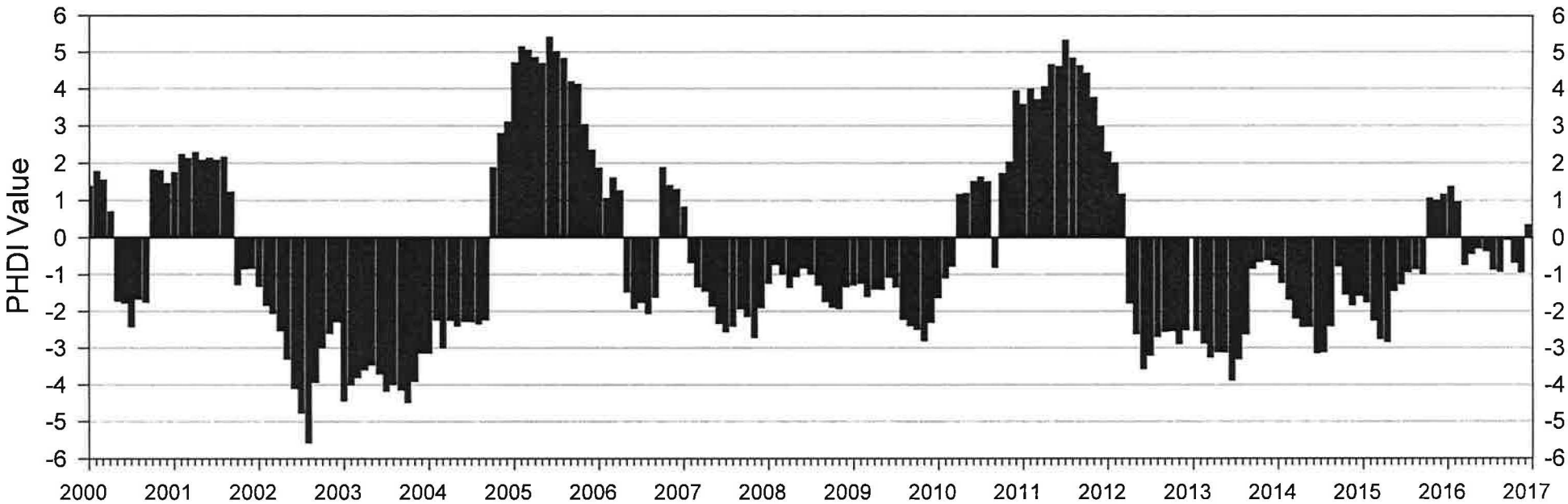
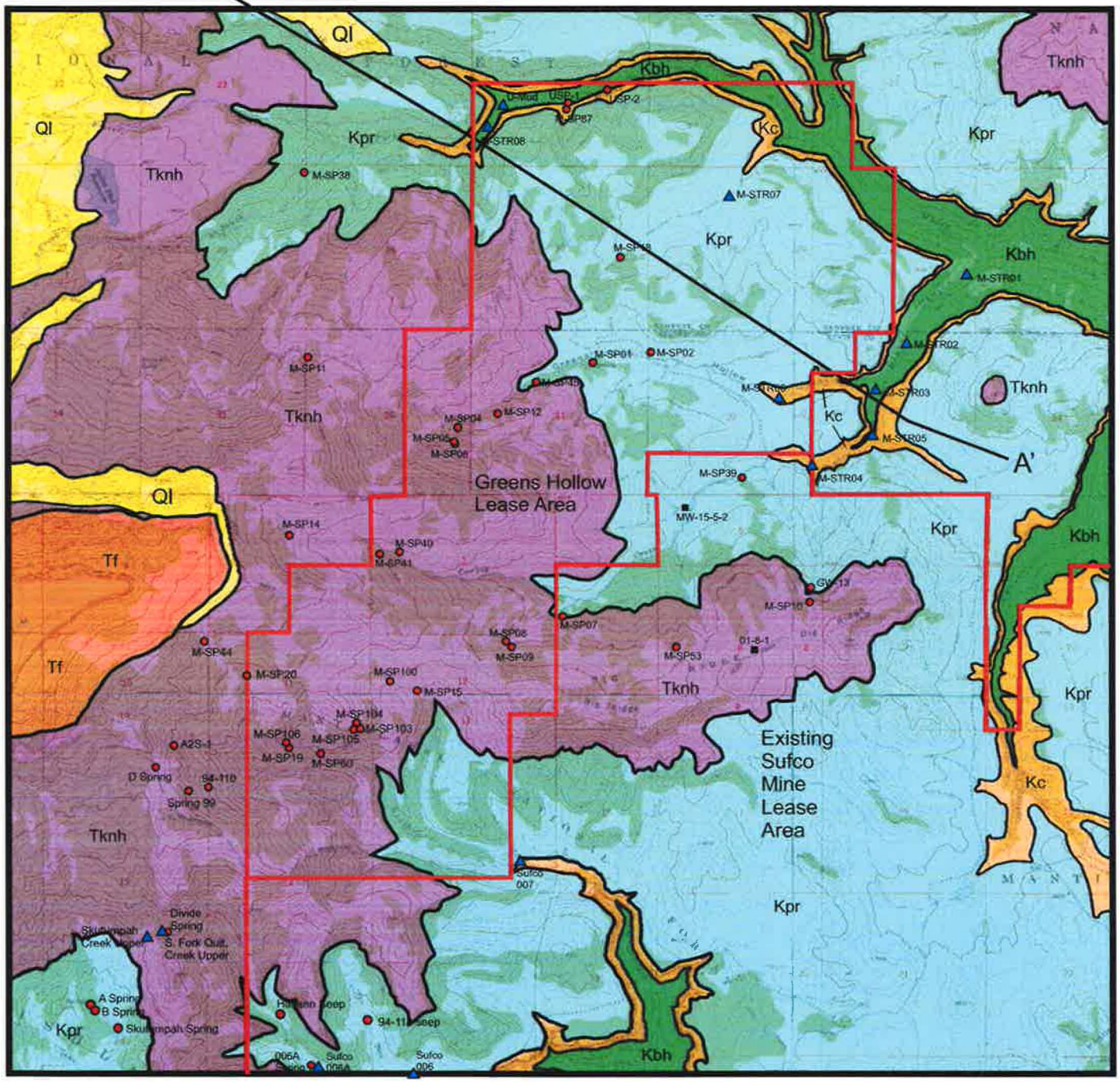
Figure 2
Baseline monitoring locations for the Greens Hollow Tract.



-1 to -2 Mild Drought
-2 to -3 Moderate Drought
-3 to -4 Severe Drought
-4 to -5 Extreme Drought

1 to 2 Mild Wet Spell
2 to 3 Moderate Wet Spell
3 to 4 Severe Wet Spell
4 to 5 Extreme Wet Spell

Figure 3 Plot of Palmer Hydrologic Drought Index for Utah Region 4.



Legend

Ql	Quaternary landslide dep.	Kc	Castlegate Sandstone
Tf	Flagstaff Limestone	Kbh	Blackhawk Formation
Tknh	North Horn Formation		
Kpr	Price River Formation		

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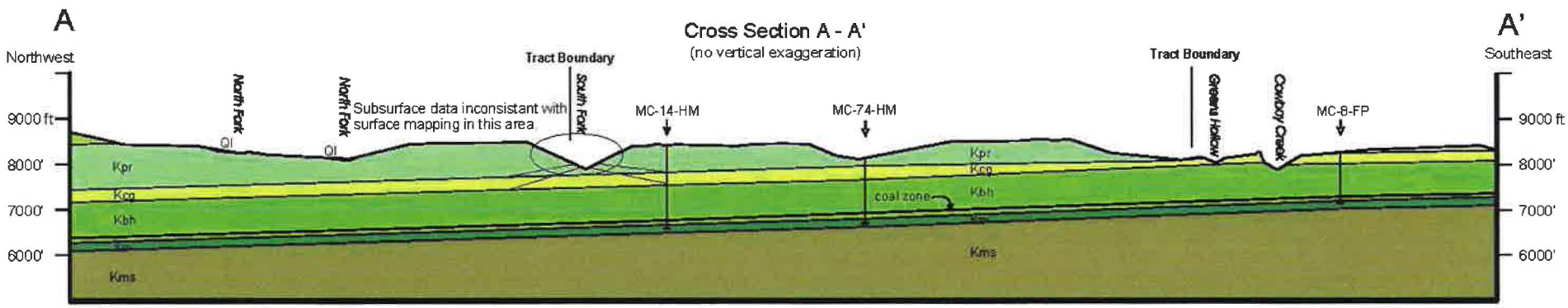
Drawing date: 21 Apr 2017
Revision:
Scale: Reference bar File: Fig4.cdr

Figure 4
Geologic map of the Greens Hollow Tract.

1927 North American Datum. UTM grid zone 12
Generated by BigTopo7 (www.gage.com)
Map compiled from USGS Quads Heliotrope Mountain, UT Flagstaff Peak, UT Acord Lakes, UT Emery West, UT

0 ¼ ½ 1 2 Miles
1000 0 2000 4000 6000 8000 10,000 Feet
1,000 Meters 500 0 ½ 1 2 Kilometers

BigTopo Map



SCALE

0 2000 4000 6000 8000 feet

See Figure 4 for cross-section location.

Explanation

- Ql — Landslide/mass movement
- Flagstaff Limestone
- North Horn Formation
- Price River Formation
- Kcg — Castlegate Sandstone
- Kbh — Blackhawk Formation
- Star Point Sandstone (cross section only)
- Mancos Shale (cross section only)

From P. Anderson, 2008; in Greens Hollow Tract SDEIS, 2014

Figure 4a Geologic cross-section through the Greens Hollow Tract area.

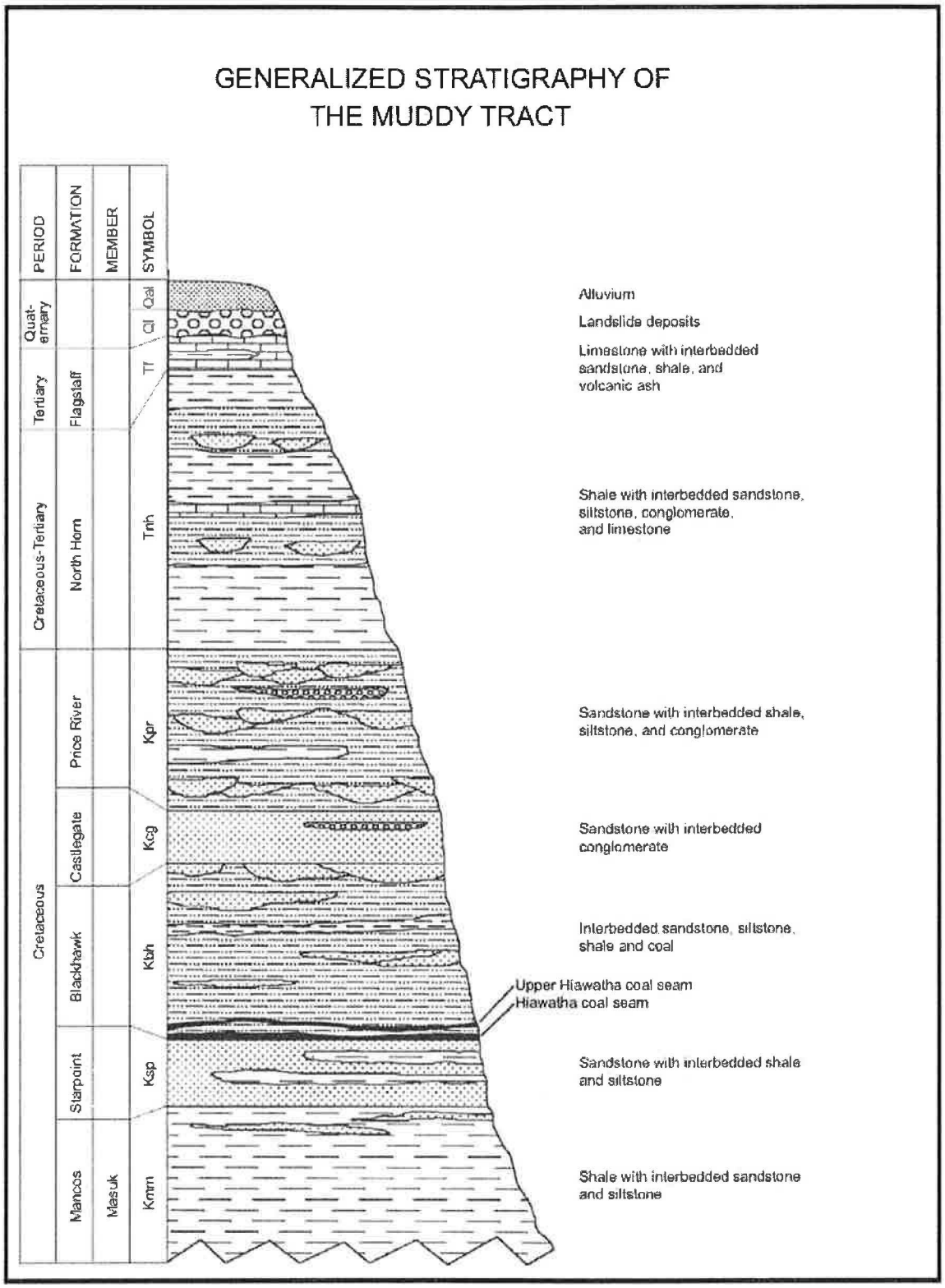
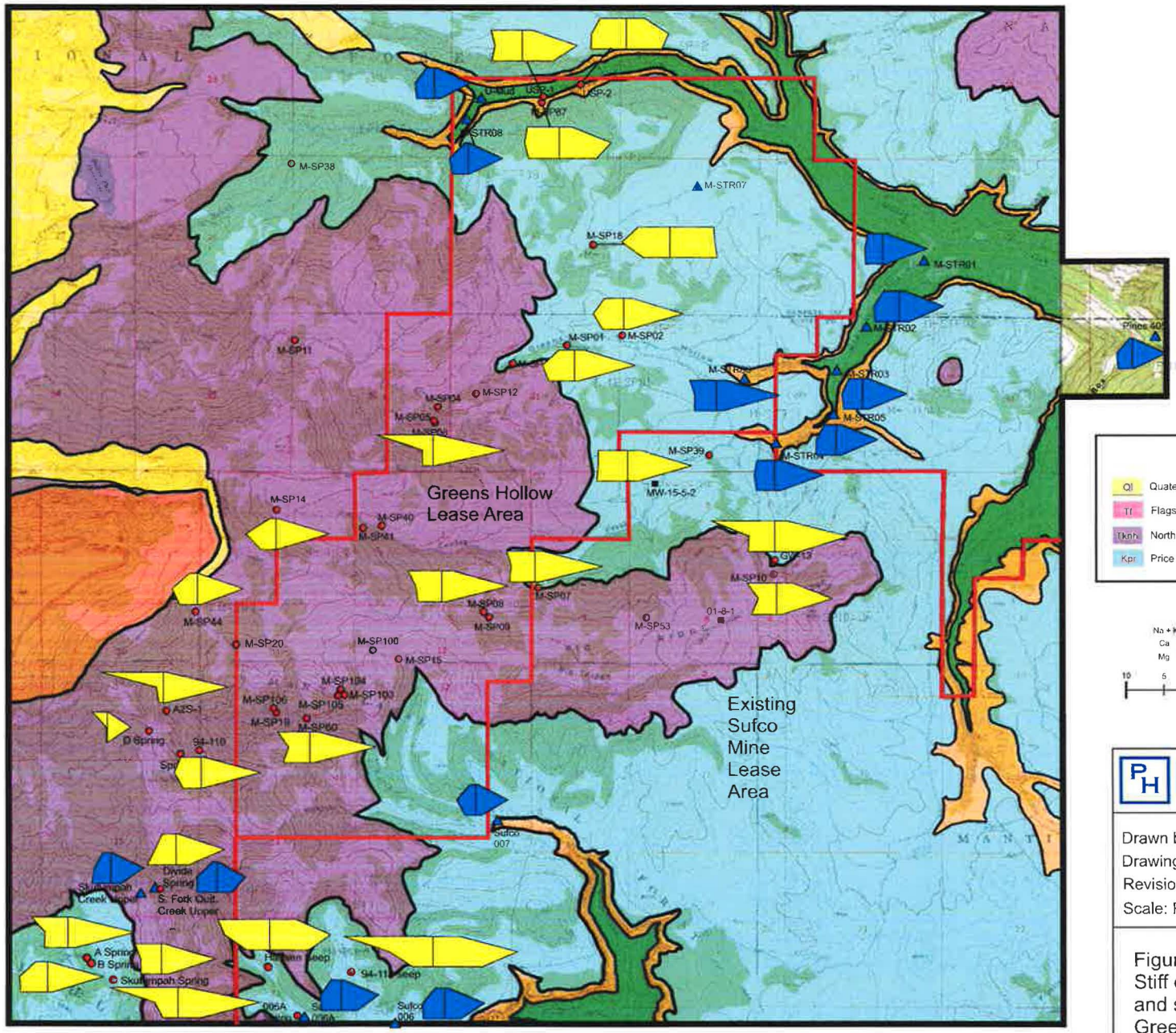
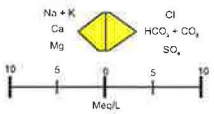


Figure 5 Generalized stratigraphy (from Anderson, 2004).



Legend

Ql	Quaternary landslide dep.	Kc	Castlegate Sandstone
Tf	Flagstaff Limestone	Kbh	Blackhawk Formation
Tknh	North Horn Formation		
Kpr	Price River Formation		



Surface water

Groundwater

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Drawn by: E. Petersen
Drawing date: 21 Apr 2017
Revision:
Scale: Reference bar File: Fig6Stiff.cdr

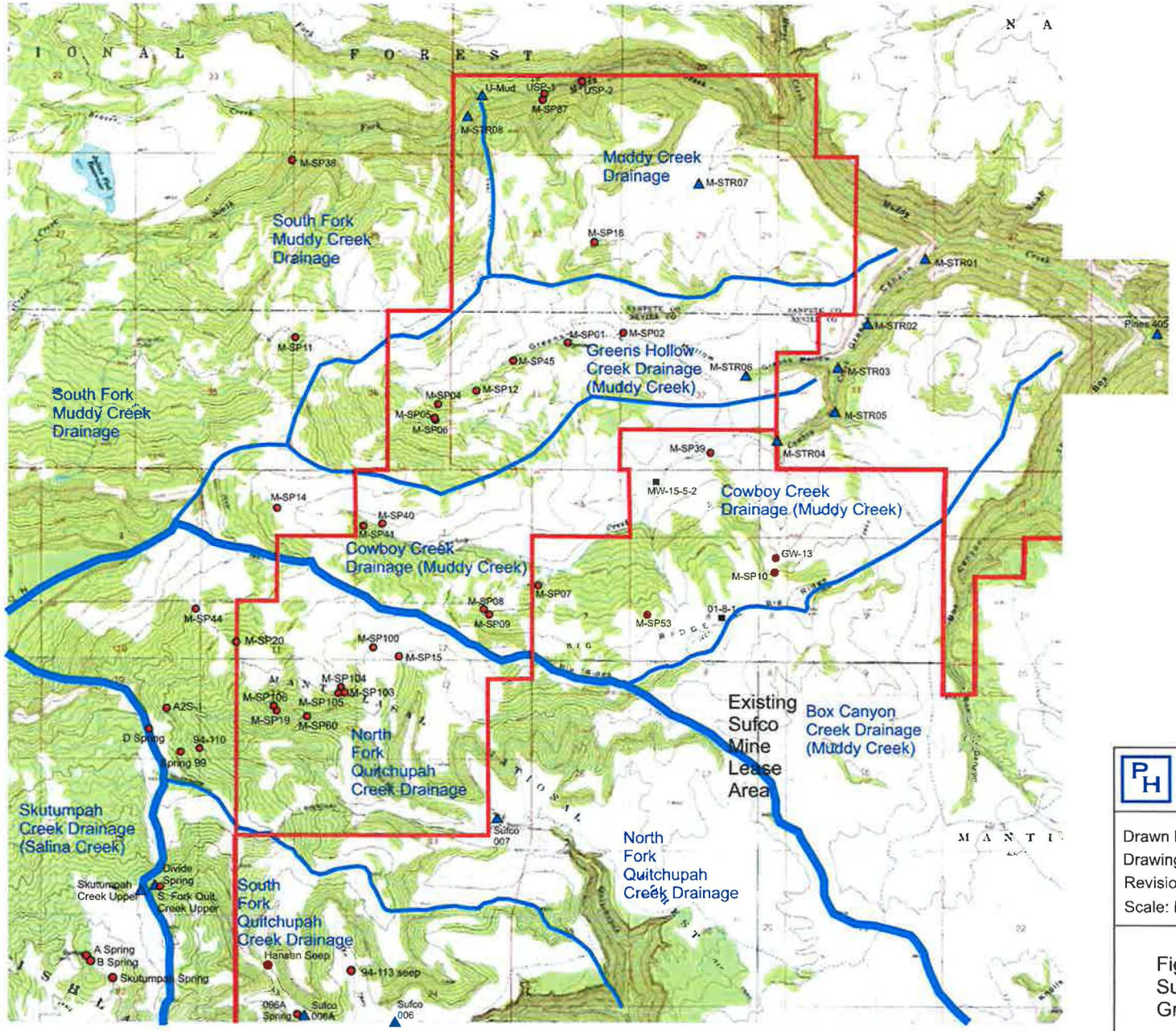
Figure 6
Stiff diagrams for groundwaters and surface-waters in the Greens Hollow Tract.

1927 North American Datum, UTM grid zone 12
Generated by BigTopo7 (www.qage.com)
Map compiled from USGS Quads Heliotrope Mountain, UT Flagstaff Peak, UT Acorn Lakes, UT Emery West, UT

0 ¼ ½ 1 2 Miles
1000 0 2000 4000 6000 8000 10,000 Feet
1,000 Meters 500 0 ½ 1 2 Kilometers

BigTopo Map

B



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Revision:
Scale: Reference bar File: Fig7.cdr

Figure 7
Surface-water basins in the Greens Hollow Tract.

1927 North American Datum, UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Heliotrope Mountain, UT; Flagstaff Peak, UT; Acord Lakes, UT; Emery West, UT

BigTopo Map

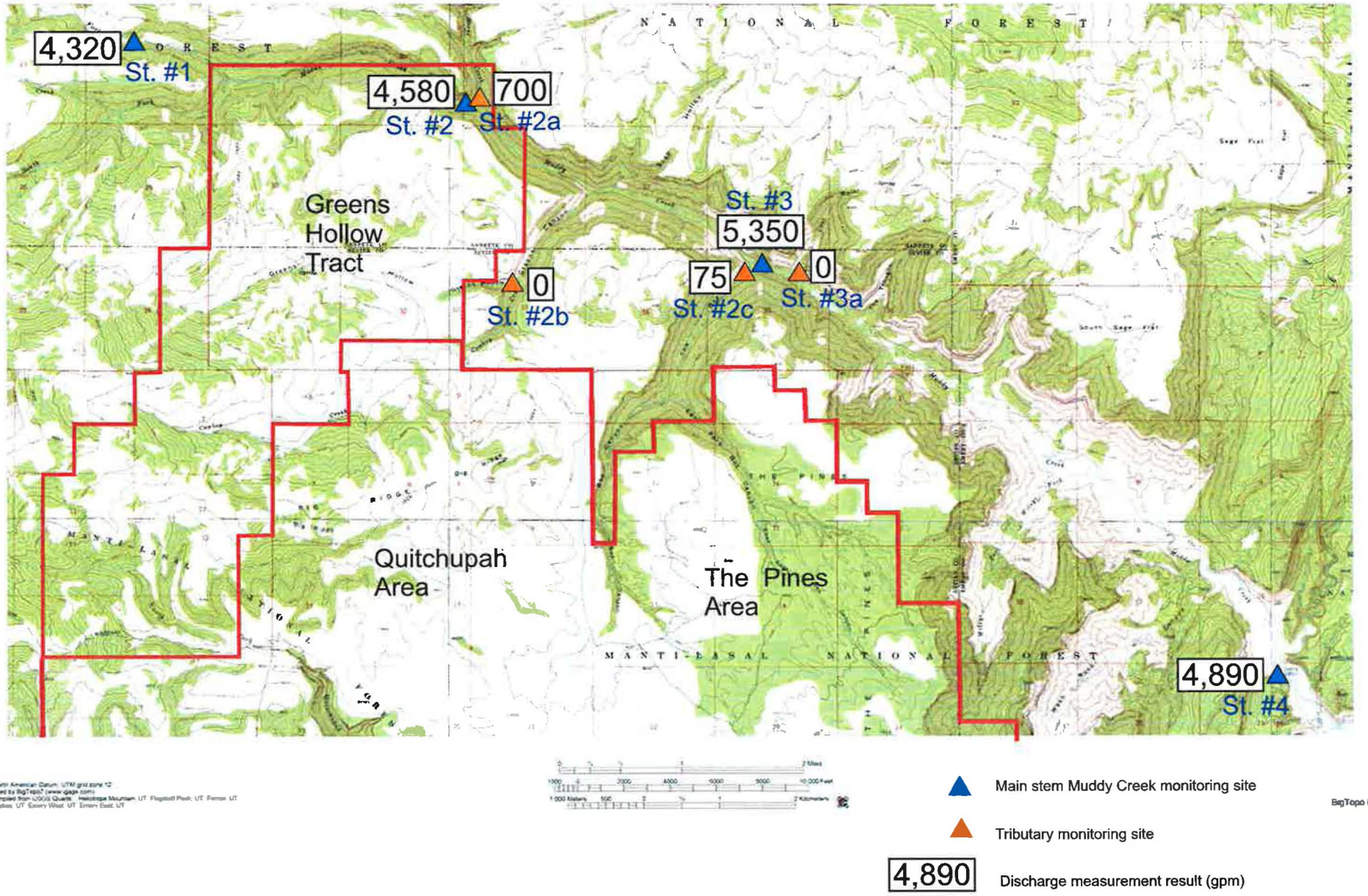
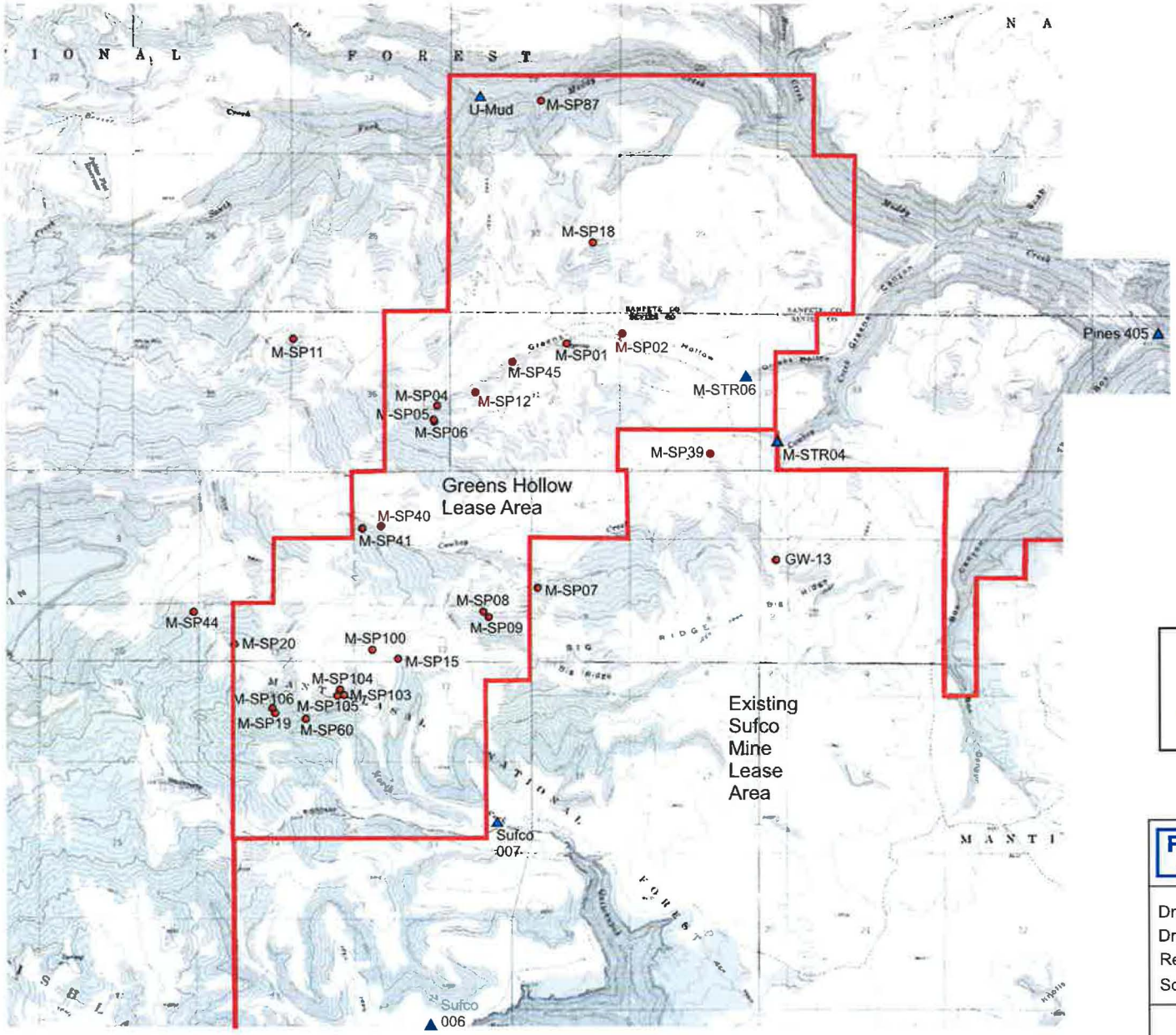


Figure 8 Discharge measurements for Muddy Creek gain/loss study
28-29 October 2015.



Legend

- Proposed spring operational monitoring station
- Proposed stream operational monitoring station

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Drawn by: E. Petersen
Drawing date: 21 Apr 2017
Revision:
Scale: Reference bar File: Fig9.cdr

Figure 9
Proposed groundwater and surface-water monitoring sites for the Greens Hollow Tract.

1927 North American Datum, UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Helpbridge Mountain, UT, Flagstaff Peak, UT, Acord Lakes, UT, Emery West, UT

Table 1 Greens Hollow Tract baseline monitoring site details

Station ID	Location UTM NAD 27		Elev. (feet)	Geologic Fm.	Monitoring Period	Baseline Field	Baseline Lab Anal.	Lab solutes/ metals	Comments/Use
North Horn Formation springs									
M-SP04	464246	4319267	8,812	North Horn Fm.	2001-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP05	464212	4319133	8,937	North Horn Fm.	2002-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP06	464215	4319121	8,952	North Horn Fm.	2001-2004; 2014-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
M-SP07	465280	4317433	8,709	North Horn Fm.	2001-2004	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
M-SP08	464754	4317178	8,820	North Horn Fm.	2001-2004; 2006-2016	Yes	Yes	Yes	Developed spring with trough - stock/wildlife use
M-SP09	464791	4317141	8,849	North Horn Fm.	2001-2004; 2011; 2015-2016	Yes	No	No	Undeveloped spring - stock/wildlife use
M-SP10	467693	4317562	8,778	North Horn Fm.	2002-2004	Yes	Yes	Yes	Developed spring with trough - stock/wildlife use
M-SP11	462772	4319958	9,237	North Horn Fm.	2001-2004; 2015-2016	Yes	Yes	No	Undeveloped spring, flows into pond - stock/wildlife use
M-SP12	464583	4319397	8,739	North Horn Fm.	2001-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP14	462545	4318227	9,584	North Horn Fm.	2001-2004	Yes	Yes	Yes	Spring with springbox - stock/wildlife use
M-SP15	463884	4316685	8,811	North Horn Fm.	2001-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP19	462644	4316124	8,968	North Horn Fm.	2001-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP20	462191	4316826	9,395	North Horn Fm.	2001-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP40	463677	4318041	9,163	North Horn Fm.	2001-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP41	463475	4318025	9,223	North Horn Fm.	2001-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP44	461759	4317150	9,599	North Horn Fm.	2001-2004; 2014-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
M-SP45	465156	4319780	8,505	North Horn Fm.	2001-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP53	466373	4317126	8,941	North Horn Fm.	2001-2004; 2006-2016	Yes	No	No	Developed spring with trough - stock/wildlife use
M-SP59	466357	4317186	8,920	North Horn Fm.	2001-2004; 2015	Yes	No	No	Undeveloped spring - stock/wildlife use
M-SP60	462887	4316092	8,801	North Horn Fm.	2002-2004; 2014-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
M-SP100	463616	4316719	8,975	North Horn Fm.	2002-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP103	463271	4316302	8,999	North Horn Fm.	2003-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP104	463250	4316335	9,052	North Horn Fm.	2003-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP105	463233	4316280	8,971	North Horn Fm.	2003-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
M-SP106	462626	4316155	8,997	North Horn Fm.	2003-2004; 2015-2016	Yes	Yes	No	Undeveloped spring - stock/wildlife use
94-110	461800	4315754	9,224	North Horn Fm.	2013-2016	Yes	Yes	Yes	Previously developed spring, now defunct - stock/wildlife use
A2S-1	461387	4316234	9,460	North Horn Fm.	2013-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
Divide Spring	461297	4314348	8,840	North Horn Fm.	2013-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
GW-13	467720	4317723	8,600	North Horn Fm.	1995-2016	Yes	Yes	No	Developed spring with trough - stock/wildlife use
Spg 99	461609	4315684	9,352	North Horn Fm.	2014-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
Spring D	461296	4315975	9,541	North Horn Fm.	2013-2016	Yes	Yes	Yes	Undeveloped spring - no use apparent
Price River Formation springs									
M-SP01	465615	4319979	8,420	Price River Fm.	2001-2004; 2006-2016	Yes	Yes	Yes	Undeveloped spg. previously cabin water supply
M-SP02	466086	4319977	8,335	Price River Fm.	2001-2004; 2006-2016	Yes	Yes	Yes	Developed spring, flows to nearby trough - stock/wildlife use
M-SP18	465794	4320892	8,295	Price River Fm.	2001-2004; 2006-2016	Yes	Yes	Yes	Developed spring, flows to nearby trough - stock/wildlife use
M-SP38	462767	4321782	8,273	Price River Fm.	2001-2004	Yes	No	No	Undeveloped spring - stock/wildlife use
M-SP39	466990	4318775	8,225	Price River Fm.	2001-2004; 2006-2016	Yes	Yes	Yes	Developed spring, flows to nearby trough - stock/wildlife use
M-SP82	465886	4323447	8,106	Price River Fm.	2002-2004	Yes	No	No	Undeveloped spring - stock/wildlife use
Hansen Seep	462514	4313461	8,399	Price River Fm.	2012-2014	Yes	Yes	Yes	Undeveloped spring in stream bottom - no use apparent
006A Spring	462827	4312962	8,330	Price River Fm.	2010-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
Skutumpah Spring	460903	4313360	8,400	Price River Fm.	2014-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
Spring 94-113	469793	4305169	8,317	Price River Fm.	2012-2016	Yes	Yes	Yes	Undeveloped seep in channel bottom - no use apparent
Spring A	460639	4313578	8,520	Price River Fm.	2013-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
Spring B	460661	4313547	8,520	Price River Fm.	2013-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
Castlegate Sandstone springs									

Station ID	Location UTM NAD 27		Elev. (feet)	Geologic Fm.	Monitoring Period	Baseline Field	Baseline Lab Anal.	Lab solutes/ metals	Comments/Use
M-SP87	470404	4318092	7,931	Castlegate S.S.	2002-2004; 2009; 2014-2016	Yes	Yes	Yes	Undeveloped spring - stock/wildlife use
USP-1	465340	4322471	7,810	Castlegate S.S.	2009	Yes	No	Yes	Undeveloped spring - stock/wildlife use
USP-2	465713	4322578	7,810	Castlegate S.S.	2009	Yes	No	Yes	Undeveloped spring - stock/wildlife use
Streams									
M-STR01	469241	4320776	7,462	Blackhawk Fm.	2001-2004	Yes	Yes	Yes	Greens Canyon lower site; stock/wildlife use
M-STR02	468670	4320106	7,740	Blackhawk Fm.	2002-2004	Yes	Yes	Yes	Greens Canyon middle site - stock/wildlife use
M-STR03	468331	4319623	7,927	Blackhawk Fm.	2001-2004	Yes	Yes	Yes	Cowboy Creek above Greens Hollow - stock/wildlife use
M-STR04	467758	4318904	8,164	Castlegate S.S.	2001-2004; 2006-2016	Yes	Yes	Yes	Cowboy Creek below lease boundary - stock/wildlife use
M-STR05	468320	4319250	7,980	Blckhwk/Cstlgt cont.	2002-2004	Yes	Yes	Yes	Cowboy Creek near base of Blackhawk - stock/wildlife use
M-STR06	467424	4319577	8,170	Castlegate S.S.	2001-2004; 2015-2016	Yes	Yes	Yes	Greens Hollow Creek - stock/wildlife use
M-STR07	466926	4321557	8,015	Price River Fm.	2002-2004	(Dry)	(Dry)	(Dry)	Unnamed eph. trib to Muddy Creek in N. tract area - no use apparent
M-STR08	464513	4322181	7,930	Blackhawk Fm.	2002-2004	Yes	Yes	Yes	South Fork Muddy Creek above North Fork - stock/wildlife use
Pines 405	471581	4320035	7,190	Star Point S.S.	1997-2016	Yes	Yes	Yes	Muddy Creek below lease area - stock/wildlife use
S Fork Quitch Upr.	461329	4314316	8,840	North Horn Fm.	2013-2016	Yes	Yes	Yes	S. Fk. Quitchupah Creek just below Skut. Diversion - stock/wildlife use
Skut Creek Upr.	461235	4314290	8,840	North Horn Fm.	2013-2016	Yes	Yes	Yes	Skutumpah Creek upper - stock/wildlife use
Sufco 007	464886	4314993	8,218	Price River Fm.	1979-2016	Yes	Yes	Yes	North Fork Quitchupah below lease - stock/wildlife use
Sufco 006	463784	4312810	8,220	Price River Fm.	1979-2016	Yes	Yes	Yes	South Fork Quitchupah Creek below lease - stock/wildlife use
Sufco 006A	462900	4312941	8,320	Price River Fm.	2010-2016	Yes	Yes	Yes	South Fork Quitchupah Creek below lease - stock/wildlife use
U-Mud	464739	4322439	7,840	Blackhawk Fm.	2014-2016	Yes	Yes	Yes	Upper Muddy Creek below forks - stock/wildlife use
Wells									
MW-15-5-2	466354	4318730	8,270	Castlegate Sandstone	2015-2016	---	---	---	Castlegate Sandstone well, constructed in 2015
01-8-1	467150	4317092	8,988	Blackhawk Fm.	2001-2016	---	---	---	Deep Blackhawk Formation well, In previously mined area

Table 2A Discharge and water-quality data for springs and streams in the Greens Hollow Tract area.

Petersen Hydrologic, LLC

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
Stream Monitoring Data																									
U-Mud	30-Jun-14	28,274	13.0	8.78	381	8.17		42.00	22.00	4.00	0.55	224.336	15	7	1	199	16	0.12	0.006		0.68	<0.05	<0.1	<0.05	<0.05
U-Mud	18-Sep-14	8,707	13.2	8.72	378	8.26		40.17	22.76	6.73	0.68	227.993	5	8	1	198	<5	0.11	0.007		0.36	<0.05	0.2	<0.05	<0.05
U-Mud	5-Nov-14	5,206	1.6	8.7	440	9.97		98.05	53.30	105.66	3.57	427.944	29	173	60	820	11	0.36	0.018	0.05	0.05	<0.05	<0.1	<0.05	<0.05
U-Mud	26-Jun-15	26,928	14.8	8.78	379	8.31		41.01	22.70	5.91	0.63	227.993	<5	6	1	217	13	0.05	0.009	0.33	0.36	<0.05	<0.1	<0.05	<0.05
U-Mud	29-Sep-15	7,315	11.4	8.72	360	8.21		37.67	24.26	7.15	0.67	231.651	<5	9	1	220	11	0.06	0.003	2.3	0.39	0.11	<0.1	<0.05	<0.05
U-Mud	28-Oct-15	4,057	3.6	8.65	412	9.86		45.16	25.04	8.43	0.74	245.062	<5	10	2	255	5	0.11	0.003	0.63	0.51	0.12	0.3	<0.05	<0.05
U-Mud	23-Jun-16	38,353	16.1	8.69	355	7.54																			
U-Mud	28-Sep-16	8,572	10.1	8.75	388	8.88										250	24	0.17	0.008						
U-Mud	7-Nov-16	4,313	4.6	8.79	416	9.10										216	7	<.05	<.002						
PINES 405	26-Jun-97		13.8	8.4	282											210		0.7	<0.1						
PINES 405	27-Aug-97	18,625	12	8.5	365													6.5	0.1						
PINES 405	22-Oct-97	9,874	13.8	8.4	282			39	23	10	<1	285	<5	13	4	210	437	5.4	<0.1						
PINES 405	1-Jun-00		11.2	8.57	355	6.5		47	21	4	< 1.	248	< 5.	8	< 1.	214	90	0.3	< .1						
PINES 405	21-Aug-00	9,470	15.3	8.19	382	6.53		36	23	8	< 1.	260	< 5.	10	1	200	227	3.4	< .1	0.49					
PINES 405	6-Dec-00	4,488	-0.5	8.4	387	11.38		43	24	10	< 1.	278	< 5.	14	2	268	42	0.4	< .1	0.65		<0.01	<0.5		
PINES 405	1-Jun-01	> 22440	8.8	8.49	369	8.42																			
PINES 405	7-Sep-01	14	9.5	8.72	391	7.92																			
PINES 405	27-Nov-01	4,084	0.1	8.69	433	8.81																			
PINES 405	18-May-02	27,511	9.3	8.38	369	8																			
PINES 405	26-Sep-02	5,520	10.5	8.61	384	6.69																			
PINES 405	18-Nov-02	5,049	0.1	8.59	385	8.78																			
PINES 405	8-Jun-03	78,540	10.2	8.6	332	7.1																			
PINES 405	21-Sep-03	6,777	7.9	8.34	390	7.62																			
PINES 405	5-Dec-03	4,533	0.4	8.59	417	8.47																			
PINES 405	13-Jun-04	49,368	11	8.72	374	6.85																			
PINES 405	21-Sep-04	7,091	5.2	8.66	364	9.3																			
PINES 405	21-Dec-04	3,142	0	8.43	357	7.23																			
PINES 405	23-May-05	157,080	9.7	8.15	409	9.73																			
PINES 405	5-Sep-05	22,440	14.5	8.68	324	7.4																			
PINES 405	20-Dec-05	5,350	0	8.56	423	8.16																			
PINES 405	23-Jun-06	53,856	6.7	8.65	374	8.84																			
PINES 405	24-Sep-06	9,510	7.1	8.54	393	8.17																			
PINES 405	8-Dec-06	6,820	0.1	8.44	427	9.1																			
PINES 405	24-Jun-07	19,300	16.7	8.79	382	8.1																			
PINES 405	16-Sep-07	5,840	13	8.92	399	8.22																			
PINES 405	6-Dec-07	4,490	1.8	8.62	334	10.4																			
PINES 405	28-Apr-08	26,900	10.4	8.58	422	8.25																			
PINES 405	17-Sep-08	9,170	10.9	8.65	383	7.89																			
PINES 405	3-Nov-08	5,850	4.1	8.74	399	9.29																			
PINES 405	29-May-09	60,760	11.4	8.64	385	8.55																			
PINES 405	14-Sep-09	8,580	10.5	8.71	384	8.8																			
PINES 405	2-Dec-09	4,040	0.4	8.47	427	10.4																			
PINES 405	17-May-10	17,560	11	8.73	407	7.28																			
PINES 405	13-Sep-10	8,340	11	8.47	371	9.35																			
PINES 405	27-Nov-10	4,480	0.9	8.25	457	9.91																			
PINES 405	18-Jun-11	134,640	6.4	8.81	358	7.77																			
PINES 405	19-Sep-11	22,090	11.9	8.72	388	8.62																			
PINES 405	18-Nov-11	8,037	0.2	8.82	445	9.29																			
PINES 405	9-Jun-12	16,400	16.2	8.93	368	7.66																			
PINES 405	7-Sep-12	5,470	17.8	8.83	372	7.51																			

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
PINES 405	16-Nov-12	5,520	0.2	8.71	419	10.43																			
PINES 405	25-Jun-13	17,413	15.8	8.83	353	8.74																			
PINES 405	22-Sep-13	8,078	9.7	8.88	408	8.18																			
PINES 405	2-Dec-13	4,880	0.2	8.74	461	10.8																			
PINES 405	27-Jun-14	28,274	14.6	8.82	367	8.46																			
PINES 405	19-Sep-14	7,271	11.8	8.81	396	8.25																			
PINES 405	2-Dec-14	5,386	0.3	8.77	479	10.56																			
PINES 405	14-Jun-15	52,958	13.3	8.7	389	7.54																			
PINES 405	20-Sep-15	8,864	10.9	8.66	383	8.27																			
PINES 405	29-Oct-15	5,222	4.6	8.67	411	9.46																			
PINES 405	13-Jun-16	118	10.6	8.53	365	8.51																			
PINES 405	26-Aug-16	13,823	13.8	8.67	381	8.7																			
M-STR01	6-Jun-01	50,094	13.6	8.61	567	7.53	18.4	43	35	54	2	349	7	34	24	378		0.5		<0.03		<0.03		<0.05	0.05
M-STR01	16-Aug-01	0																							
M-STR01	30-Aug-01	0																							
M-STR01	25-Sep-01	0																							
M-STR01	29-Oct-01	0																							
M-STR01	18-Apr-02	0																							
M-STR01	1-May-02	0																							
M-STR01	5-Jun-02	0																							
M-STR01	7-Aug-02	0																							
M-STR01	25-Sep-02	0																							
M-STR01	12-Nov-02	0																							
M-STR01	6-May-03	9,715	0.7	8.48		8.65	7.5	45	27	42	2.3	350	9	34	18	401	7	<0.02	<0.01	<0.03		<0.03	<0.2	<0.05	0.03
M-STR01	19-Jun-03	0																							
M-STR01	23-Aug-03	0																							
M-STR01	6-Oct-03	0																							
M-STR01	10-May-04	460	11.8	8.84	443	8.36	39.7	50	19	32	1.8	284	18	13	7.4	570	15	0.57	0.02				<0.2		0.05
M-STR01	6-Jun-04																			<0.05		<0.05		0.07	
M-STR02	7-Aug-02	0																							
M-STR02	25-Sep-02	1,857	8.2	7.97	509	8.35	0.7	77	53	54	3.5	370	5	140	38	531	<5	<0.02	<0.01	<0.03		<0.03	<0.2	<0.05	0.04
M-STR02	12-Nov-02	2,925	0.8	8.19	416	11.19	0.9	72	47	47	2.8	380	<5	110	35	477	30	0.08	<0.01	0.11		<0.03	<0.2	<0.05	
M-STR02	6-May-03	74,148	3.3	8.58	591	9.88	9.8	51	28	41	2.4	340	<5	36	18	391	13	0.32	0.01	<0.03		<0.03	<0.2	<0.05	0.03
M-STR02	19-Jun-03	4,235	13	8.46	705	7.51	3.73					354	6	62	24	435		0.13		<0.03				<0.05	0.08
M-STR02	4-Aug-03	1,184	14.9	8.11	722	5.84	39.9	66	36	45	4.1	350	14	72	27	457	83	1.2	0.05	<0.03		<0.03	<0.2	<0.05	0.08
M-STR02	6-Oct-03	2,379	9.3	9.25	495	7.15	2.99	74	46	46	3.6	411	<5	<0.03	28	507	9	0.05	0.01	<0.03		<0.03	<0.2	<0.05	0.06
M-STR02	10-May-04	460	11.8	8.84	443	8.36	39.7	48	18	28		280	<1	9.1	5.3	271	28	1.6	0.07				<0.2		0.12
M-STR02	6-Jun-04																			<0.05		<0.05		0.08	
M-STR03	6-Jun-01	36,62	10.4	8.54	527	7.11	22.5					344	6	24	22	364		0.4		<0.03		<0.03		<0.05	0.06
M-STR03	16-Aug-01	0.61	12.1	7.81	405	4.03	3.17					357	<5	41	28	383		<0.1	<0.05	0.31		<0.03			<0.05
M-STR03	30-Aug-01	6,052																							
M-STR03	25-Sep-01	0.501	8.7	7.85	395	3.83	2.21					371	<5	44.2	29.4	390	10	0.1		<0.03					0.05
M-STR03	29-Oct-01	0.967	3.6	7.98	202	6.68	0			39		356	<5	45.8	27.8	414	63	<0.1		0.09					<0.05
M-STR03	18-Apr-02	9.451	13	7.87	311	6.29	1.21					334	<5	53	28	406		<0.1		0.08					<0.05
M-STR03	1-May-02	7,993	3.6	8.29	409	9.7	0.67																		
M-STR03	5-Jun-02	2.61	6.3	8.18	365							346	<5	55	30	418		<0.1		0.11					0.08
M-STR03	7-Aug-02	0																							
M-STR03	25-Sep-02	1.83	8.2	7.87	405	4.85	2	60	39	42	2.7	370	<1	54	30	399	7	0.42	0.02	<0.03		<0.03	<0.2	<0.05	0.03
M-STR03	7-Oct-02																								
M-STR03	12-Nov-02	0																							
M-STR03	6-May-03	54.9	4	8.71	621	9.37	23.8	51	28	50	2.1	350	6	27	20	415	41	0.5	0.02	<0.03		<0.03	<0.2	<0.05	0.05
M-STR03	19-Jun-03	2.499	10.9	8.1	659	5.2	2.83					356	<5	39	24	379		0.35		0.08				<0.05	0.07

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-STR03	4-Aug-03	1.631	12	7.72	647	3.58	43.3	58	33	41	3.4	360	<1	40	24	361	113	1.7	0.05	0.03		<0.03	<0.2	<0.05	0.05
M-STR03	6-Oct-03	1.382	7.9	8.01	398	5.56	7.29	62	36	38	2.8	373	<5	42	25	406	11	0.11	0.02	<0.03		<0.03	<0.2	<0.05	0.04
M-STR03	10-May-04	491.5	8.4	8.73	307	8.51	51.4	42	14	28	2.2	250	<1	7.4	4.5	247		1.6	0.06				<0.2		0.13
M-STR03	6-Jun-04																			<0.05		<0.05		0.07	
M-STR04	7-Jun-01	71.081	19.4	8.55	386	6.84	3.08					344	17	22	23	353		< .1		< .03		< .03		< .05	< .05
M-STR04	7-Jun-01																								
M-STR04	7-Jun-01																								
M-STR04	22-Jun-01	11.719																							
M-STR04	16-Aug-01	0																							
M-STR04	31-Aug-01	0																							
M-STR04	27-Sep-01	0																							
M-STR04	28-Oct-01	0																							
M-STR04	17-Apr-02	13.005	6.2	8.87	470	9.19	7.49	58	41	79	2	431	11	68	47	548		0.2	< .05	< .03		11	431	<0.05	< .05
M-STR04	3-May-02																								
M-STR04	4-Jun-02	3.037	18	8.83	514	5.23	2.8					361	17	71	60	513		0.4		< .03					0.1
M-STR04	8-Aug-02	0																							
M-STR04	25-Sep-02	0																							
M-STR04	12-Nov-02	0																							
M-STR04	6-May-03	79.9	8	8.74	599			50	27	49	2	360	5	25	18	399	17	0.29	0.02	< .03		<0.03	< .2	<0.05	0.02
M-STR04	20-Jun-03	14.231	8.4	8.65	792	8.92	4.73					410	13	35	35	429		0.18		0.05				< .05	0.01
M-STR04	6-Aug-03	0																							
M-STR04	8-Oct-03	0																							
M-STR04	11-May-04	717.264	11.9	8.82	445	8.12	76.3	52	18	27	1.6	280	8	9.3	5.6	280	21	0.57	0.03				< .2		0.05
M-STR04	13-May-04																			< .03		< .03		< .05	
M-STR04	23-Jun-06	3.85	19.8	8.72	627	6.44																			
M-STR04	28-Sep-06	1.01	10.4	8.67	705	7.92																			
M-STR04	8-Nov-06	3.19	4.5	8.5	758	8.73																			
M-STR04	26-Jun-07	0																							
M-STR04	11-Sep-07	0																							
M-STR04	8-Nov-07	0																							
M-STR04	21-Jun-08	16.3	20.7	8.59	573	6.64																			
M-STR04	24-Sep-08	0																							
M-STR04	6-Nov-08	0																							
M-STR04	27-Jun-09	0.67	21.2	8.83	684	7.12																			
M-STR04	23-Sep-09	0																							
M-STR04	10-Nov-09	0																							
M-STR04	26-Jun-10	0																							
M-STR04	23-Sep-10	0																							
M-STR04	12-Nov-10	0																							
M-STR04	27-Jun-11	142	14.1	8.48	573	7.82																			
M-STR04	30-Sep-11	3.71	14.5	8.66	865	7.56																			
M-STR04	29-Oct-11	14.6	0.3	8.75	767	10.4																			
M-STR04	27-Jun-12	0																							
M-STR04	25-Sep-12	0																							
M-STR04	7-Nov-12	0																							
M-STR04	28-Jun-13	0																							
M-STR04	25-Sep-13	0																							
M-STR04	26-Oct-13	0																							
M-STR04	29-Jun-14	0																							
M-STR04	29-Aug-14	0																							
M-STR04	31-Oct-14	0																							
M-STR04	24-Jun-15	2.25	17.7	8.86	605	7.47																			
M-STR04	28-Sep-15	0																							
M-STR04	28-Oct-15	0																							

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-STR04	23-Jun-16	0																							
M-STR04	28-Sep-16	0																							
	7-Nov-16	0																							
M-STR05	8-Aug-02	1.412	9.5	6.5	346	8.45	1.56	51	34	31		312	7	37	26	329		< .1	< .05	0.16					< .05
M-STR05	25-Sep-02	1.717	7	8.38	353	8.21	4	52	35	32	2	320	< 5.	37	27	352	6	0.13	< .01	0.17		< .03	<0.2	< .05	0.01
M-STR05	6-Oct-02																								
M-STR05	12-Nov-02	immeas.	0.5	8.25	329	11.18	2.32	55	36	33	2	350	<1	39	29	381	8	0.02	< .01	0.27		< .03	< .2	< .05	
M-STR05	6-May-03	61.6	6.1	8.73	616	9.04	22.5	51	28	52	2.1	360	6	20	17		31	0.46	0.02	<0.03		<0.03	< .2	<0.05	0.02
M-STR05	19-Jun-03	2.686	10.3	8.56	605	8.04	1.37	51	34	37	2.3	304	10	33	22	345		0.02		0.03				< .05	0.02
M-STR05	5-Aug-03	2.043	10.2	8.35	610	8.5						316	6			329	400			0.12		< .03		< .05	
M-STR05	6-Aug-03							54	34	34	2.2	350	7	36	25			0.68	0.02				< .2		0.05
M-STR05	6-Oct-03	1.534	6	8.47	356	7.23	3.99	55	35	32	2	342	< 5.	34	23	366	11	0.07	0.01	0.09		< .03	<2	< .05	0.02
M-STR05	11-May-04	598.482	10	8.82	446	8.07	17.4	52	18	27	1.7	290	<1	9.1	5.6	290	49	0.63	0.02	< .03		< .03	< .2	< .05	0.05
M-STR06	7-Jun-01	16.85	20.10	8.48	808.00	6.54	67.50		33.00			400	14.00	35.00	40.00	457		1.10		<0.03		<0.03	<0.03	<0.05	<0.05
M-STR06	22-Jun-01	5.651																							
M-STR06	16-Aug-01	4.783	12.4	8.3	439	7.13	81.4	61		37		458	<5	47	47	515		1.7		<0.03		<0.03			0.06
M-STR06	25-Sep-01	1.9	11.5	7.92	575	3.14	30	66	42	86	9	538	<5	37.9	57.9	595		0.3		<0.03					0.1
M-STR06	30-Oct-01	6.438	2.7	8.39	446	8.73	11.6		38			581.565	5	44.2	43.1	539		0.3		0.05					0.06
M-STR06	17-Apr-02	18.165	9.6	8.77	462	7.16	9.63	58	32	85		439	8	46	40	536		0.4	<0.05	<0.03					0.05
M-STR06	1-May-02	4.455	8.2	8.51	819	8.55	8.32																		
M-STR06	5-Jun-02	3.020	23.3	8.52	569	5.13	40.9	45	34	90		412	7	53	53	556		0.8		0.08					0.14
M-STR06	8-Aug-02	0																							
M-STR06	24-Sep-02	0																							
M-STR06	13-Nov-02	0																							
M-STR06	7-May-03	17.836	11.7	8.54	490	7.01	8.29	55.00	31/36	80.00	2.70	524.262	02/08	38.00	31.00	474.00	25.00	0.54	0.03	0.04/<0.03		<0.03	<0.2	<0.05	0.03
M-STR06	20-Jun-03	3.024	12.6	8.66	822	8.15	12.8	58	40			464.5/381	17	36/44	39/44	452		0.31		<0.03				<0.05	0.05
M-STR06	6-Aug-03	0																							
M-STR06	8-Oct-03	0																							
M-STR06	11-May-04	27.400	15.4	8.65	723	6.59	96.3	55	25	85	2.8	512.07	13-Nov	21	21	451	42	1.4	0.04	<0.03		<0.03	<0.2	<0.05	0.08
M-STR06	13-May-04																			<0.03		<0.03		<0.05	
M-STR06	26-Jun-15	0.636	22.3	8.64	968	5.43	NM									648	680	5.67	0.251						
M-STR06	28-Sep-15	0																							
M-STR06	28-Oct-15	0																							
M-STR06	23-Jun-16	0.000	—	—	—	—																			
M-STR06	28-Sep-16	0.000	—	—	—	—																			
M-STR06	7-Nov-16	0.000	—	—	—	—																			
M-STR07	25-Sep-02	0																							
M-STR07	12-Nov-02	0																							
M-STR07	7-May-03	0																							
M-STR07	8-Aug-03	0																							
M-STR07	6-Oct-03	0																							
M-STR07	13-May-04	0																							
M-STR08	26-Sep-02	2062	9.2	8.7	234	9.1	2.2	48	27	9.8	0.7	250	7	10	2.1	218	5	0.03	<0.01	0.57		<0.03	<0.2	<0.05	
M-STR08	13-Nov-02	967	1	8.72	65	13.66	1.5	48	25	11	0.6	280	4	12	2.6	257	8	0.02	<0.01	0.67		<0.03	<0.2	<0.05	
M-STR08	7-May-03	2447	3.5	8.69	247	10.22	5.15	54	24	12	0.6	280	2	9.3	3.1	270	14	0.14	0.01	0.54		<0.03	<0.2	<0.05	
M-STR08	5-Aug-03	7145	16.2	8.74	371	7.51		43	24	5.5	0.7	230	9	6.6	1.4	208		0.45	0.02	0.68		<0.03	<0.2	<0.05	
M-STR08	7-Oct-03	3087	5.5	8.88	232	9.27	1.99	46	25	8.1	0.6	255	8	8.4	1.6	230	10	<0.08	<0.01	0.68		<0.03	<0.2	<0.05	
M-STR08	13-May-04	15644	4.2	8.9	352	9.76	6.81	53	22	7.5	0.6	270	1	6.8	1.8	246	28	0.39	0.02			<0.03	<0.02	<0.05	
Sufco 007	5-Oct-79											302.5	< .01	45	18	340	1	0.02	0.014		< .01				0.06
Sufco 007	1-Nov-80											405.04	< .01	25.5	10.1	386		6	0.1		0.02	< .01	< .01	< .001	

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{4+} mg/L	Mg^{4+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
Sufco 007	9-Jun-81											197.64	9.6	27	6	218		0.63	0.02		< .01	< .01	< .01		
Sufco 007	26-Aug-81											253.76	1.2	19.5	15.4	270	1	0.29	0.01		< .01			0.04	
Sufco 007	27-Oct-81											340	3.6	18	9.1	335		0.65	0.021		< .01	< .01		0.1	
Sufco 007	22-Jun-82	3132.624	16	8.2	654							246.6	< .01	12	6.3	128		1.2	0.14		0.28				0.005
Sufco 007	12-Aug-82	403.92	12	8.6	460							273.3	< .01	9	26	280		1.52	0.144		0.11				0.01
Sufco 007	20-Oct-82	498.168	0	9.2	690							356.2	< .01	66	19.9	425		2.22	0.135		0.12				0.44
Sufco 007	21-Jun-83	5771.568	14	8.4	446							258.6	< .01	28	12	204		10.3	0.285		< .02				0.92
Sufco 007	16-Aug-83	516.12	15	7.6	593							292.8	2.4	40	16	320		12.9	0.012		0.08				0.03
Sufco 007	12-Oct-83	269.3	12	7.7	640							339.16	< .01	48	20	377		3.39	0.21		0.02				0.05
Sufco 007	21-Jun-84	2629.968	7	7.6	525							283	< .01	28	6.1	295		0.06	0.01		0.06				0.06
Sufco 007	9-Aug-84	359.04	21	7.8	555							317.2	< .01	39	16.8	375		3.04	0.07		0.08				0.18
Sufco 007	11-Oct-84	686.664	5	7.9	621							329.4	< .01	46	17	380		2.06	0.07		1.39				0.49
Sufco 007	13-Jun-85	2217.072	7.8	7.5	409							493	< .01	475	86	904		0.66	0.14		2.03				0.18
Sufco 007	14-Aug-85	287.232	13	8	680							290.4	< .01	36	19.7	322		0.31	< .02		0.09				0.09
Sufco 007	22-Oct-85	94.248	0.5	7.6	638							353.8	< .01	47	22.8	388		1.84	0.1		< .01				0.03
Sufco 007	2-Jun-86	3388.44	14	7.6	412							200		88	4.1	258		29.6	1.46		0.15				1.64
Sufco 007	13-Aug-86	246.84	17	8.3	531							258.6	< .1	31	13.9	228		0.38	< .01		0.05				0.02
Sufco 007	7-Jun-88	1297.032	12	8.2	468							229	< .1	20	3.5	236		0.91	0.06		0.11				< .04
Sufco 007	9-Aug-88	71.81	19	7.4	500							244	< .1	31	33	310		0.04	< .01		0.1				< .04
Sufco 007	5-Oct-88	94.25	8	7.3	619							317	< .1	125	16	470		0.05	0.02		0.04				< .04
Sufco 007	13-May-92											207	3	27	3	230		2.63	0.09		0.41				0.38
Sufco 007	4-Aug-92											156	2	20	5.3	210		0.13	< .01		< .05	< .02			< .02
Sufco 007	6-Oct-92											222	0	27	11.2	300		0.18	0.02	< .05		< .02			0.02
Sufco 007	9-Jun-93											223	2.1	20.1	3.53	234		0.85	0.04		0.2				< .1
Sufco 007	6-Jun-95	3751.968	10.4	8.29	511							260	20	17	3	290									
Sufco 007	23-Aug-95	1122	15.2	8.35	419			43	17	18		235	20	15	7	220		2.7	0.1	< .1				0.23	
Sufco 007	3-Oct-95	188.5	13.5	8.37	541							265	10	21	10	250		< .1	< .1	< .1				< .01	
Sufco 007	27-Aug-96	184.008	17.2	8.6	446							204	18	23	8	234		< .1	< .1	< .1				0.01	
Sufco 007	22-Oct-96	103.224	2.1	8.38	568							323	< 5.	21	12	302		< .1	< .1	< .1				0.02	
Sufco 007	2-Jun-97		16.15	8.58	401							209	< 5.	83	3	220		< .1	< .1	< .1				0.03	
Sufco 007	18-Aug-97	664.224	19.8	8.4	467		10.2					243	< 5.	22	7	250		< .1	< .1	< .1				0.02	
Sufco 007	8-Oct-97	336.6	6.38	8.77	548		11.4					303	< 5.	26	9	320		< .1	< .1	< .1				0.02	
Sufco 007	4-Jun-98	3285.216	7.61	8.62	473	6.37		57	18	10	< 1.	215	21	36	6	265		3.1	0.1						
Sufco 007	5-Aug-98	14.8	19.65	8.08	537	7.5		50	23	24	< 1.	311	< 5.	20	11	290		0.2							
Sufco 007	1-Oct-98	94.248	12.45	8.43	598	8.27		53	26	35	1	336	< 5.	23	15	330		0.6	< .1						
Sufco 007	21-Jun-99	839.256	15.99	8.22	441	6.89		49	16	10	< 1.	239	< 5.	15	3	228		1.9	< .1						
Sufco 007	9-Aug-99	119.8296	22.2	8.37	505	6.39		41	21	25	< 1.	252	< 5.	20	8	262		1	< .1						
Sufco 007	4-Oct-99	94.248	12.05	8.32	604	8.25		55	24	31	1	310	9	26	12	316		0.2	< .1						
Sufco 007	21-Jun-00	0.18	17.97	8.29	473	6.15		49	17	15	< 1.	234	< 5.	21	5	252		0.1	< .1						
Sufco 007	2-Aug-00	42.1872	21.25	8.52	458	5.65		39	17	21	< 1.	224	< 5.	19	8	231		< .1	< .1						
Sufco 007	5-Oct-00	15.2592	10	8.24	577	6.48		50	21	29	1	295	< 5.	23	10	275		< .1	< .1						
Sufco 007	11-Jun-01	885	14.3	8.29	407	7.92		47	13	6	< 1.	197	< 5.	18	2	190		0.4	< .1						
Sufco 007	20-Aug-01	0.215	17.4	8.68	363	7.15		37	17	18	< 1.	200	6	19	5.3	242		< .1	< .05						
Sufco 007	2-Oct-01	69.2	10.3	8.56	431	7.51		47	19	24	1	261	< 5.	22	8.3	263		< .1	< .05						
Sufco 007	8-May-02	559	9.6	8.45	488	8.42		66	21	12	< 1.	262	< 5.	53	3	309		8.7	0.26						
Sufco 007	20-Sep-02	72.9	16.5	8.48	453	6.88		49	19	25	< 1.	254	< 5.	25	7	240		0.2	< .05						
Sufco 007	8-Oct-02	88.2	11.7	8.63	477	8.01		57	20	27	1	268	7	36	9	308		0.2	< .05						
Sufco 007	29-May-03	2560	12.7	8.54	358	7.62		53.7	14.4	4.84	0.743	238	7	29	1	202		9.02	0.282						
Sufco 007	19-Sep-03	68.6	12.3	8.61	376	8.14		47.1	15.8	16.1	0.873	226	7	19	5	266		0.258	0.006						
Sufco 007	30-Oct-03	61.7	11.4	8.65	465	7.63		55.9	18.6	22.9	1.38	243	8	23	6	311		0.128	0.01						
Sufco 007	26-Jun-04	1510	11	8.66	336	7.63		45.4	12.6	6.14	0.48	158	11	16	2	180		0.08	0.003						
Sufco 007	1-Sep-04	66.3	18.7	8.73	343	8.73		41.1	13.8	13	0.8	157	9	13	4	187		< .05	0.002						
Sufco 007	15-Oct-04	398	7.2	8.54	439	8.17		52.4	16.2	19.4	1.28	204	14	21	5	261		0.08	0.009						
Sufco 007	13-Jun-05	2180	12.7	8.59	373	6.78		55.6	16.9	8.76	0.85	228	< 5.	22	2	199		1.04	0.028						
Sufco 007	30-Sep-05	104	11.4	8.57	389	7.1		51.4	19.2	19.9	0.99	253	< 5.	20	6	276		0.27	0.007						

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
Sufco 007	24-Oct-05	96	7.3	8.61	470	8.03		54.9	19.6	22.9	0.74	284	< 5.	23	7	281		< .05	0.005						
Sufco 007	26-Jun-06	561	17.1	8.56	337	8.18		48.4	16.9	10.2	0.62	210	< 5.	16	4	218		< .05	0.002						
Sufco 007	13-Sep-06	62.8	15.9	8.48	375	7.1		42.47	18.2	23.17	1.06	223	10	21	7	228		0.33	0.004						
Sufco 007	4-Nov-06	190	1.5	8.58	478	9.7		59.41	21.88	22.56	0.75	284	< 5.	37	7	302		1.21	0.015						
Sufco 007	25-Jun-07	227	22.5	8.67	304	7.05		41.1	16.8	12.7	0.64	204	< 5.	20	4	216		0.17	0.004						
Sufco 007	19-Sep-07	50.7	9.4	8.73	381	7.51		44.4	16.9	19.1	1.02	233	< 5.	17	6	224		0.31	0.01						
Sufco 007	29-Oct-07	78	5.2	8.77	436	7.63		54.67	20.57	24.53	1.15	271.885	4.8	26	8	317		0.36	0.014						
Sufco 007	12-Jun-08	1550	10.9	8.63	301	7.59		52.26	14.69	5.88	0.55	197.513	3.6	24	2	233		2.88	0.074						
Sufco 007	15-Sep-08	77.4	12	8.54	303	7.72		44.36	15.75	15.29	0.79	201.17	< 5.	15	4	207		0.05	0.003						
Sufco 007	21-Oct-08	71	4.3	8.58	442	9.82		55.01	19.03	23.67	1.65	263.35	< 5.	134	26	266		0.1	0.008						
Sufco 007	19-Jun-09	716	15.7	8.56	358	7.2		50.82	15.25	7.51	0.61	185.321	7.8	23	2	213		0.42	0.014						
Sufco 007	17-Sep-09	79.3	13.5	8.61	362	8.26		45.4	15.6	15.45	0.99	207.267	5.4	15	4	225		0.25	0.006						
Sufco 007	19-Nov-09	57	0.3	8.39	515	10.6		57.16	19.5	22.18	0.98	288.954	< 5.	25	6	276		0.11	0.006						
Sufco 007	28-Jun-10	612	14.5	8.59	351	7.89		50.97	13.87	6.27	0.78	188.978	7.2	21	2	226		0.56	0.018						
Sufco 007	15-Sep-10	62.4	13.4	8.5	328	7.92		37.4	12.1	12.3	0.7	234.089	3	17	3	216		0.08	< .005						
Sufco 007	1-Nov-10	129	2.7	8.32	449	9.79		57.6	17.2	18.6	0.7	286.515	1.8	33	5	298		0.69	0.027						
Sufco 007	18-Jun-11	6032	9	8.79	352	7.88		52.1	12.8	4.8	0.8	253.597	1.8	25	< 1.	210		15.9	0.833						
Sufco 007	27-Sep-11	189	11	8.7	405	8.82		39.7	16	19.7	0.8	280.419	3	18	6	212		0.05	< .005						
Sufco 007	29-Oct-11	133	0.8	8.46	492	10.53		52	19	24.6	0.8	309.681	3	26	8	258		0.12	0.009						
Sufco 007	1-Jun-12	327	11.9	8.76	373	7.51		46.7	15.1	12	0.7	208.486	1.98	25	4	228		0.38	0.019						
Sufco 007	26-Sep-12	19.7	9.7	8.54	539	8.88		46.1	22.2	38.9	1.5	304.804	4.2	32	14	188		0.13	0.006						
Sufco 007	1-Nov-12	48.8	3.7	8.47	480	9.46		48.4	17.6	26.4	0.9	275	6	28	8	290		0.17	0.009						
Sufco 007	27-Jun-13	261	13.9	8.58	373	8.83		46.1	12.3	7.3	0.7	246.281	1.2	35	2	252		1.56	0.066						
Sufco 007	25-Sep-13	253	7.2	8.74	398	8.82		54.1	14.9	9.1	0.9	277.981	3	28	3	224		0.12	0.009						
Sufco 007	26-Oct-13	216	2.6	8.66	420	10.92		53.3	14.7	11.5	0.7	259.693	4.2	26	3	180		0.03	0.006						
Sufco 007	11-Jun-14	1521	12	8.67	351	9.63		48.22	12.87	5.92	0.49	204.828	< 5.	19	2	217		2.67	0.082						
Sufco 007	23-Sep-14	101	13.5	8.72	419	8.51		46.14	16.85	18.19	0.98	224.336	< 5.	22	5	240		0.16	0.02						
Sufco 007	6-Nov-14	90	1.7	8.6	495	9.99		56.75	20.03	25.16	0.9	268.227	< 5.	28	6	281		0.06	0.016						
Sufco 007	24-Jun-15	1107	14.9	8.7	375	8.16		47.27	16.97	13.78	0.6	207.267	< 5.	25	2	236		0.37	0.088						
Sufco 007	22-Sep-15	97	11.1	8.61	328	8.31		38.43	14.26	13.35	< .14	158	<5	16	4	188	<2	< 5.	< .002						
Sufco 007	7-Nov-15	70	0.2	8.37	514	10.95		59.8	19.36	25.11	1.1	297.488	< 5.	31	7	322	5	0.05	0.005						
Sufco 007	23-Jun-16	840	17.2	8.59	329	7.31		47.38	12.68	6.36	0.76	155	<5	17	2	172	41	0.42	0.022						
Sufco 007	28-Sep-16	115	9.9	8.61	409	8.92		48.3	14.98	15.42	0.97	176	8	23	4	254	15	0.33	0.01						
Sufco 007	6-Nov-16	99	4.1	8.71	449	9.43		52.69	15.92	20.3	0.75	215	10	25	5	221	9	0.07	0.008						
Sufco 006	5-Oct-79											283.04	< .01	90	14	396	6	0.15	0.024		< .01				0.1
Sufco 006	1-Nov-80											453.84	< .01	63	18.1	480		1.8	0.1		0.04	< .01	< .01	0.1	
Sufco 006	9-Jun-81											344.04	7.2	108	24	465		0.68	0.06		< .01	< .01	< .01	0.12	
Sufco 006	26-Aug-81											265.96	12	79.5	11	390	13	3.6	0.17		0.02			0.07	
Sufco 006	27-Oct-81											318.6	3.8	160	7.5	530		0.71	0.04		< .01	< .01		0.7	
Sufco 006	22-Jun-82	143.616	12.5	7.7	423							454.6	< .01	42	33.7	486		2.88	0.03		0.21				0.014
Sufco 006	12-Aug-82	462.264	12	8.3	510							270.8	< .01	30	20	282		2.76	0.028		0.17				0.015
Sufco 006	20-Oct-82	426.36	1	8.6	545							306.7	< .01	66	10.4	355		3	0.175		0.13				0.57
Sufco 006	21-Jun-83	933.504	16	8.4	799							400.2	< .01	74	36	424		0.81	0.065		< .02				0.2
Sufco 006	16-Aug-83	623.832	17	7.5	726							370.88	2.4	62	4	432		5.4	0.045		< .01				0.11
Sufco 006	12-Oct-83	260.3	10	7.7	833							390.4	< .01	87	34	490		0.25	0.08		0.06				0.1
Sufco 006	21-Jun-84		11	8	920							416	< .01	66	36.4	490		0.07	0.04		0.01				0.1
Sufco 006	9-Aug-84	569.976	18	7.9	688							384.3	< .01	405	29.4	850		1.3	0.09		0.02				0.14
Sufco 006	11-Oct-84	359.04	6	7.7	824							390.4	< .01	95	34	520		0.6	0.09		0.09				0.77
Sufco 006	13-Jun-85	704.616	14	7	712							256	< .01	75	14.2	316		24.6	0.73		0.42				1.12
Sufco 006	14-Aug-85	287.232	13	7.9	884							348.9	< .01	85	28	460		0.06	0.03		0.03				0.28
Sufco 006	22-Oct-85	219.912	1	7.7	729							329.4	< .01	87	24.5	484		0.56	0.09		0.05				0.02
Sufco 006	3-Jun-86	825.792	16	8	610							279		95	20.3	366		0.62	0.07		0.06				0.03
Sufco 006	13-Aug-86	260.304	17	8.1	662							275.7	14.4	69	17.2	340		0.57	0.05		0.03				0.02
Sufco 006	7-Jun-88	412.9	16	7.9	715							316	< .1	73	11.3	388		0.3	0.09		0.03				0.05

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
Sufco 006	9-Aug-88	112.2	17.5	7.4	648							301	< .1	83	32.5	430		0.68	0.09		0.15				0.09
Sufco 006	5-Oct-88	70.9	15.5	7.1	782							381	< .1	174	15	577		0.75	0.15		< .02				0.12
Sufco 006	13-May-92											399	2.3	93	26	544		1.33	0.09		1.4				0.1
Sufco 006	4-Aug-92																	1	0.04						
Sufco 006	6-Oct-92											358						0.08	0.02						
Sufco 006	9-Jun-93											468	1.7		33.1			0.04	0.05						
Sufco 006	6-Jun-95	44.88	16.1	8.07	977							420	20	95	33	570									
Sufco 006	24-Aug-95	426.4	16	8.46	578			56	32	18		235	20	73	6	320		0.3	< .1	< .1				0.03	
Sufco 006	3-Oct-95	192.98	12.5	8.2	636							275	10	66	7	360		0.2	< .1	< .1				0.01	
Sufco 006	27-Aug-96	130.152	15.9	8.35	635							260	14	72	8	378		0.1	< .1	< .1				0.02	
Sufco 006	22-Oct-96	8.5272	1.02	8.28	398							361	< 5.	81	14	450		0.3	< .1	< .1				0.03	
Sufco 006	2-Jun-97		21.53	8.3	805							385	< 5.	86	19	460		0.9	< .1	< .1				0.04	
Sufco 006	18-Aug-97	287.232	18.9	8.44	574		46.8					251	< 5.	77	5	350		0.8	< .1	< .1				0.02	
Sufco 006	8-Oct-97	184.008	5.5	8.35	629		53.2					287	< 5.	92	9	380		0.6	< .1	< .1				0.02	
Sufco 006	4-Jun-98	112.2	13.1	8.42	901	6.21		66	40	72	2	456	< 5.	95	32	269		1.1	< .1						
Sufco 006	3-Aug-98	224.4	22.75	8.08	577	6.19		55	31	17	2	135	72	70	5	359		1.4	< .01						
Sufco 006	1-Oct-98	71.808	11.54	8.33	626	9.33		54	34	23	2	292	< 5.	70	9	380		0.5	< .1						
Sufco 006	21-Jun-99	201.96	17.3	8.19	625	7.03		55	33	17	1	290	5	73	5	353		1.5	< .1						
Sufco 006	9-Aug-99	394.944	22.04	8.3	592	6.54		50	31	17	1	273	6	70	5	338		4.1	0.1						
Sufco 006	4-Oct-99	192.984	12.11	8.3	647	8.15		54	32	21	1	275	6	88	6	364		0.6	< .1						
Sufco 006	21-Jun-00	0.8	15.32	8.13	627	7.05		53	32	18	1	258	9	94	5	374		3.7	0.1						
Sufco 006	2-Aug-00	192.984	21.3	8.39	600	5.6		51	32	16	2	263	< 5.	89	4	364		2.9	0.2						
Sufco 006	5-Oct-00	179.52	9	8.12	747	7.28		59	35	34	2	323	< 5.	90	13	399		0.5	< .1						
Sufco 006	11-Jun-01	646.272	17.5	8.34	592	5		53	30	13	< 1.	237	8	96	3	330		1.2	< .1						
Sufco 006	20-Aug-01	179.0712	16.3	8.76	512	6.76		49	31	15	1	232	9	84	3.3	354		1.5	< .05						
Sufco 006	2-Oct-01	0																							
Sufco 006	8-May-02	88.1	10.4	8.28	621	8.42		63	35	29	2	291	8	107	7	388		1.9	0.07						
Sufco 006	20-Sep-02	11.5	16.8	8.47	721	6.24		63	33	37	3	301	7	107	11	402		2	< .05						
Sufco 006	8-Oct-02	35.1	10.8	8.2	738	7.51		64	35	32	2	297	8	114	10	417		0.5	< .05						
Sufco 006	29-May-03	0.909	20.9	8.42	962	6.02		66.1	43.2	80.1	3.77	371	< 5.	152	34	571		1.16	0.034						
Sufco 006	19-Sep-03	26.3	13.5	8.53	631	7.91		63.4	35.5	28.9	2.25	285	10	108	9	458		0.447	0.01						
Sufco 006	30-Oct-03	0.131	8.8	8.58	1228	7.33		94.7	56.4	110	6.47	549	< 5.	203	45	828		0.162	0.026						
Sufco 006	26-Jun-04	420	13	8.77	493	7.06		50.9	30.4	10.9	1.01	184	16	95	3	302		1.9	0.046						
Sufco 006	1-Sep-04	132	16.9	8.72	529	6.89		54	31.7	12.8	1.59	173	21	93	4	324		0.05	0.02						
Sufco 006	15-Oct-04	70.3	9.6	8.47	593	7.05		56.5	31.5	20.2	1.79	218	< 5.	109	5	362		0.37	0.013						
Sufco 006	13-Jun-05	703	15.5	8.37	523	6.37		63	34.8	15.4	2.17	282	< 5.	82	4	312		7.64	0.174						
Sufco 006	30-Sep-05	402	12.1	8.57	542	7.67		52.2	32.6	14.5	1.35	215	16	98	3	338		0.77	0.02						
Sufco 006	24-Oct-05	18.8	8.5	8.53	719	7.91		63.5	34	36.9	1.58	314	< 5.	93	13	425		< .05	0.012						
Sufco 006	26-Jun-06	363	16.8	8.54	522	7.66		56.1	32.7	12.4	1.05	245.22	< 5.	77	4	335		2.93	0.059						
Sufco 006	13-Sep-06	155	14.6	8.45	536	7.08		52.79	31.18	16.58	1.48	225	10	87	5	320		1.66	0.025						
Sufco 006	4-Nov-06	90	3.9	8.48	591	9.09		59.61	34.32	28.01	1.2	281	< 5.	91	9	350		0.91	0.023						
Sufco 006	25-Jun-07	160	17.6	8.62	543	8.72		55.1	33.8	14.3	0.93	244	< 5.	88	4	351		3.71	0.095						
Sufco 006	19-Sep-07	95	12.3	8.89	515	8.69		50.2	33.7	17.1	1.72	128	79	95	4	330		0.19	0.005						
Sufco 006	29-Oct-07	1.23	6.1	8.72	920	7.33		72.06	41.5	65.89	2.5	389	< 5.	122	25	555		0.23	0.012						
Sufco 006	12-Jun-08	146	14.9	8.65	649	7.1		62.72	34.03	26.37	1.38	281.639	5.4	90	8	401		0.95	0.034						
Sufco 006	15-Sep-08	104	11.9	8.63	518	7.82		56.09	33.36	14.57	1.36	224.336	< 5.	92	3	345		0.2	0.007						
Sufco 006	21-Oct-08	1.18	7.2	8.44	882	8.34		81.24	45.53	76.47	3.87	412.095	< 5.	134	26	578		0.1	0.008						
Sufco 006	19-Jun-09	80.4	16.5	8.46	617	6.99		65.11	35.56	25.93	1.64	273.104	9.6	95	7	391		2.33	0.066						
Sufco 006	17-Sep-09	100	14.1	8.61	531	7.81		54.06	32.98	14.37	1.62	212.143	10.8	92	3	343		1.4	0.033						
Sufco 006	19-Nov-09	71	0.3	8.39	612	10.6		56.79	34.34	21.27	1.83	256.035	< 5.	102	5	361		0.8	0.014						
Sufco 006	28-Jun-10	433	18.8	8.43	576	6.68		57.6	32.99	14.8	4.21	249.939	< 5.	97	3	372		1.84	0.094						
Sufco 006	15-Sep-10	49.9	11.2	8.42	532	7.42		55.4	31.5	20.4	2.2	297.488	4.2	98	4	372		1.26	0.034						
Sufco 006	1-Nov-10	62.4	3.2	8.21	585	9.33		60.4	32.8	22.2	1.6	318.215	1.2	102	5	404		1.41	0.048						
Sufco 006	17-Jun-11	1116	9.5	8.74	525	8.03		55.4	29.6	14.2	1.1	335.284	2.4	69	4	322		1.3	0.057						
Sufco 006	21-Sep-11	205	11.6	8.62	533	7.62		53.4	31.3	14.5	1.4	295.05	2.4	86	4	336		1.1	0.037						

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
Sufco 006	12-Oct-11	155	6.4	8.62	578	8.9		55.7	32.2	17.2	1.5	263.35	1.98	88	4	366		0.59	0.024						
Sufco 006	1-Jun-12	0.208	17.5	8.43	968	8.08		64.3	43.1	84.1	3.9	432.821	< 1.	135	27	596		0.24	0.01						
Sufco 006	12-Sep-12	45.3	11.1	8.65	557	8.35		55.2	34.9	24.4	2	254.816	4.2	105	5	338		0.1	0.009						
Sufco 006 (B)	12-Sep-12	36.8	11.5	8.66	555	8.33		48.5	31.3	22.2	1.9	247	4	104	5	390	16	0.36	0.013		<0.2	<0.2	<0.2	<0.01	0.03
Sufco 006	1-Nov-12	53.9	3.4	8.59	592	9.64		55	31.7	23.8	1.5	263	4	102	6	368		0.32	0.02						
Sufco 006	27-Jun-13	80.4	16.1	8.56	566	7.73		48.8	32.8	17.5	2	296.269	2.4	119	4	376		0.83	0.038						
Sufco 006	16-Sep-13	239	13.8	8.56	627	8.27		69.3	32.8	24.5	2.4	352.353	4.8	111	6	380		2.84	0.111						
Sufco 006	23-Oct-13	116	3.7	8.72	618	10.34		61.4	32.7	20.9	1.4	285.296	6	105	5	388		0.85	0.06						
Sufco 006	28-May-14	363	12.2	8.59	574	7.6		57.75	32.68	15.24	1.03	269.446	< 5.	90	3	373		1.1	0.072						
Sufco 006	17-Sep-14	101	14.4	8.76	557	7.5		51.85	31.77	15.51	1.68	240.185	< 5.	97	3	372		1.04	0.034						
Sufco 006	28-Oct-14	0																							
Sufco 006	21-Jun-15	142	14.9	8.58	593	8.39		53.56	36.54	17.2	1.04	280.419	< 5.	95	4	374		1.57	0.145						
Sufco 006	22-Sep-15	146	15.1	8.67	1080	7.76		51.61	34.04	17.22	1.17	230.432	< 5.	95	3	331	20	< .05	< .002						
Sufco 006	8-Nov-15	19	0.2	8.52	753	10.21		72.77	43.97	36.62	2.44	374.299	< 5.	135	9	530	79	0.5	0.019						
Sufco 006	18-Jun-16	8.58	17.6	8.58	543	7.02		58	34.55	15.58	1.1	202	<5	98	3	462	253	2.86	0.168	0.13	0.13	<0.05	0.2	<0.05	<0.05
Sufco 006	26-Sep-16	89	9.5	8.63	541	8.92		51.27	29.94	15.48	1.87	170	40	97	3	369	171	2.45	0.055						
Sufco 006	5-Nov-16	Dry																							
Sufco 006A	19-Oct-09	75																							
Sufco 006A	28-Jun-10	500	16.8	8.51	538	7.31		56.93	32.42	12.89	1.54	224.336	4.8	95	2	360		1.27	0.072						
Sufco 006A	15-Sep-10	50.8	11.7	8.44	529	7.33		48.3	29	16.1	2.6	296.269	2.4	99	4	366		0.58	0.023						
Sufco 006A	1-Nov-10	82.2	3.4	8.22	560	9.38		53.5	29.8	17.8	1.3	306.023	1.2	101	4	362		0.72	0.039						
Sufco 006A	17-Jun-11	1109	9.5	8.77	512	7.86		56.1	30.1	13.2	1	325.53	2.4	68	4	312		0.58	0.035						
Sufco 006A	21-Sep-11	296	11.7	8.68	624	7.53		47.5	28.8	12	1.1	249.939	4.8	86	3	348		0.78	0.031						
Sufco 006A	12-Oct-11	186	7.9	8.6	558	8.72		54	31.6	15.3	1.3	256.035	1.998	86	4	342		0.32	0.019						
Sufco 006A	1-Jun-12	0.949	14.3	8.5	1182	7.5		64.7	37	138	2.5	513.289	4.2	183	47	776	46	0.74	0.016	< .1		< .02	< .2	< .01	0.06
Sufco 006A	12-Sep-12	59.5	11.8	8.56	547	8.62		45.2	28.8	18	1.4	251.158	4.2	103	4	356	18	0.13	0.014		< .2	< .2	0.3	< .01	< .01
Sufco 006A	1-Nov-12	56	3.9	8.56	578	9.85		52.7	31	20.4	1.3	251	4	101	5	324	27	0.22	0.014		0.2	< .1	< .2	< .01	0.02
Sufco 006A	27-Jun-13	136	17.2	8.56	551	7.96																			
Sufco 006A	16-Sep-13	210	13	8.52	609	7.88																			
Sufco 006A	23-Oct-13	118	4	8.56	604	10.78																			
Sufco 006A	28-May-14	576	12.4	8.56	569	7.56																			
Sufco 006A	17-Sep-14	126	12.7	8.67	547	8.18																			
Sufco 006A	28-Oct-14	2.86	2.4	8.61	1123	10.08																			
Sufco 006A	23-Jun-15	168	8.7	8.7	573	7.37																			
Sufco 006A	23-Sep-15	113	11.7	8.59	518	8.22																			
Sufco 006A	8-Nov-15	28.6	0.2	8.37	640	10.5																			
Sufco 006A	28-Jun-16	339	18.5	8.51	536	7.16																			
Sufco 006A	25-Sep-16	122	9.2	8.68	536	9.24																			
S. Fk. Quitchupah Upper	11-Nov-13	128	4.6	8.63	514	10										328	4	0.05	<0.005						
S. Fk. Quitchupah Upper	1-Jul-14	731	12.5	8.61	515	8.3		52	30	9	1.16	227.993	6	88	2	322	19	0.27	0.012	NM	0.37	<0.05	<0.1	<0.05	<0.05
S. Fk. Quitchupah Upper	25-Sep-14	151	13.6	8.72	518	8.05		50.55	31.26	11.14	1.14	213.363	<5	97	2	350	8	<0.05	0.004	0.15	0.23	<0.05	<0.1	<0.05	<0.05
S. Fk. Quitchupah Upper	11-Nov-14	11.8	0.1	8.43	593	10.14		56.1	32.43	12.22	1.12	246.281	<5	102	2	372	13	0.12	0.009	0.36	0.36	<0.05	<0.1	<0.05	<0.05
S. Fk. Quitchupah Upper	29-Jul-15	411	13.4	8.77	497	8.1		48.34	32.62	10.65	1.01	209.705	<5	87	2	302	24	0.16	0.01	2.28	0.31	<0.05	<0.1	<0.05	1.99
S. Fk. Quitchupah Upper	9-Nov-15	70	0.3	8.42	503	10.02																			
S. Fk. Quitchupah Upper	9-Jul-16	455	14.7	8.69	507	8.03										331	17	0.28	0.012						
S. Fk. Quitchupah Upper	14-Nov-16	4.4	4.7	8.33	611	10.05										394	23	0.12	0.012						
Skutumpah Creek Upper	11-Nov-13	59	4.5	8.42	547	10.04										316	11	0.13	<0.005						
Skutumpah Creek Upper	2-Jul-14	81	16.5	8.24	549	7.3		36	27	34	2.56	257.254	22	46	8	305	39	0.53	0.014	NM	<0.05	<0.05	<0.1	<0.05	0.06
Skutumpah Creek Upper	25-Sep-14	7.8	15.5	8.48	527	8.39																			
Skutumpah Creek Upper	11-Nov-14	129	0.9	8.56	570	10.36																			
Skutumpah Creek Upper	29-Jul-15	27	13.4	8.52	505	7.76		49.68	33.38	10.47	1.05	223.116	<5	88	2	314	42	0.35	0.016	0.21	0.29	<0.05	<0.1	<0.05	0.05
Skutumpah Creek Upper	9-Nov-15	67	0.3	8.45	505	10.06																			

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
Skutumpah Creek Upper	9-Jul-16	75	15.3	8.65	509	7.81										323	38	0.57	0.016						
Skutumpah Creek Upper	14-Nov-16	101	5.8	8.57	540	9.89										357	22	0.22	0.007						
Spring Monitoring Stations																									
M-SP01	19-Jun-01	0.503	13.7	7.42	532		0.24																		
M-SP01	28-Aug-01	0.373	8	7.53	497		0.6					472	< 5.	26	47	502		< .1							
M-SP01	1-May-02	0.45	5.1	7.27	451		.					473	< 5.	28	44	464		< .1							
M-SP01	25-Sep-02	0.324	7.5	7.4	851	2.17	.					470	< 5.	26	41	464				< .03		< .03		< .05	
M-SP01	25-Sep-02							88	44	48	1.9	490	< 1.	28	43			< .02	< .01				< .2		
M-SP01	12-Nov-02	0.408	5.1	7.33	815	2.83	.					456	< 5.			449				< .03		< .03		< .05	
M-SP01	12-Nov-02							80	40	43	1.7	480	< 1.	27	43			< .02	< .01				< .2		
M-SP01	21-May-03	0.517	4.3	7.26	435	3.1	9.99									473				< .03		< .03		< .05	
M-SP01	21-May-03							81	40	45	1.9	470	< 1.	26	37			< .02	< .01				< .2		
M-SP01	5-Aug-03											464	< 5.			454				< .03		< .03		< .05	
M-SP01	8-Aug-03	0.539	7.9	7.1	490	2.51	0.15	82	40	45	1.7	510	< 1.	27	42			< .02	< .01				< .2		
M-SP01	7-Oct-03	0.287	7.6	7.32	500	2.03	1.82					484	< 5.			489				< .03		< .03		< .05	
M-SP01	7-Oct-03							86	42	47	1.8			26	38			0.02	< .01				< .2		
M-SP01	11-May-04	0.621	4.5	7.34	489	3.29	.					492	< 5.			500									
M-SP01	11-May-04							84	42	49	1.9	490	< 1.	30	44			< .02	< .01				< .2		
M-SP01	13-May-04																			< .03		< .03		< .05	
M-SP01	26-May-06	0.89	5	7.68	864																				
M-SP01	28-Sep-06	0.19	7	7.46	777																				
M-SP01	8-Nov-06	0.62	5.3	7.17	772																				
M-SP01	26-Jun-07	0.35	10.2	7.48	797																				
M-SP01	11-Sep-07	0.28	11.6	7.42	906																				
M-SP01	8-Nov-07	0.47	4.7	7.76	874																				
M-SP01	13-Jun-08	0.57	9.2	7.01	882																				
M-SP01	24-Sep-08	0.24	9.5	7.07	807																				
M-SP01	7-Nov-08	0.51	5.7	7.23	784																				
M-SP01	27-Jun-09	0.478	11.4	7.46	803																				
M-SP01	23-Sep-09	0.254	10.1	7.08	869																				
M-SP01	10-Nov-09	0.49	5.1	7.32	748																				
M-SP01	26-Jun-10	0.426	12.6	7.21	837																				
M-SP01	23-Sep-10	0.16	10.1	7.86	846																				
M-SP01	12-Nov-10	0.408	4.3	7.02	846																				
M-SP01	27-Jun-11	1.11	5.6	7.52	819																				
M-SP01	26-Sep-11	0.746	6.1	7.72	812																				
M-SP01	29-Oct-11	0.68	6.2	7.49	821																				
M-SP01	27-Jun-12	0.34	11.9	7.41	854																				
M-SP01	6-Sep-12	0.246	9.6	7.35	842																				
M-SP01	7-Nov-12	0.221	4.2	7.6	838																				
M-SP01	30-Jun-13	0.292	14	7.57	848																				
M-SP01	25-Sep-13	0.377	9.5	7.24	851																				
M-SP01	26-Oct-13	0.505	6.6	7.28	811																				
M-SP01	29-Jun-14	0.32	12.7	7.24	811																				
M-SP01	29-Aug-14	0.241	11.0	7.23	841																				
M-SP01	31-Oct-14	0.426	6.0	7.58	853																				
M-SP01	24-Jun-15	0.339	10.1	7.37	842																				
M-SP01	28-Sep-15	0.113	12.5	7.71	803																				
M-SP01	28-Oct-15	0.34	7.1	7.43	816																				
M-SP01	25-Jun-16	0.258	10.0	7.75	813																				
M-SP01	29-Sep-16	0.14	8.2	7.46	825																				
M-SP01	7-Nov-16	0.261	5.4	7.79	828																				

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP02	19-Jun-01	9.274	10.7	7.43	497		0.08																		
M-SP02	28-Aug-01	2.756	10.3	7.62	499		.					451	< 5.	35	44	504		< .1							
M-SP02	1-May-02	4.348	9.1	7.57	470		.					470	< 5.	38	41	463		< .1							
M-SP02	25-Sep-02	0																							
M-SP02	12-Nov-02	0																							
M-SP02	20-May-03	6.856	6.1	7.22	469	5.78	13.68									486				0.12		< .03		< .05	
M-SP02	20-May-03							80	34	56	2.1	450	< 1.	37	35			< .02	< .01				< .2		
M-SP02	5-Aug-03											459	< 5.			457				0.09		< .03		< .05	
M-SP02	8-Aug-03	0.992	8.8	7.21	485	5.7	0.15	79	34	54	2	520	< 1.	35	38			< .02	< .01				< .2		
M-SP02	7-Oct-03	0																							
M-SP02	11-May-04	2.485	6	7.37	437	4.82	0.25					462	< 5.			488									
M-SP02	11-May-04							79	33	60	2	460	< 1.	36	37			0.02	< .01				< .2		
M-SP02	13-May-04																			0.11		< .03		< .05	
M-SP02	26-May-06	13.4	6.3	7.67	824																				
M-SP02	28-Sep-06	4.19	8.2	7.24	772																				
M-SP02	8-Nov-06	2.26	7.8	7	765																				
M-SP02	26-Jun-07	4.16	6.7	7.49	813																				
M-SP02	11-Sep-07	0.046	12.1	7.72	898																				
M-SP02	8-Nov-07	0																							
M-SP02	13-Jun-08	5.17	6.8	7.27	917																				
M-SP02	24-Sep-08	< .1	9.1	7.47	805																				
M-SP02	7-Nov-08	0	3.3	7.93	783																				
M-SP02	27-Jun-09	2.01	10.8	7.01	829																				
M-SP02	23-Sep-09	0	10.8	7.92	881																				
M-SP02	10-Nov-09	0	4.9	8.49	676																				
M-SP02	26-Jun-10	1.19	6.7	7.15	835																				
M-SP02	23-Sep-10	0																							
M-SP02	12-Nov-10	0																							
M-SP02	27-Jun-11	6.25	5.2	7.41	799																				
M-SP02	26-Sep-11	1.76	6.8	7.52	796																				
M-SP02	29-Oct-11	0.35	7.8	7.55	826																				
M-SP02	27-Jun-12	2.05	10.2	7.55	877																				
M-SP02	6-Sep-12	0.872	11.2	7.45	841																				
M-SP02	7-Nov-12	0	2.2	7.6	1385																				
M-SP02	30-Jun-13	0.063	7.8	7.62	865																				
M-SP02	25-Sep-13	< .1	10.7	7.99	842																				
M-SP02	26-Oct-13	< .001	5.7	8.35	783																				
M-SP02	29-Jun-14	0.005	6.8	7.36	848																				
M-SP02	29-Aug-14	0	11.4	7.59	847																				
M-SP02	31-Oct-14	< .005	5.9	8.2	721																				
M-SP02	24-Jun-15	< .1	12.1	7.47	782																				
M-SP02	28-Sep-15	0.000	—	—	—																				
M-SP02	28-Sep-15	0	—	—	—																				
M-SP02	28-Oct-15	0.000	—	—	—																				
M-SP02	28-Oct-15	0	—	—	—																				
M-SP02	25-Jun-16	< .001	10.6	7.42	834																				
M-SP02	29-Sep-16	0.000	—	—	—																				
M-SP02	29-Sep-16	0	—	—	—																				
M-SP02	7-Nov-16	0.000	—	—	—																				
M-SP02	7-Nov-16	0	—	—	—																				
M-SP04	19-Jun-01	2.838	5.6	8.05	499	NM	0.62																		
M-SP04	28-Aug-01	1.832	4.7	7.73	379	NM	0.47																		
M-SP04	3-May-02	2.043	4.5	7.61	866	NM	0.00																		

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP04	26-Sep-02	0.900	5.3	7.41	844	6.21	0.91																		
M-SP04	12-Nov-02	1.230	4.8	7.56	885	6.64	5.40																		
M-SP04	20-May-03	3.226	4.2	7.38	929	7.69	0.00																		
M-SP04	5-Aug-03	0.849	5.4	7.40	408	7.40	0.10																		
M-SP04	6-Oct-03	0.747	5.4	7.50	861	7.30	1.02																		
M-SP04	12-May-04	2.921	4.4	7.59	512	0.69	0.69																		
M-SP04	26-Jun-15	1.81	4.9	7.68	986											590	36	0.14	0.007						
M-SP04	30-Sep-15	0.251	6.9	7.89	872											550	152	0.48	0.044						
M-SP04	1-Nov-15	0.638	5.6	7.72	873											517	109	0.37	0.018						
M-SP04	25-Jun-16	0.987	5.5	7.75	924											590	36	0.14	0.007						
M-SP04	28-Sep-16	0.192	6.9	7.90	923											581	129	1.86	0.146						
M-SP04	31-Oct-16	0.617	5.8	7.77	898											566	83	1.1	0.047						
M-SP05	26-Sep-02	0.082	7.7	7.77	780		19.00																		
M-SP05	20-May-03	0.216	4.3	7.60	910		0.35																		
M-SP05	25-Sep-03	0.119	7.3	7.78	533		17.70																		
M-SP05	12-May-04	0.264	3.9	7.92	524		0.16																		
M-SP05	26-Jun-15	0.127	7.8	7.8	934											577	34	0.41	0.027						
M-SP05	30-Sep-15	0.085	8.9	7.91	870											561	115	0.38	0.078						
M-SP05	1-Nov-15	0.157	6.6	7.84	888											548	93	0.83	0.073						
M-SP05	25-Jun-16	0.096	7.3	7.86	889																				
M-SP05	28-Sep-16	0.130	7.9	7.91	895											572	117	2.4	0.161						
M-SP05	31-Oct-16	0.137	6.8	7.92	902											582	93	0.54	0.024						
M-SP06	19-Jun-01	2.30	9.30	9	550		7.5																		
M-SP06	4-Oct-01	1.86	6.30	8	474		13.2																		
M-SP06	3-May-02	2.06	4.90	9	899		0.88																		
M-SP06	26-Sep-02	1.549	5.4	7.55	895		0																		
M-SP06	20-May-03	1.472	4.6	7.62	918		1.24																		
M-SP06	25-Sep-03	1.665	5.3	7.59	514		0																		
M-SP06	12-May-04	1.624	4.7	7.78	528		0.05																		
M-SP06	30-Jun-14	1.47	5.3	7.81	916																				
M-SP06	18-Sep-14	1.46	5.9	7.76	922			29.81	16.02	166.53	1.25	571.812	<5	15	15	559	23	0.39	0.016		0.16	<0.05	<0.1	<0.05	0.05
M-SP06	31-Oct-14	1.33	5.2	7.78	934			29.06	16.47	165.67	1.3	536.455	18.6	15	15	566	16	<0.05	<0.002		0.17	<0.05		<0.05	<0.05
M-SP06	26-Jun-15	1.45	5.5	7.82	932			25.6	17.69	165.88	1.28	571.812	<5	15	15	557	11	0.17	0.032	0.14	0.13	<0.05	<0.1	<0.05	0.07
M-SP06	29-Sep-15	1.34	5.8	7.68	868			26.1	16.59	176.66	1.26	551.085	<5	15	12	559	9	<0.05	0.002	1.43	0.17	<0.05	<0.1	<0.05	<0.05
M-SP06	1-Nov-15	1.23	5.5	7.77	887			26.4	16.31	172.56	1.44	582.785	<5	15	15	542	25	0.1	0.008	0.9	0.18	<0.05	<0.1	<0.05	<0.05
M-SP06	25-Jun-16	1.34	5.9	7.76	886																				
M-SP06	28-Sep-16	1.32	5.9	7.78	897											566	67	0.42	0.017						
M-SP06	31-Oct-16	1.39	5.7	7.79	906											568	12	0.15	0.007						
M-SP07	20-Jun-01	1.137	7.8	7.37	491		1.02																		
M-SP07	29-Aug-01	0.249	7.3	7.5	541		2.25					560	< 5.	27	35	561		0.3							
M-SP07	3-May-02	0.409	4.6	8.37	530		11.5					540	< 5.	28	32	498		2.2							
M-SP07	26-Sep-02	0.211	6.5	7.45	878	5.21	1.8					520	< 5.	29	31	472				0.14		< .03		< .05	
M-SP07	26-Sep-02							65	43	86	1.9	530	< 1.	29	30			0.8	0.01				< .2		
M-SP07	12-Nov-02	0.273	3.9	7.46	799	4.94	3.9					553	< 5.			509				0.14		< .03		< .05	
M-SP07	12-Nov-02							61	40	80	1.8	530	< 1.	30	30			0.19	< .01				< .2		
M-SP07	20-May-03	0.601	4.6	7.36	854	6.17	6.25									493				0.33		< .03		< .05	
M-SP07	20-May-03							60	40	81	1.7	520	< 1.	27	26			0.55	< .01				< .2		
M-SP07	5-Aug-03	0.28	6.7	7.32	442	6.03	0.95	60	39	81	1.9	530	< 1.	28	29			0.36	< .01				< .2		
M-SP07	5-Aug-03											506	< 5.			480				0.22		< .03		< .05	
M-SP07	7-Oct-03	0.283	6.3	7.62	865	7.02	0.56					516	< 5.			517				0.21		< .03		< .05	
M-SP07	7-Oct-03							63	41	85	2			27	27			2.5	0.03				< .2		
M-SP07	10-May-04	0.677	4	7.38	500	6.28	0.53					528	< 5.			531									

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP07	10-May-04							64	42	87	1.8	530	< 1.	37	30			< .02	< .01				< .2		
M-SP07	13-May-04																			0.14		< .03		< .05	
M-SP08	20-Jun-01	1.03	8.4	7.78	424		7.58																		
M-SP08	29-Aug-01	0.433	7.3	7.26	332		2.04					340	< 5.	28	53	569		0.1							
M-SP08	3-May-02	0.775	6.3	8.27	600		3.5					564	< 5.	33	52	545		0.8							
M-SP08	26-Sep-02	0.023	11.7	7.91	901	5.8						517	< 5.	23	43	494				0.14		< .03		< .05	
M-SP08	26-Sep-02							68	38	86	2.7	520	< 1.	24	43			0.02	< .01				< .2		
M-SP08	12-Nov-02	0																							
M-SP08	20-May-03	0.79	3.9	7.27	1013	2.93	0.66									590				0.13		< .03		< .05	
M-SP08	20-May-03							69	38	110	1.9	560	< 1.	34	48			0.03	< .01				< .2		
M-SP08	5-Aug-03	0.096	10.1	7.25	541	2.86	21	65	36	87	2.3	550	< 1.	28	40			1.4	0.05				< .2		
M-SP08	5-Aug-03											521	< 5.			501				0.18		< .03		< .05	
M-SP08	7-Oct-03	0.08	7.7	7.33	896	2.54	2.08					526	< 5.			238				0.07		< .03		< .05	
M-SP08	7-Oct-03							67	37	90	2.1			24	37			0.94	0.03				< .2		
M-SP08	10-May-04	1.189	4.8	7.4	557	5.42						564	< 5.			651									
M-SP08	10-May-04							67	37	120	2.5	570	< 1.	44	60			0.23	0.01				< .2		
M-SP08	13-May-04																			0.11		< .03		< .05	
M-SP08	23-Jun-06	0.68	7.8	7.83	931																				
M-SP08	28-Sep-06	0.51	7.3	7.78	837																				
M-SP08	8-Nov-06	0.78	5.5	7.49	878																				
M-SP08	26-Jun-07	0.37	8.6	7.52	888																				
M-SP08	11-Sep-07	0.071	13.2	7.93	864																				
M-SP08	8-Nov-07	0.16	3.6	7.82	709																				
M-SP08	21-Jun-08	0.46	7.8	7.35	932																				
M-SP08	24-Sep-08	0.016	12.6	8.03	912																				
M-SP08	6-Nov-08	0																							
M-SP08	22-Jun-09	0.26	8.1	7.55	897																				
M-SP08	23-Sep-09	0.011	13.2	7.94	963																				
M-SP08	10-Nov-09	< .01	5.9	7.74	698																				
M-SP08	26-Jun-10	0.12	12.1	7.58	930																				
M-SP08	16-Jul-10	0.0084	27.6	7.1	951																				
M-SP08	23-Sep-10	0																							
M-SP08	12-Nov-10	0																							
M-SP08	27-Jun-11	1.04	6.2	7.72	912																				
M-SP08	27-Sep-11	0.49	7.9	7.71	930																				
M-SP08	29-Oct-11	0.73	5.5	7.77	941																				
M-SP08	27-Jun-12	0.138	10.1	7.99	954																				
M-SP08	25-Sep-12	0.021	12.9	7.99	996																				
M-SP08	7-Nov-12	0.0689	5.4	7.93	934																				
M-SP08	28-Jun-13	0.017	23.9	7.93	1037																				
M-SP08	25-Sep-13	0.01	9.5	7.67	715																				
M-SP08	26-Oct-13	0.014	13.4	7.98	953																				
M-SP08	29-Jun-14	0.015	20.8	8.34	1061																				
M-SP08	18-Sep-14	0																							
M-SP08	31-Oct-14	0.012	2.6	7.92	504																				
M-SP08	25-Jun-15	0.01	36	8.38	1125																				
M-SP08	26-Sep-15	0.094	15.2	8.05	982																				
M-SP08	1-Nov-15	0.064	7.8	7.64	988																				
M-SP08	26-Jun-16	0.074	20.4	7.8	1140																				
M-SP08	27-Sep-16	0.035	17.5	8.38	972																				
M-SP08	26-Oct-16	0.050	8.0	7.91	980																				
M-SP09	20-Jun-01	1	7.9	7.53	464		1.43																		
M-SP09	29-Aug-01	0																							

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP09	3-May-02	0.254	3.6	8.55	429		141																		
M-SP09	26-Sep-02	0																							
M-SP09	20-May-03	0																							
M-SP09	7-Oct-03	0																							
M-SP09	10-May-04	0																							
M-SP09	27-Sep-11	1.430	5.4	7.77	794																				
M-SP09	29-Oct-11	1.820	—	—	—																				
M-SP09	25-Jun-15	0																							
M-SP09	26-Sep-15	0																							
M-SP09	1-Nov-15	0																							
M-SP09	26-Jun-16	0.000	—	—	—																				
M-SP09	27-Sep-16	0.000	—	—	—																				
M-SP09	26-Oct-16	0.000	—	—	—																				
M-SP10	20-Jun-01	0.532	14.5	7.75	610		0.16																		
M-SP10	28-Aug-01	0.489	7.8	7.76	526		.					428	< 5.	29	85	531		< .1							
M-SP10	1-May-02	0.42	8.5	7.99	490		.					429	< 5.	29	75	469		< .1							
M-SP10	25-Sep-02	0.238	7.7	7.84	833	4.56	.					403	< 5.	25	68	456				0.19		< .03		< .05	
M-SP10	25-Sep-02							49	40	84	2.5	420	< 1.	27	70			< .02	< .01				< .2		
M-SP10	13-Nov-02	0.244	3.8	7.55	814	5.98	.					512	< 5.			448				0.22		< .03		< .05	
M-SP10	13-Nov-02							47	38	80	2.4	420	< 1.	27	73			< .02	< .01				< .2		
M-SP10	20-May-03	0.243	5.8	7.56	509	4.16	1.71									510				0.17		< .03		< .05	
M-SP10	20-May-03							49	40	92	2.5	440	< 1.	28	66			< .02	< .01				< .2		
M-SP10	5-Aug-03	0.224	9.9	7.7	500	5.6	.	46	38	84	2.3	430	4	27	67			< .02	< .01				< .2		
M-SP10	5-Aug-03											409	< 5.			420				0.16		< .03		< .05	
M-SP10	7-Oct-03	0.275	6.7	7.67	846	5.55	.					415	< 5.			464				0.21		< .03		< .05	
M-SP10	7-Oct-03							49	39	86	2.5			24	62			< .02	< .01				< .2		
M-SP10	10-May-04	0.271	6.1	7.52	538	4.02	0.82					468	< 5.			473									
M-SP10	10-May-04							51	41	98	2.4	460	< 2.	30	69			0.11	0.02				< .2		
M-SP10	13-May-04																			0.18		< .03		< .05	
M-SP11	21-Jun-01	0.408	12.8	7.50	488																				
M-SP11	4-Oct-01	0.000	—	—	—	—																			
M-SP11	2-May-02	0.548	4.4	7.72	433																				
M-SP11	28-Sep-02	0.000	—	—	—	—																			
M-SP11	22-May-03	6.275	7.6	7.83	754																				
M-SP11	25-Sep-03	0.000	—	—	—	—																			
M-SP11	4-Jun-04	5.984	6.0	8.02	396																				
M-SP11	26-Jun-15	0.932	9.3	7.78	866											534	46	0.27	0.063						
M-SP11	30-Sep-15	Damp	—	—	—																				
M-SP11	1-Nov-15	0.000	—	—	—																				
M-SP11	25-Jun-16	<1	13.0	7.69	1,060																				
M-SP11	28-Sep-16	0.000	—	—	—																				
M-SP11	31-Oct-16	0.000	—	—	—																				
M-SP12	19-Jun-01	0.746	22.0	8.44	495																				
M-SP12	4-Oct-01	0.749	5.4	7.55	399																				
M-SP12	3-May-02	0.472	2.8	8.07	785																				
M-SP12	26-Sep-02	0.422	5.5	7.71	714																				
M-SP12	21-May-03	Immeas.	3.9	7.62	779																				
M-SP12	27-Sep-03	0.263	5.5	7.56	443																				
M-SP12	3-Jun-04	0.937	4.4	7.71	430																				
M-SP12	26-Jun-15	0.873	5.5	7.94	837											500	13	<0.05	0.003						
M-SP12	30-Sep-15	0.769	6.5	7.96	784											484	44	0.09	0.006						
M-SP12	6-Nov-15	0.847	5.3	7.75	798											506	26	0.16	0.006						

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP12	25-Jun-16	0.781	5.3	7.84	804																				
M-SP12	29-Sep-16	0.785	6.1	7.82	808											459	6	0.28	0.009						
M-SP12	31-Oct-16	0.817	5.8	7.80	814											496	7	0.08	<.002						
M-SP14	21-Jun-01	11.229	4.8	7.35	295																				
M-SP14	29-Aug-01	0.865	6.9	7.35	340							526	<5	6	3	358		<0.1							
M-SP14	20-May-02	1.95	4	7.47	542							392	<5	6	3	300		<0.1							
M-SP14	26-Sep-02	Dry	—	—	—																				
M-SP14	20-May-03	37.2	3.9	7.42	304			79	25	17	0.7	390	<1	6.1	2.1	349		<0.02	<0.01						
M-SP14	4-Aug-03	Dry	—	—	—																				
M-SP14	9-Oct-03	Dry	—	—	—																				
M-SP14	6-Jun-04	61.4	4.4	7.58	309			77	24	15	0.8	360	<5	7.6	3.3	338		<0.02	<0.01						
M-SP15	11-Jul-01	4.822	13.5	8.26	621		69.90																		
M-SP15	3-Oct-01	1.733	6.4	8.34	433		3.68																		
M-SP15	2-May-02	0.548	5.4	7.70	448		0.00																		
M-SP15	27-Sep-02				NOF																				
M-SP15	21-May-03	0.433	14.9	7.65	509		14.07																		
M-SP15	8-Oct-03				NOF																				
M-SP15	5-Jun-04	0.268	15.5	8.14	930		2.52																		
M-SP15	27-Jun-15	0.059	12.9	7.42	1073											528	31	0.29	0.046						
M-SP15	29-Sep-15	0																							
M-SP15	7-Nov-15	0																							
M-SP15	23-Jun-16	<0.1	9.9	7.37	986											575	15	0.22	0.052						
M-SP15	26-Sep-16	0.000	—	—	—																				
M-SP15	6-Nov-16	0.000	—	—	—																				
M-SP18	22-Jun-01	0.34	6.6	6.96	728		0.36																		
M-SP18	28-Aug-01	0.212	8.3	7.58	726		0.32					431	< 5.	261	833	865		0.2							
M-SP18	1-May-02	0.33	6.8	7.23	1274		0.46					346	< 5.	316	70	868		0.7							
M-SP18	25-Sep-02	0																							
M-SP18	12-Nov-02	0																							
M-SP18	20-May-03	0.147	5.5	7.35	748	4.65	9.6									879				0.08		< .03		< .05	
M-SP18	20-May-03							130	45	96	5.2	350	< 1.	260	73			37	0.24				< .2		
M-SP18	6-Aug-03											344	< 5.			830				0.07		< .03		< .05	
M-SP18	8-Aug-03	0.344	10	7.34	748	4.74	1.3	120	41	88	5.1	350	< 1.	300	78			0.07	< .01				< .2		
M-SP18	6-Oct-03	0.47	6.9	7.26	1276	5.16	0.38					350	< 5.			876				0.07		< .03		< .05	
M-SP18	6-Oct-03							120	42	90	5.2			300	72			0.57	0.01				< .2		
M-SP18	11-May-04	0.463	4.2	7.47	728	5.01	2.62					329	< 5.			883				0.08		< .03		< .05	
M-SP18	11-May-04							130	44	96	5.2	350	< 1.	330	81			1.2	< .01				< .2		
M-SP18	26-May-06	0.65	4.2	7.66	1214																				
M-SP18	28-Sep-06	0.45	6	7.46	1174																				
M-SP18	8-Nov-06	0.47	4.5	7.45	1165																				
M-SP18	26-Jun-07	0.25	6	7.49	1198																				
M-SP18	11-Sep-07	0.21	8.3	7.75	1435																				
M-SP18	8-Nov-07	0.29	4.1	7.66	1428																				
M-SP18	21-Jun-08	0.2	5.2	7.24	1245																				
M-SP18	24-Sep-08	0.06	6.9	7.29	1227																				
M-SP18	6-Nov-08	0.252	4.3	7.41	1226																				
M-SP18	27-Jun-09	0.082	6.3	7.11	1283																				
M-SP18	23-Sep-09	0.229	7.8	7.25	1264																				
M-SP18	10-Nov-09	0.244	4.5	7.38	1259																				
M-SP18	26-Jun-10	0.227	6.9	7.17	1347																				
M-SP18	23-Sep-10	0.118	7.6	7.18	1394																				
M-SP18	12-Nov-10	0.257	2.2	7.27	1359																				

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP18	27-Jun-11	0.77	9.1	7.52	1228																				
M-SP18	26-Sep-11	0.431	7.8	7.44	1289																				
M-SP18	29-Oct-11	0.456	3.4	7.79	1324																				
M-SP18	27-Jun-12	0.36	16.5	7.49	1317																				
M-SP18	6-Sep-12	0.149	14.2	7.51	1528																				
M-SP18	7-Nov-12	0.128	2.2	7.6	1385																				
M-SP18	30-Jun-13	0.115	8.3	7.31	1365																				
M-SP18	25-Sep-13	0.145	8.2	7.35	1389																				
M-SP18	26-Oct-13	0.128	6.6	7.39	1302																				
M-SP18	29-Jun-14	< .05	7.4	7.51	1356																				
M-SP18	29-Aug-14	0	8.1	7.33	1364																				
M-SP18	5-Nov-14	0.299	3.6	7.53	1380																				
M-SP18	26-Jun-15	0.225	8.9	7.49	1352																				
M-SP18	28-Sep-15	0.078	8.9	7.72	1298																				
M-SP18	28-Oct-15	0.151	5.6	7.76	1323																				
M-SP18	23-Jun-16	0.131	10.1	7.54	1314																				
M-SP18	28-Sep-16	0.186	7.7	7.52	1336																				
M-SP18	7-Nov-16	0.229	5.1	7.67	1,333																				
M-SP19	11-Jul-01	2.260	10.4	8.24	508		5.90																		
M-SP19	3-Oct-01	1.976	6.1	7.83	443		0.17																		
M-SP19	2-May-02	3.031	5.1	8.28	456		0.46																		
M-SP19	27-Sep-02	2.114	5.8	7.94	457		0.35																		
M-SP19	21-May-03	2.866	5.2	7.86	449		12.30																		
M-SP19	8-Oct-03	2.555	6.1	8.21	480		0.68																		
M-SP19	5-Jun-04	3.128	6.5	8.23	851		1.34																		
M-SP19	27-Jun-15	2.56	5.7	7.97	873											522	40	0.36	0.044						
M-SP19	29-Sep-15	1.73	6.3	8.04	824											523	12	0.27	0.004						
M-SP19	7-Nov-15	1.95	6	7.98	829											519	16	0.11	0.004						
M-SP19	23-Jun-16	2.53	6.0	8.00	835																				
M-SP19	26-Sep-16	1.74	6.4	8.00	845											533	25	0.49	0.009						
M-SP19	6-Nov-16	2.05	6.3	8.07	840											509	<5	<.05	<.002						
M-SP20	11-Jul-01	3.507	14.2	7.84	486		3.52																		
M-SP20	3-Oct-01	0.909	12.1	7.85	435		5.20																		
M-SP20	2-May-02	0.814	10.5	7.97	432		0.00																		
M-SP20	28-Sep-02	0.706	7.4	7.79	435		20.00																		
M-SP20	22-May-03	1.041	7.6	7.59	420		19.05																		
M-SP20	8-Oct-03	0.781	11.0	8.31	494		18.60																		
M-SP20	5-Jun-04	8.621	10.8	7.92	814		0.35																		
M-SP20	25-Jun-15	5.24	8.3	7.78	824											468	13	0.15	0.016						
M-SP20	26-Sep-15	1.04	7.5	7.38	769											505	87	0.37	0.049						
M-SP20	1-Nov-15	1.21	6.8	7.69	763											453	23	0.85	0.042						
M-SP20	26-Jun-16	1.90	6.6	7.41	775																				
M-SP20	27-Sep-16	0.980	7.0	7.56	781											484	13	0.11	0.004						
M-SP20	26-Oct-16	0.980	7.8	7.79	770											440	7	0.13	0.013						
M-SP38	20-Jul-01	5.71	8.4	7.99	302																				
M-SP38	29-Aug-01	5.538	8.5	7.39	303																				
M-SP38	26-May-02	2.832	7.8	7.70	321																				
M-SP38	26-Sep-02	4.956	8.7	7.59	301																				
M-SP38	13-Nov-02	4.999	8.4	7.64	276																				
M-SP38	20-May-03	5.111	7.7	7.65	179																				
M-SP38	4-Aug-03	5.24	8.5	7.47	267																				
M-SP38	7-Oct-03	5.764	8.8	7.7	312																				

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP38	6-Jun-04	5.808	7.9	7.7	313																				
M-SP39	30-Aug-01	1.068	7.1	7.16	590							552	< 5.	67	63	604		0.1							
M-SP39	3-May-02	4.663	5.3	7.48	603		3.25					520	< 5.	70	61	554		0.2							
M-SP39	25-Sep-02	0.441	6.5	7.56	1011	5.63						504	< 5.	68	60	563				0.1		< .03		< .05	
M-SP39	25-Sep-02							78	49	88	2.2	520	< 1.	68	60			0.02	< .01				< .2		
M-SP39	13-Nov-02	0.566	5.8	7.36	986	5.04	0.15					403	< 5.			553				0.04		< .03		< .05	
M-SP39	13-Nov-02							73	48	82	2.1	510	< 1.	67	61			0.02	< .01				< .2		
M-SP39	20-May-03	2.374	5.7	7.43	573	7.39	9.24									609				0.05		< .03		< .05	
M-SP39	20-May-03							79	50	88	2.1	510	< 1.	68	57			< .02	< .01				< .2		
M-SP39	6-Aug-03											503	< 5.			596				< .03		< .03		< .05	
M-SP39	9-Aug-03	0.509	6.4	7.4	585	5.78	0.11	74	46	83	2	550	< 1.	75	62			< .02	< .01				< .2		
M-SP39	7-Oct-03	0.268	6.2	7.39	1035	4.5	0.13					519	< 5.			595				0.03		< .03		< .05	
M-SP39	7-Oct-03							78	48	87	2.2			65	56			0.09	0.01				< .2		
M-SP39	12-May-04	0.446	5.7	7.54	604	4.86	0.24					488	< 5.			1214				0.04		< .03		< .05	
M-SP39	12-May-04							80	50	89	2.1	530	< 1.	76	64			< .02	< .01				< .2		
M-SP39	30-Aug-01	1.068	7.1	7.16	590																				
M-SP39	3-May-02	4.663	5.3	7.48	603																				
M-SP39	25-Sep-02	0.441	6.5	7.56	1011	5.63																			
M-SP39	13-Nov-02	0.566	5.8	7.36	986	5.04																			
M-SP39	20-May-03	2.374	5.7	7.43	573	7.39																			
M-SP39	9-Aug-03	0.509	6.4	7.40	585	5.78																			
M-SP39	7-Oct-03	0.268	6.2	7.39	1035	4.50																			
M-SP39	12-May-04	0.446	5.7	7.54	604	4.86																			
M-SP39	23-Jun-06	1.84	5.4	7.59	982																				
M-SP39	28-Sep-06	0.66	6.2	7.87	931																				
M-SP39	8-Nov-06	0.64	5.9	7.64	960																				
M-SP39	26-Jun-07	0.72	6.7	7.67	983																				
M-SP39	11-Sep-07	0.94	7.8	8.31	1080																				
M-SP39	8-Nov-07	1.38	5.9	7.74	1048																				
M-SP39	13-Jun-08	2.04	6.1	7.39	1086																				
M-SP39	24-Sep-08	0.89	6.1	7.72	954																				
M-SP39	6-Nov-08	1.2	5.8	7.5	941																				
M-SP39	27-Jun-09	2.04	6.8	7.22	975																				
M-SP39	23-Sep-09	1.11	7.1	7.39	1058																				
M-SP39	10-Nov-09	1.9	6.2	7.51	858																				
M-SP39	26-Jun-10	0.24	11.2	7.29	1054																				
M-SP39	23-Sep-10	0.753	5.8	7.65	1029																				
M-SP39	12-Nov-10	1.12	4.6	7.29	994																				
M-SP39	27-Jun-11	2.71	4.1	7.67	981																				
M-SP39	26-Sep-11	0.962	4.8	7.53	782																				
M-SP39	29-Oct-11	1.38	6.2	7.72	1007																				
M-SP39	27-Jun-12	1.03	9.2	7.63	1024																				
M-SP39	6-Sep-12	0.221	5.2	7.55	1013																				
M-SP39	7-Nov-12	1.29	6.2	7.77	1007																				
M-SP39	28-Jun-13	1.44	6.1	7.64	997																				
M-SP39	25-Sep-13	1.06	6.8	7.53	984																				
M-SP39	26-Oct-13	1.17	6.5	7.51	942																				
M-SP39	29-Jun-14	0.61	6.3	7.51	982																				
M-SP39	29-Aug-14	0.987	6.5	7.5	1002																				
M-SP39	31-Oct-14	0.769	6.2	7.52	1021																				
M-SP39	26-Jun-15	1.27	6.2	7.59	1026																				
M-SP39	28-Sep-15	0.581	6.9	7.65	947																				
M-SP39	28-Oct-15	0.67	6.7	7.58	964																				
M-SP39	25-Jun-16	0.87	6.6	7.44	960																				

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP39	29-Sep-16	0.434	7.2	7.49	969																				
M-SP39	7-Nov-16	0.434	6.6	7.65	970																				
M-SP40	26-Sep-01	0.657	7.9	7.64	497		30.40																		
M-SP40	2-May-02	0.455	7.5	7.92	865		11.60																		
M-SP40	28-Sep-02	0.336	8.4	7.72	483		0.70																		
M-SP40	22-May-03	0.314	6.9	7.77	538		15.03																		
M-SP40	9-Oct-03	0.180	8.3	7.76	900		19.00																		
M-SP40	6-Jun-04	0.447	7.7	8.10	545		0.68																		
M-SP40	25-Jun-15	0.102	7.4	7.82	959											584	283	3.43	0.228						
M-SP40	26-Sep-15	0.082	9.5	7.77	905											598	337	1.13	0.253						
M-SP40	1-Nov-15	0.093	8	7.78	925											554	218	0.87	0.076						
M-SP40	26-Jun-16	0.107	8.0	7.74	930																				
M-SP40	27-Sep-16	0.068	9.1	7.85	956											606	106	0.37	0.017						
M-SP40	26-Oct-16	0.087	8.4	7.93	943											569	32	0.37	0.018						
M-SP41	26-Sep-01	0.422	5.3	7.85	285		1.25																		
M-SP41	2-May-02	2.253	10.2	8.53	616		28.90																		
M-SP41	28-Sep-02	0.427	5.1	7.97	323		4.50																		
M-SP41	22-May-03	0.472	3.9	7.99	429		24.03																		
M-SP41	9-Oct-03	0.402	4.9	7.67	799		0.86																		
M-SP41	6-Jun-04	0.509	6.0	8.14	452		0.48																		
M-SP41	25-Jun-15	0.974	9.7	7.52	897											952	28	0.18	0.031						
M-SP41	26-Sep-15	0.313	5.9	7.94	765											521	435	1.1	0.111						
M-SP41	1-Nov-15	0.321	5	7.87	789											479	60	0.68	0.016						
M-SP41	26-Jun-16	0.210	4.7	7.80	786																				
M-SP41	27-Sep-16	0.193	5.4	7.97	795											503	107	1.62	0.068						
M-SP41	26-Oct-16	0.245	5.2	7.98	796											490	37	0.47	0.015						
M-SP44	3-Oct-01	0.561	9.2	7.52	314		5.39																		
M-SP44	2-May-02	2.018	4.8	7.66	269		0.00																		
M-SP44	28-Sep-02	0.196	10.3	7.66	376		110.00																		
M-SP44	22-May-03	13.029	6.1	7.65	276		11.91																		
M-SP44	24-Sep-03	0.197	12.1	7.93	721		15.30																		
M-SP44	5-Jun-04	4.900	5.4	7.65	542		0.00																		
M-SP44	29-Jun-14	3.18	5.9	7.64	554			66.00	33.00	15.00	0.48	345.038	<5	19	1	313		<0.05	<0.002	0.34			<0.1	<0.05	<0.05
M-SP44	18-Sep-14	0.588	8.7	7.78	610			64.82	23.48	27.48	0.58	360.888	<5	25	2	340	26	0.22	0.010		0.24	<0.05	<0.1	<0.05	<0.05
M-SP44	31-Oct-14	0.595	8.2	7.58	611			63.52	24.9	26.29	0.69	370.641	<5	26	2	358	27	0.12	0.010	<0.05	0.06	<0.05	0.1	<0.05	<0.05
M-SP44	25-Jun-15	4.21	6	7.67	570			68.47	32.10	9.94	0.57	362.107	<5	14	1	348	37	0.34	0.046	0.14	0.16	<0.05	<0.1	<0.05	<0.05
M-SP44	26-Sep-15	0.493	9.2	7.54	581			63.37	26.32	30.97	<0.14	362.107	<5	18	1	367		0.12	0.006	0.29	0.06	<0.05	0.3	<0.05	<0.05
M-SP44	1-Nov-15	0.45	8.3	7.59	594			65.95	25.55	35.83	0.64	375.518	<5	26	2	365	14	0.13	0.005	0.86	0.12	<0.05	0.9	0.06	<0.05
M-SP44	26-Jun-16	3.74	6.3	7.52	547			68.47	32.1	9.94	0.57	362	<5	14	1	348	37	0.34	0.046	0.14	0.16	<0.05	<0.1	<0.05	
M-SP44	27-Sep-16	0.530	8.9	7.55	593											372	35	0.25	0.019						
M-SP44	26-Oct-16	0.495	8.6	7.65	597											330	41	0.61	0.022						
M-SP45	4-Oct-01	2.230	5.9	7.32	508		0.60																		
M-SP45	3-May-02	1.837	3.5	7.85	969		0.00																		
M-SP45	25-Sep-02	1.713	6.0	7.58	977		0.00																		
M-SP45	21-May-03	1.824	3.7	7.30	977		1.67																		
M-SP45	27-Sep-03	1.541	5.9	7.30	545		0.29																		
M-SP45	3-Jun-04	0.673	5.0	7.42	369		1.08																		
M-SP45	26-Jun-15	1.26	5.1	7.47	996											594	<5	<0.05	<0.002						
M-SP45	30-Sep-15	1.21	6.5	7.47	923											580	34	0.34	0.005						
M-SP45	6-Nov-15	1.21	5.9	7.38	933											586	25	0.3	0.006						
M-SP45	25-Jun-16	1.28	5.4	7.53	931																				

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP45	29-Sep-16	1.29	6.5	7.38	952											532	13	1.45	0.021						
M-SP45	31-Oct-16	1.03	6.1	7.46	940											597	55	0.26	0.004						
M-SP53	24-Oct-01																								
M-SP53	24-Oct-01	0.092	2.9	7.82	368																				
M-SP53	2-May-02	0.109	4.5	7.81	15		0.17																		
M-SP53	27-Sep-02	0.090	7.2	7.61	402																				
M-SP53	21-May-03	0.101	6.7	7.66	381		0.75																		
M-SP53	27-Sep-03	0.48	8.5	7.68	694		0.84																		
M-SP53	6-Jun-04	0.087	6.9	7.77	417																				
M-SP53	23-Jun-06	0.11	10.4	7.79	696																				
M-SP53	28-Sep-06	0.104	8.5	7.93	639																				
M-SP53	4-Nov-06	0.11	3.8	7.49	648																				
M-SP53	25-Jun-07	0.079	10.2	7.95	697																				
M-SP53	24-Sep-07	0.087	5	7.58	580																				
M-SP53	29-Oct-07	0.084	5.9	7.51	592																				
M-SP53	21-Jun-08	0.072	9.2	7.52	692																				
M-SP53	24-Sep-08	0.27	8.7	7.63	687																				
M-SP53	6-Nov-08	0.081	3.2	7.75	644																				
M-SP53	19-Jun-09	0.062	8.6	7.55	683																				
M-SP53	23-Sep-09	0.065	8.6	7.67	686																				
M-SP53	10-Nov-09	0.064	5.5	7.46	682																				
M-SP53	26-Jun-10	0.057	9.8	7.51	734																				
M-SP53	16-Jul-10	0.058	14.3	7.75	698																				
M-SP53	23-Sep-10	0.059	9.1	7.69	713																				
M-SP53	12-Nov-10	0.058	3.1	7.52	682																				
M-SP53	27-Jun-11	0.124	6.2	7.87	663																				
M-SP53	26-Sep-11	0.117	12.9	7.63	728																				
M-SP53	29-Oct-11	0.125	6.4	7.78	703																				
M-SP53	27-Jun-12	0.11	8.3	7.85	730																				
M-SP53	25-Sep-12	0.116	6	7.69	723																				
M-SP53	7-Nov-12	0.113	6.3	7.79	713																				
M-SP53	28-Jun-13	0.091	9.5	7.79	728																				
M-SP53	25-Sep-13	0.078	9.5	7.67	715																				
M-SP53	26-Oct-13	0.08	8.6	7.66	684																				
M-SP53	21-Jun-14	0.07	11.6	7.75	701																				
M-SP53	18-Sep-14	0.063	13.8	7.75	714																				
M-SP53	31-Oct-14	0.063	9.5	7.67	722																				
M-SP53	25-Jun-15	0.055	14.3	7.9	722																				
M-SP53	26-Sep-15	0.056	14.5	7.76	684																				
M-SP53	1-Nov-15	0.06	9.6	7.67	686																				
M-SP53	26-Jun-16	0.053	19.2	7.68	711																				
M-SP53	27-Sep-16	0.054	14.3	7.59	708																				
M-SP53	26-Oct-16	0.054	7.6	7.76	699																				
M-SP59	24-Oct-01	0.372	3.4	7.58	446		1.13																		
M-SP59	2-May-02	0																							
M-SP59	27-Sep-02	0.117	6.4	7.6	451		1.1																		
M-SP59	21-May-03	0.216	8.5	8.04	478		1.53																		
M-SP59	27-Sep-03	0.69	7.1	7.92	859		13.9																		
M-SP59	6-Jun-04	0.173	7.4	8.08	509		0.67																		
M-SP59	27-Jun-15	0.014	13.7	7.87	836																				
M-SP60	2-May-02	0.888	5.7	7.64	403		5.70																		
M-SP60	27-Sep-02	0.728	8.0	7.52	512		0.10																		

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP60	21-May-03	0.761	6.5	7.63	491		14.25																		
M-SP60	8-Oct-03	0.600	7.8	7.63	428		0.81																		
M-SP60	4-Jun-04	0.676	9.6	7.79	943		0.76																		
M-SP60	30-Jun-14	0.72	11.5	7.68	931			54.00	40.00	89.00	2.00	535.235	<5	27	39	513		0.08	0.007		0.18	<0.05	<0.1	<0.05	<0.05
M-SP60	23-Sep-14	0.57	8.4	7.67	935			57.42	43.29	94.13	1.69	510.851	<5	26	39	527	<5	0.05	<0.002		0.13	<0.05	<0.1	<0.05	<0.05
M-SP60	6-Nov-14	0.56	6.9	7.61	932			61.05	41.92	95.59	1.74	513.289	<5	26	39	507	13	<0.05	0.002	<0.05	0.13	<0.05	<0.1	<0.05	<0.05
M-SP60	27-Jun-15	0.545	6.9	7.61	960			52.96	43.64	92.22	1.76	507.193	<5	26	39	536		0.14	0.017	2.76	0.11	<0.05	<0.1	<0.05	<0.05
M-SP60	29-Sep-15	0.348	8.5	7.8	876			53.87	41.74	98.2	1.81	518.166	<5	25	36	552	23	0.55	0.043	1.36	0.17	0.39	0.3	<0.05	<0.05
M-SP60	7-Nov-15	0.39	6.7	7.47	893			54.05	39.98	93.24	1.68	530.358	<5	25	38	535	93	0.58	0.039	1.41	0.3	0.32	0.1	<0.05	0.08
M-SP60	23-Jun-16	0.424	7.4	7.72	889																				
M-SP60	26-Sep-16	0.330	8.3	7.51	909											549	20	0.07	0.003						
M-SP60	6-Nov-16	0.299	7.3	7.83	896											513	6	<.05	<.002						
M-SP82	25-May-02	2.383	6.8	7.65	667		0.00																		
M-SP82	7-Oct-02	1.303	4.6	8.01	370		0.00																		
M-SP82	3-Jun-03	5.384	5.1	7.70	629		16.95																		
M-SP82	23-Sep-03	1.259	5.9	7.98	471		1.47																		
M-SP82	4-Jun-04	3.601	5.0	7.87	491		0.00																		
M-SP87	26-May-02	2.193	5.2	8.32	681		0.25																		
M-SP87	29-Sep-02	2.313	5.2	8.13	627		0.05																		
M-SP87	22-May-03	3.079	4.1	7.86	699		16.17																		
M-SP87	7-Oct-03	2.52	6.1	8.14	770	6.6	5.020																		
M-SP87	13-May-04	2.907	3.6	8.39	1,277		0.59																		
M-SP87	20-Nov-09	1.65	3.3	7.10	1,203																				
M-SP87	30-Jun-14	1.14	7.1	7.78	1,282			101.00	53.00	109.00	4.00	441.356	<5	279	59	845		0.25	0.013		0.37	0.14	<0.1	<0.05	<0.05
M-SP87	18-Sep-14	0.92	7.6	7.84	1,259			100.27	53.33	108.57	3.93	440.137	<5	261	99	851	<5	<0.05	0.004		<0.05	0.22	<0.1	<0.05	<0.05
M-SP87	5-Nov-14	1.15	3.8	7.85	1,301			45.60	23.28	8.90	0.63	242.624	26	10	2	214	68	0.35	0.022	0.48	0.48	<0.05	<0.1	<0.05	<0.05
M-SP87	26-Jun-15	1.08	6.6	7.78	1,311			92.73	55.40	105.15	3.93	451.109	<5	265	60	858	<5	<0.05	0.010	2.83	<0.05	<0.05	<0.1	<0.05	<0.05
M-SP87	29-Sep-15	0.8	7.6	7.77	1,224			98.84	54.52	114.31	4.06	440.137	<5	297	61	851	18	0.14	0.011	1.79	0.1	0.31	<0.1	<0.05	<0.05
M-SP87	28-Oct-15	0.58	5.1	7.78	1,262			103.16	52.53	111.3	4.2	443.794	<5	272	55	853	22	0.27	0.016	0.33	0.08	0.25	0.2	<0.05	<0.05
M-SP87	23-Jun-16	0.980	6.6	7.75	1,254																				
M-SP87	28-Sep-16	0.962	7.7	7.52	1,336											839	11	0.28	0.013						
M-SP87	7-Nov-16	1.05	5.0	7.73	1,254											817	<5	0.14	0.006						
M-SP100	27-Sep-02	0.774	6.8	7.25	388		0.20																		
M-SP100	21-May-03	0.840	7.9	7.35	373		38.78																		
M-SP100	8-Oct-03	0.794	6.7	7.38	292		0.83																		
M-SP100	5-Jun-04	1.076	9.4	7.47	683		0.51																		
M-SP100	27-Jun-15	0.802	6.3	7.51	695											389	12	<0.05	0.004						
M-SP100	29-Sep-15	0.777	7	7.47	651											407	46	0.2	0.016						
M-SP100	7-Nov-15	0.754	6.8	7.46	661											384	87	0.17	0.012						
M-SP100	23-Jun-16	0.826	6.4	7.48	689																				
M-SP100	26-Sep-16	0.838	7.4	7.59	677											426	13	0.18	0.01						
M-SP100	6-Nov-16	0.872	7.1	7.53	673											375	35	0.32	0.015						
M-SP103	21-May-03	1.193	10.3	8.28	377		35.67																		
M-SP103	8-Oct-03	0.939	16.5	8.27	416		1.23																		
M-SP103	5-Jun-04	1.506	9.2	7.67	706		0.12																		
M-SP103	27-Jun-15	1.16	9.4	7.59	703											389	145	0.5	0.035						
M-SP103	29-Sep-15	0.878	10.9	7.55	669											404	9	<0.05	<0.002						
M-SP103	7-Nov-15	0.963	8.6	7.58	675											387	14	<0.05	0.006						
M-SP103	23-Jun-16	1.30	9.8	7.85	682																				
M-SP103	26-Sep-16	0.591	10.7	7.77	690											415	192	1.61	0.1						
M-SP103	6-Nov-16	1.13	9.6	7.79	680											374	70	0.14	0.01						

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
M-SP104	21-May-03	0.115	11.5	8.51	327																				
M-SP104	8-Oct-03	NOF																							
M-SP104	5-Jun-04	0.382	20.4	8.26	686																				
M-SP104	27-Jun-15	0.279	12.4	7.94	678											392	39	0.06	0.011						
M-SP104	29-Sep-15	0.279	12.9	7.88	577											326	67	0.26	0.023						
M-SP104	7-Nov-15	0.355	5.7	7.95	665											355	239	1.03	0.274						
M-SP104	23-Jun-16	0.421	11.4	7.89	691																				
M-SP104	26-Sep-16	0.3080082	10.3	8.02	624											379	76	0.84	0.034						
M-SP104	6-Nov-16	0.313	9.3	8.24	673											323	257	1.86	0.114						
M-SP105	21-May-03	0.795	8.0	8.18	363		18.20																		
M-SP105	8-Oct-03	0.617	12.8	8.09	381		0.00																		
M-SP105	5-Jun-04	0.945	10.3	7.78	696		0.35																		
M-SP105	27-Jun-15	0.652	9.3	7.67	700											397	64	0.09							
M-SP105	29-Sep-15	0.475	11.1	7.98	646											382	64	0.38	0.025						
M-SP105	7-Nov-15	0.568	8.9	7.89	665											397	18	0.09	0.009						
M-SP105	23-Jun-16	0.682	9.6	7.88	663																				
M-SP105	26-Sep-16	0.586	10.3	7.97	667											396	232	2.27	0.14						
M-SP105	6-Nov-16	0.579	9.7	8.04	670											332	150	3.73	0.462						
M-SP106	21-May-03	0.685	4.7	7.84	451		9.42																		
M-SP106	8-Oct-03	1.095	7.3	7.68	430		6.80																		
M-SP106	5-Jun-04	0.476	7.6	7.70	878		116																		
M-SP106	27-Jun-15	0.345	6.1	7.67	884											539	32	0.32	0.017						
M-SP106	29-Sep-15	0.339	7	7.65	824											519	52	0.51	0.018						
M-SP106	7-Nov-15	0.325	5.5	7.64	834											543	229	1.92	0.089						
M-SP106	23-Jun-16	0.377	6.2	7.74	849																				
M-SP106	26-Sep-16	0.586	6.8	7.74	860											539	75	1.41	0.049						
M-SP106	6-Nov-16	0.334	6.0	7.78	863											496	27	1.96	0.049						
GW-13	5-Jun-95	0.52	9	7.72	1344							540	20	140	56	850									
GW-13	23-Aug-95	0.41	10	7.85	1325			67	42	189	3	560	10	142	54	770									
GW-13	3-Oct-95	0.45	10	7.5	1353							585	< 5.	175	56	790		1.4	< .1						
GW-13	26-Aug-96	0.449	12.8	8.22	1351							559	8	142	56	801									
GW-13	3-Jun-97	0.6	8.45	7.95	1318																				
GW-13	18-Aug-97	0.269	16.13	7.85	1335							581	< 5.	150	57	780									
GW-13	8-Oct-97	0.898	6.65	6.86	1320							585	< 5.	150	56	800									
GW-13	20-Jun-98	1.76	13.62	8.11	1292							576	< 5.	185	57	830									
GW-13	5-Aug-98	1.5	15.27	7.61	1335																				
GW-13	3-Oct-98	0.804	7.09	7.25	1292																				
GW-13	30-Jun-99	0.003	10.89	7.65	1334																				
GW-13	12-Aug-99	1.795	11.17	7.69	1337																				
GW-13	4-Oct-99	0.898	9.91	7.58	1328																				
GW-13	22-Jun-00	0.002	7	7.61	1302																				
GW-13	1-Aug-00	0.583	10	7.86	1333																				
GW-13	6-Oct-00	0.583	7	7.24	1310																				
GW-13	12-Jun-01	0.882	6	7.89	1351																				
GW-13	22-Aug-01	0.597	11.7	7.62	135																				
GW-13	1-Oct-01	0.316	7.6	7.86	1205																				
GW-13	8-May-02	0.519	4.2	7.96	1187																				
GW-13	21-Sep-02	0.361	6.9	8.25	1335																				
GW-13	9-Oct-02	0.332	5.7	7.58	1347																				
GW-13	6-Jun-03	0.125	8.8	8.47	1209																				
GW-13	4-Aug-03	0.353	9.9	8.18	1243																				

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
GW-13	17-Oct-03	0.359	6.8	7.73	1346																				
GW-13	25-Jun-04	0.331	9.6	8.19	1315																				
GW-13	12-Aug-04	1.58	10.8	8.19	1358																				
GW-13	2-Nov-04	0.247	1.0	7.46	1253																				
GW-13	27-Jun-05	0.439	8.8	8.16	1134																				
GW-13	29-Sep-05	0.65	7.8	7.98	1467																				
GW-13	27-Oct-05	0.72	4.8	8.16	1437																				
GW-13	23-Jun-06	0.35	8.1	8.05	1227																				
GW-13	28-Sep-06	0.38	6.1	8.03	1450																				
GW-13	8-Nov-06	0.46	4.5	7.95	1420																				
GW-13	26-Jun-07	0.44	7.4	8.24	1475																				
GW-13	10-Sep-07	0.38	9.7	8.14	1493																				
GW-13	6-Nov-07	0.45	2.1	8.21	1442																				
GW-13	13-Jun-08	0.234	6.1	8.06	1531																				
GW-13	24-Sep-08	0.31	6.2	8.07	1522																				
GW-13	11-Dec-08	0.323	2.7	7.82	1258																				
GW-13	27-Jun-09	0.289	8.8	8.03	1576																				
GW-13	18-Sep-09	0.361	8.1	8.05	1557																				
GW-13	26-Oct-09	0.16	2.8	8.06	1262																				
GW-13	26-Jun-10	0.45	14.2	8	1501																				
GW-13	23-Sep-10	0.43	6	7.89	1386																				
GW-13	12-Nov-10	0.59	5.2	7.21	1367																				
GW-13	27-Jun-11	0.83	5.2	7.91	1333																				
GW-13	26-Sep-11	0.754	5.6	7.84	1409																				
GW-13	29-Oct-11	0.9	5.5	7.72	1309																				
GW-13	27-Jun-12	0.84	5.6	7.66	1474																				
GW-13	25-Sep-12	0.76	6.2	7.45	1399																				
GW-13	7-Nov-12	0.688	5.7	7.66	1413																				
GW-13	28-Jun-13	0.84	5.8	7.64	1603																				
GW-13	25-Sep-13	0.87	6.2	7.49	1578																				
GW-13	26-Oct-13	0.83	6.3	7.48	1537																				
GW-13	29-Jun-14	0.77	5.9	7.52	1584																				
GW-13	29-Aug-14	0.755	6.4	7.48	1637																				
GW-13	31-Oct-14	0.688	5.4	7.5	1663																				
GW-13	24-Jun-15	0.701	5.8	7.51	1670																				
GW-13	28-Sep-15	0.59	11.5	7.64	1621																				
GW-13	28-Oct-15	0.62	4.6	7.71	1648																				
GW-13	25-Jun-16	0.62	13.4	7.54	1677																				
GW-13	29-Sep-16	0.63	9.5	7.55	1687																				
Sufco 006A Spring	28-Jun-2010	0.28	5.3	7.39	1,302																				
Sufco 006A Spring	15-Sep-2010	0.19	6.5	7.29	1,255																				
Sufco 006A Spring	1-Nov-2010	0.27	5.6	7.17	1,227			63.2	24.8	205	3.4	605	<1	151	37	832		0.59	0.012						
Sufco 006A Spring	17-Jun-2011	0.44	4.5	7.66	1261			59.3	23.4	206	3.3	644	<1	150	38	796		0.14	<0.005						
Sufco 006A Spring	21-Sep-2011	0.30	6.5	7.47	1277			59.6	23.3	190	3.4	713	<1	135	36	816		0.09	<0.005						
Sufco 006A Spring	12-Oct-2011	0.37	6.1	7.68	1298																				
Sufco 006A Spring	1-Jun-2012	0.39	4.4	7.36	1263			62.1	24.8	207	3.4	629	<1	137	37	800		0.29	<0.005						
Sufco 006A Spring	12-Sep-12	0.18	7.1	7.56	1216																				
Sufco 006A Spring	1-Nov-12	0.29	6.1	7.50	1247																				
Sufco 006A Spring	27-Jun-13	0.19	6.5	7.61	1271																				
Sufco 006A Spring	26-Sep-13	0.203	7.1	7.65	1246																				
Sufco 006A Spring	23-Oct-13	0.303	4.7	7.60	1210																				
Sufco 006A Spring	28-May-14	0.495	4	7.57	1267																				
Sufco 006A Spring	23-Sep-14	0.373	6.6	7.44	1254																				
Sufco 006A Spring	28-Oct-14	0.439	5.6	7.53	1273																				

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
Sufco 006A Spring	23-Jun-15	0.493	8.5	7.48	1293																				
Sufco 006A Spring	21-Sep-15	0.36	6.7	7.49	1174																				
Sufco 006A Spring	8-Nov-15	0.40	5.1	7.53	1221																				
Sufco 006A Spring	28-Jun-16	0.376	6.0	7.37	1247																				
Sufco 006A Spring	25-Sep-16	0.292	6.8	7.48	1250																				
Sufco 006A Spring	11-Nov-16	0.379	5.8	7.47	1237																				
Spring 94-110	11-Nov-13	0.115	5.2	7.59	724																				
Spring 94-110	30-Jun-14	0.299	6.1	7.52	744			67	28	56	1.48	485.248	<5	8	10	445	NM	0.22	0.008	NM	0.32	<0.05	<0.1	<0.05	<0.05
Spring 94-110	25-Sep-14	0.205	9.2	7.6	775			70.64	27.85	59.09	1.22	481.59	<5	8	11	468	15	<0.05	<0.002	1.47	0.24	<0.05	<0.1	<0.05	<0.05
Spring 94-110	11-Nov-14	0.181	4.4	7.54	777			67.26	27.66	60.22	1.28	497.44	<5	8	11	427	91	0.31	0.019	0.27	0.27	<0.05	<0.1	<0.05	<0.05
Spring 94-110	29-Jul-15	0.253	7.1	7.47	756			70.31	30.18	59.92	1.2	475.494	<5	9	11	411	10	0.13	0.005	0.37	0.29	<0.05	<0.1	<0.05	<0.05
Spring 94-110	9-Nov-15	0.179	5.9	7.50	758			73.21	28.33	63.93	1.47	412	<5	8	11	444	17	0.19	0.007	3.08	0.31	<0.05	0.2	<0.05	<0.05
Spring 94-110	9-Jul-16	0.192	7.3	7.48	748											439	18	0.13	<0.002						
Spring 94-110	14-Nov-16	0.126	5.9	7.62	771											482	14	<0.05	<0.002						
Spring 94-113	1-Jun-12	0																							
Spring 94-113	27-Jun-13	0																							
Spring 94-113	26-Sep-13	<.01	7.1	7.99	1808			114	33	263	4.2	665	<1	306	122	1120	1040	4.75	0.043		<0.1	<0.1	<0.2	0.02	1.9
Spring 94-113	23-Oct-13	<0.01	5.3	7.69	1,830																				
Spring 94-113	28-May-14	<0.05	11.2	7.74	1,761																				
Spring 94-113	23-Sep-14	0																							
Spring 94-113	28-Oct-14	0.000																							
Spring 94-113	21-Jun-15	0.000																							
Spring 94-113	21-Sep-15	0.000																							
Spring 94-113	8-Nov-15	Damp																							
Spring 94-113	28-Jun-16	0																							
Spring 94-113	25-Sep-16	0.000																							
Spring 94-113	11-Nov-16	0.000																							
A Spring	8-Nov-13	1.47	6.7	7.47	882																				
A Spring	31-Jul-14	1.76	6.4	7.5	946																				
A Spring	21-Nov-14	1.42	6.2	7.54	944			58.45	35.53	100.35	1.61	558.4	<5	47	15	576	<5	0.07	0.005	3.16	0.06	<0.05	<0.1	<0.05	<0.05
A Spring	31-Jul-15	1.60	6.7	7.52	904			58.42	38.63	110.45	1.55	553.524	<5	48	15	595	NM	<0.05	<0.002	0.13	0.09	<0.05	<0.1	<0.05	<0.05
A Spring	14-Nov-15	0.83	6.8	7.45	997			60.27	37.69	112.84	2.07	472	<5	50	15	595	8	<0.05	<0.002	3.5	0.11	<0.05	<0.1	<0.05	<0.05
A Spring	23-Jul-16	1.01	7.0	7.58	953											563	69	0.98	0.019						
A Spring	15-Nov-16	1.06	7.0	7.51	947											575	10	0.23	0.009						
B Spring	8-Nov-13	4.31	6.4	7.5	717																				
B Spring	31-Jul-14	5.37	6.0	7.54	753																				
B Spring	21-Nov-14	0.773	5.3	7.59	782			71.69	40.52	34.61	1.28	466.959	<5	32	5	441	8	0.09	<0.002	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05
B Spring	31-Jul-15	6.020	6.1	7.52	738			72.84	44.01	33.12	1.41	462.082	<5	31	3	436	NM	<0.05	<0.002	0.13	<0.05	<0.05	<0.1	<0.05	<0.05
B Spring	14-Nov-15	0.340	6.2	7.48	717			73.41	41.84	35.53	1.63	385	<5	32	4	422	38	0.38	0.007	1.12	<0.05	<0.05	<0.1	<0.05	0.07
B Spring	23-Jul-16	3.04	6.5	7.59	733											416	19	<0.05	<0.002						
B Spring	15-Nov-16	0.000	—	—	—																				
D Spring	11-Nov-13	0.545	7.7	9.44	235			3.4	2.3	43.3	2.8	171	7	3	2	133	848	26.6	1.48	0.3			<0.2	0.45	2.2
D Spring	30-Jun-14	0																							
D Spring	25-Sep-14	0																							
D Spring	29-Jul-15	0																							
D Spring	9-Nov-15	0																							
A2S-1	11-Nov-13	0																							
A2S-1	30-Jun-14	0.106	9.5	7.98	832			18	8	174	1.78	499.878	<5	16	14	511	NM	0.86	0.031	NM	0.18	<0.05	<0.1	<0.05	0.08
A2S-1	25-Sep-14	0.028	12.9	7.97	882			17.85	7.44	181	1.24	534.016	<5	19	14	584	137	0.66	0.156	1.02	0.24	<0.05	<0.1	<0.05	0.17

		Field Measurements						Major Ions								Baseline				Nutrients					
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	NO2+ mg/L	NO3 mg/L	NO2 mg/L	NH3 mg/L	O-PO4 mg/L	T-P mg/L
A2S-1	11-Nov-14	0.063	5.9	7.97	909			17.92	6.96	205.84	1.34	535.235	20	19	14	480	357	2.03	0.074	0.31	0.31	<0.05	<0.1	<0.05	<0.05
A2S-1	29-Jul-15	0.062	12.1	7.37	832			18.83	8.22	185.06	1.43	513.289	<5	46	3	540	158	2.03	0.094	3.37	<0.05	<0.05	0.2	<0.05	0.13
A2S-1	9-Nov-15	0.045	7.2	8.03	902			18.02	7.3	93.792.16		484	<5	19	15	660	372	2.54	0.246	3.37	0.35	0.13	0.6	<0.05	5.69
A2S-1	9-Jul-16	0.100	11.9	7.99	819											518	59	0.63	0.019						
A2S-1	14-Nov-16	0.054	8.3	8.24	878											558	78	3.07	0.082						
Divide Spring	1-Jul-14	1.63	7.4	7.59	743			55	43	43	1.33	402.341	<5	81	8	429	NM	<0.05	<0.002	NM	0.05	<0.05	<0.1	<0.05	<0.05
Divide Spring	25-Sep-14	DAMP																							
Divide Spring	11-Nov-14	0																							
Divide Spring	29-Jul-15	0.268	7.9	7.78	703			54.48	47.41	35.97	1.23	365.764	<5	79	7	419	<5	<0.05	0.002	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05
Divide Spring	9-Nov-15	0.000	—	—	—																				
Divide Spring	14-Nov-15	0	–	–	–																				
Divide Spring	9-Jul-16	2.36	10.7	7.52	720											460	300	0.07	<0.002						
Divide Spring	14-Nov-16	0.000	—	—	—																				
Hansen Seep	23-Apr-12	0.356	11.3	7.63	1489			127	38.4	158	2.9	501	<1	228	118	974	82	1.06	0.279		<0.1	<0.1	<0.2	0.02	0.08
Hansen Seep	27-Jun-13	<0.1	14.9	7.41	1461																				
Hansen Seep	26-Sep-13	0.284	8.4	7.85	1452			114	36.5	150	2.8	467	<1	254	127	904	6	0.14	0.06		<0.1	<0.1	<0.2	0.04	0.05
Hansen Seep	23-Oct-13	0.242	5.0	7.57	1,418																				
Hansen Seep	28-May-14	0.266	8.8	7.68	1,431																				
Hansen Seep	17-Sep-14	0.196	10.9	7.64	4,590			114.06								915	49	0.92	0.389						
Hansen Seep	28-Oct-14	0.226	6.1	7.44	1,473			113.03	35.82	151.39	2.66	466.959	<5	247	114	928	50	0.37	0.228	NM	<0.05	<0.05	<0.1	<0.05	0.08
Skutumpah Spring	8-Nov-13	12.2	7.0	7.53	785																				
Skutumpah Spring	31-Jul-14	14.9	6.6	7.59	805																				
Skutumpah Spring	21-Nov-14	13.4	6.8	7.63	819			55.62	30.42	75.36	1.2	452.329	<5	49	11	503	12	0.08	0.002	<0.05	0.08	<0.05	<0.1	<0.05	0.1
Skutumpah Spring	31-Jul-15	14.0	6.7	7.39	786			53.45	33.52	81.39	1.23	454.767	<5	49	11	472		<0.05	<0.002	0.22	0.06	<0.05	<0.1	<0.05	<0.05
Skutumpah Spring	14-Nov-15	13.2	17.0	7.50	777			53.76	32.85	79.38	1.23	371	<5	50	11	445	12	<0.05	<0.002	3.65	1.13	<0.05	<0.01	<0.05	<0.05
Skutumpah Spring	23-Jul-16	13.3	7.0	7.59	785											470	11	<0.05	<0.002						
Skutumpah Spring	15-Nov-16	12.0	7.2	7.58	793											500	<5	<0.05	<0.002						
USP-1	20-Nov-09	0.18	4.2	7.59	1,146			70.98	47.73	90.64	4.79	434	<1	191	44.2										
USP-2	20-Nov-09	0.43	5.5	7.46	1,287			90.47	55.85	75.61	4.5	335	<1	222	83.9										
Spg 99	11-Nov-14	0.200	5.0	7.61	660																				
Spg 99	29-Jul-15	0.337	8.3	7.38	584																				
Spg 99	9-Nov-15	0.229	5.5	7.51	620																				
Spg 99	9-Jul-16	0.265	8.2	7.74	560											310	44	1.01	0.075						
Spg 99	14-Nov-16	0.130	5.5	7.79	637											370	30	0.2	0.013						

Groundwater Monitoring Well Data

	Date	W.L. (feet toc)
MW 15-5-2	28-Sep-15	301.37
MW 15-5-2	1-Nov-15	Dry
MW 15-5-2	23-Jun-16	Dry
MW 15-5-2	28-Sep-16	Dry
MW 15-5-2	7-Nov-16	Dry
01-8-1	1-Oct-01	1464.8
01-8-1	30-Oct-02	1491.5
01-8-1	29-May-03	1487.2
01-8-1	19-Sep-03	1493.81
01-8-1	27-Oct-03	1496.65
01-8-1	24-Jun-04	1498.72
01-8-1	1-Sep-04	1497.11
01-8-1	15-Oct-04	1496.86
01-8-1	13-Jun-05	1500.33
01-8-1	29-Sep-05	1501.88
01-8-1	24-Oct-05	1501.99
01-8-1	23-Jun-06	1525.33
01-8-1	3-Aug-06	1535.44
01-8-1	4-Nov-06	1551.81
01-8-1	25-Jun-07	1599.11
01-8-1	24-Sep-07	1641.62
01-8-1	29-Oct-07	1652.24
01-8-1	21-Jun-08	1776.87
01-8-1	24-Sep-08	1781.18
01-8-1	6-Nov-08	1778.44
01-8-1	19-Jun-09	1779.15
01-8-1	23-Sep-09	1785.54
01-8-1	10-Nov-09	1786.22
01-8-1	26-Jun-10	1788.99
01-8-1	23-Sep-10	1790.07
01-8-1	12-Nov-10	1790.4
01-8-1	27-Jun-11	1791.07
01-8-1	27-Sep-11	1799.36
01-8-1	29-Oct-11	1798.94
01-8-1	27-Jun-12	1799.21
01-8-1	25-Sep-12	1798.95
01-8-1	7-Nov-12	1798.44
01-8-1	28-Jun-13	1797.75
01-8-1	25-Sep-13	1774.51
01-8-1	26-Oct-13	1765.13
01-8-1	29-Jun-14	1724.31
01-8-1	18-Sep-14	1728.61
01-8-1	5-Nov-14	1728.99
01-8-1	24-Jun-15	1732.41
01-8-1	26-Sep-15	1735.67
01-8-1	1-Nov-15	1735.56
01-8-1	26-Jun-16	1739.45
01-8-1	27-Sep-16	1740.31

Table 2B Discharge and water-quality data for springs and streams in the Greens Hollow Tract area.

			Field Measurements					Trace Metals																		Other parameters				
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	D-Fe mg/L	D-Mn mg/L	D-Al mg/L	Al-T mg/L	D-As mg/L	D-B mg/L	D-Cd mg/L	D-Cr mg/L	D-Cu mg/L	T-Hg ug/L	D-Hg ug/L	D-Mb mg/L	D-Ni mg/L	D-Pb mg/L	D-Se mg/L	T-Se mg/L	D-Zn mg/L	O&G mg/L	Acidty mg/L	CN mg/L	T-Alk mg/L	T-Hard mg/L
Stream Monitoring Data																														
U-Mud	30-Jun-14	28,274	13.0	8.78	381	8.17		<0.03	<0.002	<0.03	0.20	<0.01	0.01	<0.001	<0.001	<0.01		<0.2		0.002	<0.01	<0.02	<0.02	<0.004	<5	<5		199	196
U-Mud	18-Sep-14	8,707	13.2	8.72	378	8.26		<0.03	<0.002	<0.03	0.14	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	<5	<5		192	194
U-Mud	5-Nov-14	5,206	1.6	8.7	440	9.97		<0.03	0.002	<0.03	0.17	<0.01	0.07	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	0.02	<0.004	<5	<5		380	464
U-Mud	26-Jun-15	26,928	14.8	8.78	379	8.31		<0.03	<0.002	<0.03	0.09	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	0.009	<5	<5		187	196
U-Mud	29-Sep-15	7,315	11.4	8.72	360	8.21		<0.03	<0.002	<0.03	0.08	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	<5	<5		190	194
U-Mud	28-Oct-15	4,057	3.6	8.65	412	9.86		<0.03	<0.002	<0.03	0.12	<0.01	0.01	<0.001	<0.001	<0.01		<0.2		0.002	<0.01	<0.02	<0.02	0.005	<5	<5		201	216
U-Mud	23-Jun-16	36,353	16.1	8.69	355	7.54																							
U-Mud	28-Sep-16	8,572	10.1	8.75	388	8.88																							
U-Mud	7-Nov-16	4,313	4.6	8.79	416	9.10																							
PINES 405	26-Jun-97		13.8	8.4	282																								
PINES 405	27-Aug-97	18,625	12	8.5	365																								
PINES 405	22-Oct-97	9,874	13.8	8.4	282																								
PINES 405	1-Jun-00		11.2	8.57	355	6.5						< .01		< .01							< .1				< 2.			203	204
PINES 405	21-Aug-00	9,470	15.3	8.19	382	6.53		< .1	< .1			< .01		< .01				< .2			< .1				< 2.			213	185
PINES 405	6-Dec-00	4,488	-0.5	8.4	387	11.38						< .01		< .01				< .2			< .1	< .01			4			229	206
PINES 405	1-Jun-01	> 22440	8.8	8.49	369	8.42																							
PINES 405	7-Sep-01	14	9.5	8.72	391	7.92																							
PINES 405	27-Nov-01	4,084	0.1	8.69	433	8.81																							
PINES 405	18-May-02	27,511	9.3	8.38	369	8																							
PINES 405	26-Sep-02	5,520	10.5	8.61	384	6.69																							
PINES 405	18-Nov-02	5,049	0.1	8.59	385	8.78																							
PINES 405	8-Jun-03	78,540	10.2	8.6	332	7.1																							
PINES 405	21-Sep-03	6,777	7.9	8.34	390	7.62																							
PINES 405	5-Dec-03	4,533	0.4	8.59	417	8.47																							
PINES 405	13-Jun-04	49,368	1.	8.72	374	6.85																							
PINES 405	21-Sep-04	7,091	5.2	8.66	364	9.3																							
PINES 405	21-Dec-04	3,142	0	8.43	357	7.23																							
PINES 405	23-May-05	157,080	9.7	8.15	409	9.73																							
PINES 405	5-Sep-05	22,440	14.5	8.68	324	7.4																							
PINES 405	20-Dec-05	5,350	0	8.56	423	8.16																							
PINES 405	23-Jun-06	53,856	6.7	8.65	374	8.84																							
PINES 405	24-Sep-06	9,510	7.1	8.54	393	8.17																							
PINES 405	8-Dec-06	6,820	0.1	8.44	427	9.1																							
PINES 405	24-Jun-07	19,300	16.7	8.79	382	8.1																							
PINES 405	16-Sep-07	5,840	13	8.92	399	8.22																							
PINES 405	6-Dec-07	4,490	1.8	8.62	334	10.4																							
PINES 405	28-Apr-08	26,900	10.4	8.58	422	8.25																							
PINES 405	17-Sep-08	9,170	10.9	8.65	383	7.89																							
PINES 405	3-Nov-08	5,850	4.1	8.74	399	9.29																							
PINES 405	29-May-09	80,780	11.4	8.64	385	8.55																							
PINES 405	14-Sep-09	8,580	10.5	8.71	384	8.8																							
PINES 405	2-Dec-09	4,040	0.4	8.47	427	10.4																							
PINES 405	17-May-10	17,560	11	8.73	407	7.28																							
PINES 405	13-Sep-10	8,340	11	8.47	371	9.35																							
PINES 405	27-Nov-10	4,480	0.9	8.25	457	9.91																							
PINES 405	18-Jun-11	134,640	6.4	8.81	358	7.77																							
PINES 405	19-Sep-11	22,090	11.9	8.72	388	8.62																							
PINES 405	18-Nov-11	8,037	0.2	8.82	445	9.29																							
PINES 405	9-Jun-12	16,400	16.2	8.93	368	7.66																							
PINES 405	7-Sep-12	5,470	17.8	8.83	372	7.51																							
PINES 405	16-Nov-12	5,520	0.2	8.71	419	10.43																							
PINES 405	25-Jun-13	17,413	15.8	8.83	353	8.74																							
PINES 405	22-Sep-13	8,078	9.7	8.88	408	8.18																							
PINES 405	2-Dec-13	4,880	0.2	8.74	461	10.8																							
PINES 405	27-Jun-14	28,274	14.6	8.82	367	8.46																							
PINES 405	19-Sep-14	7,271	11.8	8.81	396	8.25																							
PINES 405	2-Dec-14	5,386	0.3	8.77	479	10.56																							

			Field Measurements					Trace Metals																	Other parameters				
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
PINES 405	14-Jun-15	52,958	13.3	8.7	389	7.54																							
PINES 405	20-Sep-15	8,864	10.9	8.66	383	8.27																							
PINES 405	29-Oct-15	5,222	4.6	8.67	411	9.46																							
PINES 405	13-Jun-16	118	10.6	8.53	365	8.51																							
PINES 405	26-Aug-16	13,823	13.8	8.67	381	8.7																							
M-STR01	6-Jun-01	50,094	13.6	8.61	567	7.53	18.4			0.03		0.0008		<0.0005	0.0034	0.001		2E-04		0.002	<0.005	0.0005		0.02				298	220
M-STR01	16-Aug-01	0																											
M-STR01	30-Aug-01	0																											
M-STR01	25-Sep-01	0																											
M-STR01	29-Oct-01	0																											
M-STR01	18-Apr-02	0																											
M-STR01	1-May-02	0																											
M-STR01	5-Jun-02	0																											
M-STR01	7-Aug-02	0																											
M-STR01	25-Sep-02	0																											
M-STR01	12-Nov-02	0																											
M-STR01	6-May-03	9.715	0.7	8.48		8.65	7.5	0.15	<0.01	<0.03		0.1	<0.05	<0.005	<0.005	<0.01	<0.0002			<0.01	<0.07	<0.1		<0.01				290	
M-STR01	19-Jun-03	0																											
M-STR01	23-Aug-03	0																											
M-STR01	6-Oct-03	0																											
M-STR01	10-May-04	460	11.8	8.84	443	8.36	39.7	<0.02	<0.01	<0.1		0.001	<0.05	<0.005	<0.005	<0.01		2E-04		<0.01	<0.07	0.001		<0.01		<5		250	200
M-STR01	6-Jun-04																												
M-STR02	7-Aug-02	0																											
M-STR02	25-Sep-02	1,857	8.2	7.97	509	8.35	0.7	<0.02	<0.01	0.06		0.0009	0.06	<0.005	<0.005	<0.01		<0.0002		<0.01	<0.07	0.0021		0.01		<5		297	410
M-STR02	12-Nov-02	2,925	0.8	8.19	416	11.19	0.9	<0.02	<0.01	0.05		<0.1	<0.05	<0.005		<0.01					<0.07	<0.1	<0.1	0.02		<5		303	370
M-STR02	6-May-03	74,148	3.3	8.58	591	9.88	9.8	<0.02	<0.01	<0.03		<0.1	0.05	<0.005	<0.005	<0.01		<0.0002		<0.01	<0.07	<0.1		<0.01		<5		290	240
M-STR02	19-Jun-03	4,235	13	8.46	705	7.51	3.73			<0.03		0.001		<0.0005	<0.005	<0.01	<0.0002			<0.01	<0.001	0.0012		0.01				300	
M-STR02	4-Aug-03	1,184	14.9	8.11	722	5.84	39.9	<0.02	0.02	<0.03		0.0016	0.07	<0.005	<0.005	<0.01	<0.0002			<0.01	<0.07	0.0012		<0.01		<5		310	310
M-STR02	6-Oct-03	2,379	9.3	9.25	495	7.15	2.99	<0.02	<0.01	<0.03		0.001	0.06	<0.005	<0.005	<0.01	<0.0002			<0.01	<0.07	0.0007		<0.01		<5		337	370
M-STR02	10-May-04	460	11.8	8.84	443	8.36	39.7	<0.02	<0.01	<0.1		<0.0005	<0.05	<0.005	<0.005	<0.01	<0.0002			<0.01	<0.07	0.0006		0.01		<5		230	190
M-STR02	6-Jun-04																												
M-STR03	6-Jun-01	36.62	10.4	8.54	527	7.11	22.5			<0.03		0.001		<0.0005	0.0037	0.001		<0.0002		0.002	<0.005	0.0006		<0.01				293	
M-STR03	16-Aug-01	0.61	12.1	7.81	405	4.03	3.17			0.04		0.0009		<0.0005	0.0036	7E-04		<0.0002		0.002	<0.005	0.0013		0.02				293	
M-STR03	30-Aug-01	6.052																											
M-STR03	25-Sep-01	0.501	8.7	7.85	395	3.83	2.21			0.04		0.0008		<0.0005	0.001	8E-04		<0.0002		0.001	<0.005	0.0012		<0.01				304	
M-STR03	29-Oct-01	0.967	3.6	7.98	202	6.68	0			<0.03		<0.1		<0.0005	<0.005	<0.01		<0.0002		<0.01	<0.005	0.0017		0.04				292	
M-STR03	18-Apr-02	9.451	13	7.87	311	6.29	1.21		<0.05	0.03		0.0011		<0.0005	<0.005	<0.005		<0.002		0.003	<0.001	0.0021		<0.01				274	
M-STR03	1-May-02	7.993	3.6	8.29	409	9.7	0.67																						
M-STR03	5-Jun-02	2.61	6.3	8.18	365					0.05		<0.1		<0.005	<0.005	<0.01		<0.0004		<0.01	<0.07	<0.1		<0.01				284	
M-STR03	7-Aug-02	0																											
M-STR03	25-Sep-02	1.83	8.2	7.87	405	4.85	2	<0.02	<0.01	0.05		0.001	0.07	<0.005	<0.005	<0.01		<0.0002		<0.01	<0.07	0.0027		<0.01		<5		293	310
M-STR03	7-Oct-02																												
M-STR03	12-Nov-02	0																											
M-STR03	6-May-03	54.9	4	8.71	621	9.37	23.8	<0.02	<0.01	<0.03		0.1	0.05	<0.005	<0.005	<0.01		<0.0002		<0.01	<0.07	<0.1		<0.01		<5		290	240
M-STR03	19-Jun-03	2.499	10.9	8.1	659	5.2	2.83			<0.03		0.0011		<0.0005	<0.005	<0.01		<0.0002		0.01	<0.001	0.0014		0.01				292	
M-STR03	4-Aug-03	1.631	12	7.72	647	3.58	43.3	<0.02	0.01	<0.03		0.0013	0.06	<0.005	<0.005	<0.01		<0.0002		<0.01	<0.07	0.0014		0.01		6		300	280
M-STR03	6-Oct-03	1.382	7.9	8.01	398	5.56	7.29	<0.02	0.02	<0.03		0.0009	0.05	<0.005	<0.005	<0.01		<0.0002		<0.01	<0.07	0.0011		<0.01		<5		306	300
M-STR03	10-May-04	491.5	8.4	8.73	307	8.51	51.4	<0.02	<0.01	<0.1		<0.0005	<0.05	<0.005	<0.005	<0.01		<0.0002		<0.01	<0.07	0.0005		0.03		<5		210	160
M-STR03	6-Jun-04																												
M-STR04	7-Jun-01	71.081	19.4	8.55	386	6.84	3.08			0.03		0.0011		<0.0005	0.0039	0.001		<0.0002		0.002	<0.005	0.0006		<0.01				310	
M-STR04	7-Jun-01																										< .002		
M-STR04	7-Jun-01									0.03		0.0011		< .0005	0.0039	0.001		< .2		0.002	< .005	0.0006		< .01					
M-STR04	22-Jun-01	11,719																											
M-STR04	16-Aug-01	0																											
M-STR04	31-Aug-01	0																											
M-STR04	27-Sep-01	0																											
M-STR04	28-Oct-01	0																											
M-STR04	17-Apr-02	13.005	6.2	8.87	470	9.19	7.49			<0.07		< .0005		< .0005	< .005	< .005		<0.0002		0.002	< .001	0.0016		< .01			< .002	372	

			Field Measurements					Trace Metals																	Other parameters			
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	D-Fe mg/L	D-Mn mg/L	D-Al mg/L	Al-T mg/L	D-As mg/L	D-B mg/L	D-Cd mg/L	D-Cr mg/L	D-Cu mg/L	T-Hg ug/L	D-Hg ug/L	D-Mb mg/L	D-Ni mg/L	D-Pb mg/L	D-Se mg/L	T-Se mg/L	D-Zn mg/L	O&G mg/L	Acidty mg/L	CN mg/L	T-Alk mg/L	T-Hard mg/L
M-STR04	3-May-02																												
M-STR04	4-Jun-02	3.037	18	8.83	514	5.23	2.8			0.06		0.1		<0.005	<0.005	<0.01		<0.0004		<0.01	<0.07	<0.1		<0.01			<0.002	325	
M-STR04	8-Aug-02	0																											
M-STR04	25-Sep-02	0																											
M-STR04	12-Nov-02	0																											
M-STR04	6-May-03	79.9	8	8.74	599			< .02	0.01	< .03		< .1	< .05	< .005	< .005	< .01		< .2	< .02	< .01	< .07	< .1		0.01		<5	0	300	240
M-STR04	20-Jun-03	14.231	8.4	8.65	792	8.92	4.73			< .03		0.0014		< .0005	< .005	< .01		<0.0002		0.01	< .001	0.0013		< .01			< .002	358	
M-STR04	6-Aug-03	0																											
M-STR04	8-Oct-03	0																											
M-STR04	11-May-04	717.264	11.9	8.82	445	8.12	76.3	< .02	0.01	< .1		0.0008	< .05	< .005	< .005	< .01		< .2	< .02	< .01	< .07	0.0006		0.01		<5	< .002	240	200
M-STR04	13-May-04																												
M-STR04	23-Jun-06	3.85	19.8	8.72	627	6.44																							
M-STR04	28-Sep-06	1.01	10.4	8.67	705	7.92																							
M-STR04	8-Nov-06	3.19	4.5	8.5	758	8.73																							
M-STR04	26-Jun-07	0																											
M-STR04	11-Sep-07	0																											
M-STR04	8-Nov-07	0																											
M-STR04	21-Jun-08	16.3	20.7	8.59	573	6.64																							
M-STR04	24-Sep-08	0																											
M-STR04	6-Nov-08	0																											
M-STR04	27-Jun-09	0.67	21.2	8.83	684	7.12																							
M-STR04	23-Sep-09	0																											
M-STR04	10-Nov-09	0																											
M-STR04	26-Jun-10	0																											
M-STR04	23-Sep-10	0																											
M-STR04	12-Nov-10	0																											
M-STR04	27-Jun-11	142	14.1	8.48	573	7.82																							
M-STR04	30-Sep-11	3.71	14.5	8.66	865	7.56																							
M-STR04	29-Oct-11	14.6	0.3	8.75	767	10.4																							
M-STR04	27-Jun-12	0																											
M-STR04	25-Sep-12	0																											
M-STR04	7-Nov-12	0																											
M-STR04	28-Jun-13	0																											
M-STR04	25-Sep-13	0																											
M-STR04	26-Oct-13	0																											
M-STR04	29-Jun-14	0																											
M-STR04	29-Aug-14	0																											
M-STR04	31-Oct-14	0																											
M-STR04	24-Jun-15	2.25	17.7	8.86	605	7.47																							
M-STR04	28-Sep-15	0																											
M-STR04	28-Oct-15	0																											
M-STR04	23-Jun-16	0																											
M-STR04	28-Sep-16	0																											
	7-Nov-16	0																											
M-STR05	8-Aug-02	1.412	9.5	6.5	346	8.45	1.56			0.04		< .002		< .001	0.0034	< .001		< .2		0.007	< .001	< .002		0.08			0	267	
M-STR05	25-Sep-02	1.717	7	8.38	353	8.21	4	< .02	< .01	0.05		0.0009	0.06	< .005	< .005	< .01		< .2	< .02	< .01	< .07	0.0035		0.01		< 5.		267	300
M-STR05	6-Oct-02																										< .002		
M-STR05	12-Nov-02	immeas.	0.5	8.25	329	11.18	2.32	< .02	< .01	0.03		< .1	0.05	< .005		< .01			< .02		< .07	< .1		0.01		< 5.		277	290
M-STR05	6-May-03	61.6	6.1	8.73	616	9.04	22.5	< .02	< .01	< .03		< .1	< .05	< .005	< .005	< .01		< .2	< .02	< .01	< .07	< .1		< .01		<5	< .002	300	240
M-STR05	19-Jun-03	2.686	10.3	8.56	605	8.04	1.37			<0.03		0.0009		<0.0005	<0.005	<0.01		<0.0002		0.01	< .001	0.002		0.01			< .002	265	
M-STR05	5-Aug-03	2.043	10.2	8.35	610	8.5																				< 5.		270	
M-STR05	6-Aug-03							< .02	< .01	< .03		0.0008	0.05	< .005	< .005	< .01		< .2	< .02	< .01	< .07	0.0022		< .01			< .002	300	270
M-STR05	6-Oct-03	1.534	6	8.47	356	7.23	3.99	< .02	< .01	< .03		0.0006	0.05	< .005	< .005	< .01	< .2		< .02	0.01	< .07	0.002		< .01		< 5.	< .002	280	280
M-STR05	11-May-04	598.482	10	8.82	446	8.07	17.4	< .02	< .01	< .1		0.0008	< .05	< .005	< .005	< .01		< .2	< .02	< .01	< .07	0.0006		0.02		< 5.	< .002	232	200
M-STR06	7-Jun-01	16.85	20.10	8.48	808.00	6.54	67.50			<0.03		0.00		<0.0005	0.00	0.00		<0.0002		0.00	<0.005	0.00		0.01				351.00	
M-STR06	22-Jun-01	5.651																											
M-STR06	16-Aug-01	4.783	12.4	8.3	439	7.13	81.4			0.05		0.0022		<0.0005	0.0051	<0.01		<0.0002		0.003	<0.005	0.0011		0.01				378	
M-STR06	25-Sep-01	1.9	11.5	7.92	575	3.14	30			0.05		0.0025		<0.0005	0.006	0.002		<0.0002		0.004	<0.005	0.0009		0.01				441	
M-STR06	30-Oct-01	6.438	2.7	8.39	446	8.73	11.6			<0.03		<0.1		<0.0005	<0.005	<0.01		<0.0002		<0.01	<0.005	0.0008		0.01				391	
M-STR06	17-Apr-02	18.165	9.6	8.77	462	7.16	9.63			<0.07		<0.001		<0.0005	<0.005	<0.005		<0.0002		0.002	<0.001	0.0009		0.01				373	

		Field Measurements						Trace Metals																		Other parameters				
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	D-Fe mg/L	D-Mn mg/L	D-Al mg/L	Al-T mg/L	D-As mg/L	D-B mg/L	D-Cd mg/L	D-Cr mg/L	D-Cu mg/L	T-Hg ug/L	D-Hg ug/L	D-Mb mg/L	D-Ni mg/L	D-Pb mg/L	D-Se mg/L	T-Se mg/L	D-Zn mg/L	O&G mg/L	Acidty mg/L	CN mg/L	T-Alk mg/L	T-Hard mg/L
M-STR06	1-May-02	4.455	8.2	8.51	819	8.55	8.32			0.07		<0.1		<0.0005	<0.005	<0.01		<0.0004		<0.01	<0.07	<0.1	0.0009	0.01					
M-STR06	5-Jun-02	3.020	23.3	8.52	569	5.13	40.9			0.04		<0.1		<0.0005	<0.0005	<0.01		<0.0004		<0.01	<0.07	<0.1		0.01				350	
M-STR06	8-Aug-02	0																											
M-STR06	24-Sep-02	0																											
M-STR06	13-Nov-02	0																											
M-STR06	7-May-03	17.836	11.7	8.54	490	7.01	8.29	<0.02	0.01	<0.03		<0.1	0.06	<0.0005	0.01	<0.01		<0.0002		<0.01	0.07		<0.1	<0.01		<5		360/369	260.00
M-STR06	20-Jun-03	3.024	12.6	8.66	822	8.15	12.8			<0.03		0.0015		<0.0005	<0.0005	<0.01		<0.0002		<0.01	<0.001	0.0012		<0.01				341	
M-STR06	6-Aug-03	0																											
M-STR06	8-Oct-03	0																											
M-STR06	11-May-04	27.400	15.4	8.65	723	6.59	96.3	<0.02	<0.01	<0.1		0.0016	0.05	<0.005	<0.005	<0.01		<0.0002		0.01	<0.07	0.0014		0.02		<5		368/370	240
M-STR06	13-May-04																												
M-STR06	26-Jun-15	0.636	22.3	8.64	968	5.43	NM																						
M-STR06	28-Sep-15	0																											
M-STR06	28-Oct-15	0																											
M-STR06	23-Jun-16	0.000	—	—	—	—																							
M-STR06	28-Sep-16	0.000	—	—	—	—																							
M-STR06	7-Nov-16	0.000	—	—	—	—																							
M-STR07	25-Sep-02	0																											
M-STR07	12-Nov-02	0																											
M-STR07	7-May-03	0																											
M-STR07	8-Aug-03	0																											
M-STR07	6-Oct-03	0																											
M-STR07	13-May-04	0																											
M-STR08	26-Sep-02	2062	9.2	8.7	234	9.1	2.2	<0.02	<0.01	0.04		0.0009	<0.05	<0.005		<0.01					<0.07	0.0007		0.01		<5		215	230
M-STR08	13-Nov-02	967	1	8.72	65	13.66	1.5	<0.02	<0.01	0.03		<0.1	.05	<0.005		<0.01					<0.07	<0.1		<0.01		5		227	220
M-STR08	7-May-03	2447	3.5	8.69	247	10.22	5.15	<0.02	<0.01	<0.03		<0.1	<0.05	<0.005		<0.01					<0.07	<0.1		0.01		<5		230	230
M-STR08	5-Aug-03	7145	16.2	8.74	371	7.51		<0.02	<0.01	<0.03		0.0011	.05	<0.005		<0.01					<0.07	0.0006		<0.01		<5		200	210
M-STR08	7-Oct-03	3087	5.5	8.88	232	9.27	1.99	<0.02	<0.01	<0.03		0.0011	0.05	<0.005		<0.01					<0.07	0.0008		<0.01		<5		222	220
M-STR08	13-May-04	15644	4.2	8.9	352	9.76	6.81	<0.02	<0.01	<0.1		0.0009	<0.05	<0.005		<0.01					<0.07	0.0006		<0.01		<5		220	220
Sufco 007	5-Oct-79																						< 1.						
Sufco 007	1-Nov-80							0.94									< .2						< 1.					332	244
Sufco 007	9-Jun-81							0.08									< .2						< 1.					178	168
Sufco 007	26-Aug-81																						< 1.						
Sufco 007	27-Oct-81							0.095	0.018																			284.7	244
Sufco 007	22-Jun-82	3132.624	16	8.2	654			0.34	0.13																			202.1	178
Sufco 007	12-Aug-82	403.92	12	8.6	460			0.335	0.13																			224	210
Sufco 007	20-Oct-82	498.168	0	9.2	690			0.04	0.045																			292	288
Sufco 007	21-Jun-83	5771.568	14	8.4	446			0.08	0.003																			220	192
Sufco 007	16-Aug-83	516.12	15	7.6	593			0.11	0.01																			244	240
Sufco 007	12-Oct-83	269.3	12	7.7	640			0.12	0.01																			278	262
Sufco 007	21-Jun-84	2629.968	7	7.6	525			0.01	0.01																			232	210
Sufco 007	9-Aug-84	359.04	21	7.8	555			< .01																				260	260
Sufco 007	11-Oct-84	686.664	5	7.9	621			0.03	0.03																			270	335
Sufco 007	13-Jun-85	2217.072	7.8	7.5	409			0.04	0.13																			404	720
Sufco 007	14-Aug-85	287.232	13	8	680			< .01	< .02																			238	208
Sufco 007	22-Oct-85	94.248	0.5	7.6	638			0.03	0.03																			290	264
Sufco 007	2-Jun-86	3388.44	14	7.6	412			< .01	< .01																			182	216
Sufco 007	13-Aug-86	246.84	17	8.3	531			< .01	< .01																			212	200
Sufco 007	7-Jun-88	1297.032	12	8.2	468			< .03	< .01																			188	214
Sufco 007	9-Aug-88	71.81	19	7.4	500			< .03	< .01																			200	218
Sufco 007	5-Oct-88	94.25	8	7.3	619			< .03	0.02																			260	365
Sufco 007	13-May-92							< .02	< .02																			175	213
Sufco 007	4-Aug-92							0.11	< .01																				164
Sufco 007	6-Oct-92							0.08	0.02																				208
Sufco 007	9-Jun-93							< .04	< .02																			186	224
Sufco 007	6-Jun-95	3751.968	10.4	8.29	511			1	0.2																			240	270
Sufco 007	23-Aug-95	1122	15.2	8.35	419			< .1	< .1																			220	177
Sufco 007	3-Oct-95	188.5	13.5	8.37	541			< .1	< .1																			235	213
Sufco 007	27-Aug-96	184.008	17.2	8.6	446			< .1	< .1																			197	186

		Field Measurements					Trace Metals																	Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sufco 007	22-Oct-96	103.224	2.1	8.38	568			< .1	< .1																			265	233
Sufco 007	2-Jun-97		16.15	8.58	401			< .1	< .1																			171	283
Sufco 007	18-Aug-97	664.224	19.8	8.4	467		10.2	< .1	< .1																			199	196
Sufco 007	8-Oct-97	336.6	6.38	8.77	548		11.4	< .1	< .1																			248	230
Sufco 007	4-Jun-98	3285.216	7.61	8.62	473	6.37		< .1	< .1																< 2.			210	216
Sufco 007	5-Aug-98	14.8	19.65	8.08	537	7.5		< .1	< .1																3			255	
Sufco 007	1-Oct-98	94.248	12.45	8.43	598	8.27		< .1	< .1																< 2.			275	
Sufco 007	21-Jun-99	839.256	15.99	8.22	441	6.89		< .1	< .1																< 2.			203	
Sufco 007	9-Aug-99	119.8296	22.2	8.37	505	6.39		< .1	< .1																< 2.			213	
Sufco 007	4-Oct-99	94.248	12.05	8.32	604	8.25		< .1	< .1																< 2.			269	
Sufco 007	21-Jun-00	0.18	17.97	8.29	473	6.15		< .1	< .1																< 2.			196	192
Sufco 007	2-Aug-00	42.1872	21.25	8.52	458	5.65		< .1	< .1																< 2.			184	167
Sufco 007	5-Oct-00	15.2592	10	8.24	577	6.48		< .1	< .1																< 2.			242	211
Sufco 007	11-Jun-01	885	14.3	8.29	407	7.92		< .1	< .1																< 2.			169	171
Sufco 007	20-Aug-01	0.215	17.4	8.68	363	7.15		< .1	< .05																< 2.			174	162
Sufco 007	2-Oct-01	69.2	10.3	8.56	431	7.51		< .1	< .05																< 2.			218	196
Sufco 007	8-May-02	559	9.6	8.45	488	8.42		< .1	< .05																< 2.			215	251
Sufco 007	20-Sep-02	72.9	16.5	8.48	453	6.88		< .1	< .05																				
Sufco 007	8-Oct-02	88.2	11.7	8.63	477	8.01		< .1	< .05																< 2.			231	304
Sufco 007	29-May-03	2560	12.7	8.54	358	7.62		0.008	< .005																< 2.			206	193
Sufco 007	19-Sep-03	68.6	12.3	8.61	376	8.14		< .005	< .005																< 2.			197	183
Sufco 007	30-Oct-03	61.7	11.4	8.65	465	7.63		0.009	0.009																< 2.			213	216
Sufco 007	26-Jun-04	1510	11	8.66	336	7.63		< .03	0.002																< 2.			169	165
Sufco 007	1-Sep-04	66.3	18.7	8.73	343	8.73		< .03	< .002																< 2.			167	159
Sufco 007	15-Oct-04	398	7.2	8.54	439	8.17		< .03	0.009																< 2.			217	198
Sufco 007	13-Jun-05	2180	12.7	8.59	373	6.78		< .03	< .002																< 2.			192	208
Sufco 007	30-Sep-05	104	11.4	8.57	389	7.1		< .03	0.004																< 2.			211	207
Sufco 007	24-Oct-05	96	7.3	8.61	470	8.03		< .03	0.004																< 2.			233	218
Sufco 007	26-Jun-06	661	17.1	8.56	337	8.18		< .03	< .002																< 2.			173	190
Sufco 007	13-Sep-06	62.8	15.9	8.48	375	7.1		< .03	0.002																< 2.			198	181
Sufco 007	4-Nov-06	190	1.5	8.58	478	9.7		< .03	0.004																< 2.			233	238
Sufco 007	25-Jun-07	227	22.5	8.67	304	7.05		< .03	< .002																< 2.			167	172
Sufco 007	19-Sep-07	50.7	9.4	8.73	381	7.51		< .03	0.003																< 2.			191	180
Sufco 007	29-Oct-07	78	5.2	8.77	436	7.63		< .03	0.005																< 2.			230	221
Sufco 007	12-Jun-08	1550	10.9	8.63	301	7.59		< .03	< .002																< 5.			168	191
Sufco 007	15-Sep-08	77.4	12	8.54	303	7.72		< .03	< .002																< 5.			165	176
Sufco 007	21-Oct-08	71	4.3	8.58	442	9.82		< .03	0.007																< 5.			216	216
Sufco 007	19-Jun-09	716	15.7	8.56	358	7.2		< .03	0.002																< 5.			165	190
Sufco 007	17-Sep-09	79.3	13.5	8.61	362	8.26		< .03	< .002																< 5.			179	178
Sufco 007	19-Nov-09	57	0.3	8.39	515	10.6		< .03	0.004																< 5.			237	223
Sufco 007	28-Jun-10	612	14.5	8.59	351	7.89		< .03	< .002																< 5.			167	184
Sufco 007	15-Sep-10	62.4	13.4	8.5	328	7.92		< .02	< .005																< 5.			165	
Sufco 007	1-Nov-10	129	2.7	8.32	449	9.79		< .02	0.007																< 5.			198	
Sufco 007	18-Jun-11	6032	9	8.79	352	7.88		< .02	< .005																< 6.			176	
Sufco 007	27-Sep-11	189	11	8.7	405	8.82		< .02	< .005																< 5.			196	
Sufco 007	29-Oct-11	133	0.8	8.46	492	10.53		< .02	0.007																8			254	
Sufco 007	1-Jun-12	327	11.9	8.76	373	7.51		< .02	< .005																< 6.			171	
Sufco 007	26-Sep-12	19.7	9.7	8.54	539	8.88		< .02	< .005																< 5.			250	
Sufco 007	1-Nov-12	48.8	3.7	8.47	480	9.46		< .02	< .005																9			235	
Sufco 007	27-Jun-13	261	13.9	8.58	373	8.83		0.02	< .005																< 5.				
Sufco 007	25-Sep-13	253	7.2	8.74	398	8.82		< .02	< .005																< 6.				
Sufco 007	26-Oct-13	216	2.6	8.66	420	10.92		< .02	< .005																< 5.			213	
Sufco 007	11-Jun-14	1521	12	8.67	351	9.63		< .03	< .002																< 5.				
Sufco 007	23-Sep-14	101	13.5	8.72	419	8.51		< .03	< .002																< 5.				
Sufco 007	6-Nov-14	90	1.7	8.6	495	9.99		< .03	0.002																< 5.				
Sufco 007	24-Jun-15	1107	14.9	8.7	375	8.16		< .03	< .002																< 5.				188
Sufco 007	22-Sep-15	97	11.1	8.61	328	8.31		< .03	< .002																< 5.			158	155
Sufco 007	7-Nov-15	70	0.2	8.37	514	10.95		< .03	0.002																< 5.				
Sufco 007	23-Jun-16	840	17.2	8.59	329	7.31		< .03	0.022																< 5.			155	171
Sufco 007	28-Sep-16	115	9.9	8.61	409	8.92		< .03	< .002																< 5.			184	182
Sufco 007	6-Nov-16	99	4.1	8.71	449	9.43		<0.03	0.005																			225	197

		Field Measurements						Trace Metals																		Other parameters				
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sufco 006	5-Oct-79																						1						
Sufco 006	1-Nov-80							0.46									0.1						< 1.					372	293
Sufco 006	9-Jun-81							0.21									< .2						< 1.					294	232
Sufco 006	26-Aug-81																						< 1.						
Sufco 006	27-Oct-81							0.24	0.028																			267.2	252
Sufco 006	22-Jun-82	143.616	12.5	7.7	423			0.01	0.005																			372.6	290
Sufco 006	12-Aug-82	462.264	12	8.3	510			0.075	0.02																			222	250
Sufco 006	20-Oct-82	426.36	1	8.6	545			0.08	0.055																			251.4	274
Sufco 006	21-Jun-83	933.504	16	8.4	799			0.03	0.042																			328	298
Sufco 006	16-Aug-83	623.832	17	7.5	726			0.09	0.015																			308	280
Sufco 006	12-Oct-83	260.3	10	7.7	833			0.044	0.07																			320	328
Sufco 006	21-Jun-84		11	8	920			0.01	0.03																			341	307
Sufco 006	9-Aug-84	569.976	18	7.9	688			0.07																				315	610
Sufco 006	11-Oct-84	359.04	6	7.7	824			0.23	0.07																			320	390
Sufco 006	13-Jun-85	704.616	14	7	712			0.03	< .01																			210	246
Sufco 006	14-Aug-85	287.232	13	7.9	884			< .01	< .02																			286	284
Sufco 006	22-Oct-85	219.912	1	7.7	729			< .01	0.05																			270	346
Sufco 006	3-Jun-86	825.792	16	8	610			< .01	0.02																			259	264
Sufco 006	13-Aug-86	260.304	17	8.1	662			< .01	< .01																			250	278
Sufco 006	7-Jun-88	412.9	16	7.9	715			< .03	0.05																			259	286
Sufco 006	9-Aug-88	112.2	17.5	7.4	648			< .03	0.03																			247	300
Sufco 006	5-Oct-88	70.9	15.5	7.1	782			< .03	0.08																			312	425
Sufco 006	13-May-92							< .02	< .02																			331	355
Sufco 006	4-Aug-92							0.13	0.01																				
Sufco 006	6-Oct-92							0.05	< .02																				
Sufco 006	9-Jun-93							< .04	0.029																			386	351
Sufco 006	6-Jun-95	44.88	16.1	8.07	977			0.1	< .1																			370	330
Sufco 006	24-Aug-95	426.4	16	8.46	578			< .1	< .1																			220	272
Sufco 006	3-Oct-95	192.98	12.5	8.2	636			< .1	< .1																			240	278
Sufco 006	27-Aug-96	130.152	15.9	8.35	635			< .1	< .1																			237	294
Sufco 006	22-Oct-96	8.5272	1.02	8.28	398			< .1	< .1																			296	329
Sufco 006	2-Jun-97		21.53	8.3	805			< .1	< .1																			315	310
Sufco 006	18-Aug-97	287.232	18.9	8.44	574		46.8	< .1	< .1																			206	265
Sufco 006	8-Oct-97	184.008	5.5	8.35	629		53.2	< .1	< .1																			235	272
Sufco 006	4-Jun-98	112.2	13.1	8.42	901	6.21		< .1	< .1																< 2.			374	330
Sufco 006	3-Aug-98	224.4	22.75	8.08	577	6.19		< .01	< .01																< 2.			231	
Sufco 006	1-Oct-98	71.808	11.54	8.33	626	9.33		< .1	< .1																< 2.			240	
Sufco 006	21-Jun-99	201.96	17.3	8.19	625	7.03		< .1	< .1																< 2.			247	
Sufco 006	9-Aug-99	394.944	22.04	8.3	592	6.54		< .1	< .1																< 2.			234	
Sufco 006	4-Oct-99	192.984	12.11	8.3	647	8.15		< .1	< .1																< 2.			236	
Sufco 006	21-Jun-00	0.8	15.32	8.13	627	7.05		< .1	< .1																< 2.			226	264
Sufco 006	2-Aug-00	192.984	21.3	8.39	600	5.6		< .1	< .1																< 2.			217	259
Sufco 006	5-Oct-00	179.52	9	8.12	747	7.28		< .1	< .1																< 2.				
Sufco 006	11-Jun-01	646.272	17.5	8.34	592	5		< .1	< .1																< 2.			207	256
Sufco 006	20-Aug-01	179.0712	16.3	8.76	512	6.76		< .1	< .05																< 2.			204	250
Sufco 006	2-Oct-01	0																											
Sufco 006	8-May-02	88.1	10.4	8.28	621	8.42		< .1	< .05																< 2.			252	301
Sufco 006	20-Sep-02	11.5	16.8	8.47	721	6.24		< .1	< .05																				
Sufco 006	8-Oct-02	35.1	10.8	8.2	738	7.51		< .1	< .05																< 2.			257	227
Sufco 006	29-May-03	0.909	20.9	8.42	962	6.02		0.006	0.013																< 2.			310	343
Sufco 006	19-Sep-03	26.3	13.5	8.53	631	7.91		0.009	0.005																< 2.			250	304
Sufco 006	30-Oct-03	0.131	8.8	8.58	1228	7.33		0.008	0.021																< 2.			450	469
Sufco 006	26-Jun-04	420	13	8.77	493	7.06		< .03	0.006																< 2.			200	252
Sufco 006	1-Sep-04	132	16.9	8.72	529	6.89		< .03	0.005																< 2.			194	265
Sufco 006	15-Oct-04	70.3	9.6	8.47	593	7.05		< .03	0.003																< 2.			220	271
Sufco 006	13-Jun-05	703	15.5	8.37	523	6.37		< .03	< .002																< 2.			231	301
Sufco 006	30-Sep-05	402	12.1	8.57	542	7.67		< .03	0.007																< 2.			202	265
Sufco 006	24-Oct-05	18.8	8.5	8.53	719	7.91		< .03	0.006																< 2.			257	299
Sufco 006	26-Jun-06	363	16.8	8.54	522	7.66		< .03	< .002																< 2.			203	275
Sufco 006	13-Sep-06	155	14.6	8.45	536	7.08		< .03	0.003																< 2.			201	260
Sufco 006	4-Nov-06	90	3.9	8.48	591	9.09		< .03	0.007																< 2.			230	290
Sufco 006	25-Jun-07	160	17.6	8.62	543	8.72		< .03	< .002																< 2.			200	277

			Field Measurements					Trace Metals																	Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sufco 006	19-Sep-07	95	12.3	8.69	515	8.69		< .03	0.003																< 2.			237	264
Sufco 006	29-Oct-07	1.23	6.1	8.72	920	7.33		< .03	0.007																< 2.			319	351
Sufco 006	12-Jun-08	146	14.9	8.65	649	7.1		< .03	0.004																< 5.			240	297
Sufco 006	15-Sep-08	104	11.9	8.63	518	7.82		< .03	0.002																< 5.			184	277
Sufco 006	21-Oct-08	1.18	7.2	8.44	882	8.34		< .03	0.007																< 5.			338	390
Sufco 006	19-Jun-09	80.4	16.5	8.46	617	6.99		< .03	0.007																< 5.			240	309
Sufco 006	17-Sep-09	100	14.1	8.61	531	7.81		0.03	0.007																< 5.			193	271
Sufco 006	19-Nov-09	71	0.3	8.39	612	10.6		< .03	0.004																< 5.			210	283
Sufco 006	28-Jun-10	433	18.8	8.43	576	6.68		< .03	< .002																< 5.			205	280
Sufco 006	15-Sep-10	49.9	11.2	8.42	532	7.42		0.03	< .005																< 5.			211	
Sufco 006	1-Nov-10	62.4	3.2	8.21	585	9.33		0.02	0.006																< 5.			217	
Sufco 006	17-Jun-11	1116	9.5	8.74	525	8.03		< .02	< .005																< 5.			232	
Sufco 006	21-Sep-11	205	11.6	8.62	533	7.62		< .02	< .005																< 6.			205	
Sufco 006	12-Oct-11	155	6.4	8.62	578	8.9		< .02	< .005																< 6.			216	
Sufco 006	1-Jun-12	0.208	17.5	8.43	968	8.08		< .02	< .005																< 6.			355	
Sufco 006	12-Sep-12	45.3	11.1	8.65	557	8.35		< .02	< .005																< 6.			209	
Sufco 006 (B)	12-Sep-12	36.8	11.5	8.66	555	8.33		<0.02	<0.005	<0.05	0.5	<0.05	<0.05	<0.005	<0.005	<0.005		<0.2	<0.01	<0.005	<0.02	0.04	0.02	<0.01	<6	<5		210	260
Sufco 006	1-Nov-12	53.9	3.4	8.59	592	9.64		< .02	< .005																6			223	
Sufco 006	27-Jun-13	80.4	16.1	8.56	566	7.73		< .02	< .005																< 5.				
Sufco 006	16-Sep-13	239	13.8	8.56	627	8.27		< .02	< .005																< 5.				
Sufco 006	23-Oct-13	116	3.7	8.72	618	10.34		< .02	< .005																< 5.			234	
Sufco 006	28-May-14	363	12.2	8.59	574	7.6		< .03	< .002																< 5.				
Sufco 006	17-Sep-14	101	14.4	8.76	557	7.5		0.09	0.003																< 5.			197	260
Sufco 006	28-Oct-14	0																											
Sufco 006	21-Jun-15	142	14.9	8.58	593	8.39		< .03	< .002																< 5.				284
Sufco 006	22-Sep-15	146	15.1	8.67	1080	7.76		< .03	< .002																< 5.				
Sufco 006	8-Nov-15	19	0.2	8.52	753	10.21		< .03	< .002																< 5.				
Sufco 006	18-Jun-16	8.58	17.6	8.58	543	7.02		< .03	< .002		5.03	<0.1	0.05	.001	<0.001	<0.01		<0.02	0.007	0.002	<0.01	0.02	0.02	).00475.42	< 5.	202		202	287
Sufco 006	26-Sep-16	89	9.5	8.63	541	8.92		< .03	< .002																< 5.				
Sufco 006	5-Nov-16	Dry																											
Sufco 006A	19-Oct-09	75																											
Sufco 006A	28-Jun-10	500	16.8	8.51	538	7.31		< .03	< .002																< 5.				
Sufco 006A	15-Sep-10	50.8	11.7	8.44	529	7.33		0.02	0.008																< 5.			206	
Sufco 006A	1-Nov-10	82.2	3.4	8.22	560	9.38		0.02	0.013																< 5.			210	
Sufco 006A	17-Jun-11	1109	9.5	8.77	512	7.86		< .02	< .005																< 6.			226	
Sufco 006A	21-Sep-11	296	11.7	8.68	624	7.53		< .02	< .005																< 5.			205	
Sufco 006A	12-Oct-11	186	7.9	8.6	558	8.72		< .02	< .005																< 5.			210	
Sufco 006A	1-Jun-12	0.949	14.3	8.5	1182	7.5		< .02	0.006			< .05		< .005				< .2			< .02	< .02	< 20.		< 6.			421	314
Sufco 006A	12-Sep-12	59.5	11.8	8.56	547	8.62		< .02	< .005			< .05		< .005				< .2			< .02	0.02	20		< 5.			206	251
Sufco 006A	1-Nov-12	56	3.9	8.56	578	9.85		< .02	< .005			< .05		< .005				0.2			< .02	0.03	30		< 6.			213	259
Sufco 006A	27-Jun-13	136	17.2	8.56	551	7.96																							
Sufco 006A	16-Sep-13	210	13	8.52	609	7.88																							
Sufco 006A	23-Oct-13	118	4	8.56	604	10.78																							
Sufco 006A	28-May-14	576	12.4	8.56	569	7.56																							
Sufco 006A	17-Sep-14	126	12.7	8.67	547	8.18																							
Sufco 006A	28-Oct-14	2.86	2.4	8.61	1123	10.08																							
Sufco 006A	23-Jun-15	168	8.7	8.7	573	7.37																							
Sufco 006A	23-Sep-15	113	11.7	8.59	518	8.22																							
Sufco 006A	8-Nov-15	28.6	0.2	8.37	640	10.5																							
Sufco 006A	28-Jun-16	339	18.5	8.51	536	7.16																							
Sufco 006A	25-Sep-16	122	9.2	8.68	536	9.24																							
S. Fk. Quitchupah Upper	11-Nov-13	128	4.6	8.63	514	10																							
S. Fk. Quitchupah Upper	1-Jul-14	731	12.5	8.61	515	8.3		<0.03	<0.002	<0.03	0.5	<0.01	0.03	<0.001	<0.001	<0.01		<0.2		0.002	<0.01	<0.02	<0.02	<0.004	<5	<5		193	253
S. Fk. Quitchupah Upper	25-Sep-14	151	13.6	8.72	518	8.05		<0.03	<0.002	<0.03	0.07	<0.01	0.04	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	<5	<5		175	255
S. Fk. Quitchupah Upper	11-Nov-14	11.8	0.1	8.43	593	10.14		<0.03	<0.002	<0.03	0.21	<0.01	0.03	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	<5	<5		202	274
S. Fk. Quitchupah Upper	29-Jul-15	411	13.4	8.77	497	8.1		<0.03	<0.002	<0.03	0.27	<0.01	0.04	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	0.03	0.005	<5	<5		172	255
S. Fk. Quitchupah Upper	9-Nov-15	70	0.3	8.42	503	10.02																							
S. Fk. Quitchupah Upper	9-Jul-16	455	14.7	8.69	507	8.03																							
S. Fk. Quitchupah Upper	14-Nov-16	4.4	4.7	8.33	611	10.05																							

			Field Measurements					Trace Metals																	Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Skutumpah Creek Upper	11-Nov-13	59	4.5	8.42	547	10.04																							
Skutumpah Creek Upper	2-Jul-14	81	16.5	8.24	549	7.3		<0.03	<0.002	<0.03	1.03	<0.01	0.04	<0.001	<0.001	<0.01		<0.2		0.002	<0.01	<0.02	<0.02	<0.004	<5	<5		232	203
Skutumpah Creek Upper	25-Sep-14	7.8	15.5	8.48	527	8.39																							
Skutumpah Creek Upper	11-Nov-14	129	0.9	8.56	570	10.36																							
Skutumpah Creek Upper	29-Jul-15	27	13.4	8.52	505	7.76		<0.03	<0.002	<0.03	0.52	<0.01	0.04	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	NM	<5		183	262
Skutumpah Creek Upper	9-Nov-15	67	0.3	8.45	505	10.06																							
Skutumpah Creek Upper	9-Jul-16	75	15.3	8.65	509	7.81																							
Skutumpah Creek Upper	14-Nov-16	101	5.8	8.57	540	9.89																							
Spring Monitoring Stations																													
M-SP01	19-Jun-01	0.503	13.7	7.42	532		0.24																						
M-SP01	28-Aug-01	0.373	6	7.53	497		0.6																					387	
M-SP01	1-May-02	0.45	5.1	7.27	451		.																					388	
M-SP01	25-Sep-02	0.324	7.5	7.4	851	2.17	.																			33		385	
M-SP01	25-Sep-02							< .02	< .01	0.05		0.0012	0.07	< .005		< .01			< .02		< .07	0.0044		< .01					400
M-SP01	12-Nov-02	0.408	5.1	7.33	815	2.83	.																			35		374	
M-SP01	12-Nov-02							< .02	< .01	0.04		0.1	0.06	< .005		< .01			< .02		< .07	< .1		< .01					360
M-SP01	21-May-03	0.517	4.3	7.26	435	3.1	9.99																			23			
M-SP01	21-May-03							< .02	< .01	< .03		0.0009	< .05	< .005		< .01			< .02		< .07	0.0037		0.01				380	370
M-SP01	5-Aug-03																									24		381	
M-SP01	8-Aug-03	0.539	7.9	7.1	490	2.51	0.15	< .02	< .01	< .03		0.0007	0.06	< .005		< .01			< .02		< .07	0.0026		< .01				420	370
M-SP01	7-Oct-03	0.287	7.6	7.32	500	2.03	1.82																			36		397	
M-SP01	7-Oct-03							< .02	< .01	< .03		0.0006	0.06	< .005		< .01			< .02		< .07	0.0027		0.13					390
M-SP01	11-May-04	0.621	4.5	7.34	489	3.29	.																			17		403	
M-SP01	11-May-04							< .02	< .01	< .1		0.0008	0.06	< .005		< .01			< .02		< .07	0.0024		< .01				400	380
M-SP01	13-May-04																												
M-SP01	26-May-06	0.89	5	7.68	864																								
M-SP01	28-Sep-06	0.19	7	7.46	777																								
M-SP01	8-Nov-06	0.62	5.3	7.17	772																								
M-SP01	26-Jun-07	0.39	10.2	7.48	797																								
M-SP01	11-Sep-07	0.28	11.6	7.42	906																								
M-SP01	8-Nov-07	0.47	4.7	7.76	874																								
M-SP01	13-Jun-08	0.57	9.2	7.01	882																								
M-SP01	24-Sep-08	0.24	9.5	7.07	807																								
M-SP01	7-Nov-08	0.51	5.7	7.23	784																								
M-SP01	27-Jun-09	0.478	11.4	7.46	803																								
M-SP01	23-Sep-09	0.254	10.1	7.08	869																								
M-SP01	10-Nov-09	0.49	5.1	7.32	748																								
M-SP01	26-Jun-10	0.426	12.6	7.21	837																								
M-SP01	23-Sep-10	0.16	10.1	7.86	846																								
M-SP01	12-Nov-10	0.408	4.3	7.02	846																								
M-SP01	27-Jun-11	1.11	5.6	7.52	819																								
M-SP01	26-Sep-11	0.746	6.1	7.72	812																								
M-SP01	29-Oct-11	0.68	6.2	7.49	821																								
M-SP01	27-Jun-12	0.34	11.9	7.41	854																								
M-SP01	6-Sep-12	0.246	9.6	7.35	842																								
M-SP01	7-Nov-12	0.221	4.2	7.6	838																								
M-SP01	30-Jun-13	0.292	14	7.57	848																								
M-SP01	25-Sep-13	0.377	9.5	7.24	851																								
M-SP01	26-Oct-13	0.505	6.3	7.28	811																								
M-SP01	29-Jun-14	0.32	12.7	7.24	811																								
M-SP01	29-Aug-14	0.241	11.0	7.23	841																								
M-SP01	31-Oct-14	0.426	6.0	7.58	853																								
M-SP01	24-Jun-15	0.339	10.1	7.37	842																								
M-SP01	28-Sep-15	0.113	12.5	7.71	803																								
M-SP01	28-Oct-15	0.34	7.1	7.43	816																								
M-SP01	25-Jun-16	0.258	10.0	7.75	813																								
M-SP01	29-Sep-16	0.14	8.2	7.46	825																								
M-SP01	7-Nov-16	0.261	5.4	7.79	828																								

			Field Measurements					Trace Metals																		Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
M-SP02	19-Jun-01	9.274	10.7	7.43	497		0.08																						
M-SP02	28-Aug-01	2.756	10.3	7.62	499		.																					370	
M-SP02	1-May-02	4.348	9.1	7.57	470		.																					385	
M-SP02	25-Sep-02	0																											
M-SP02	12-Nov-02	0																											
M-SP02	20-May-03	6.856	6.1	7.22	469	5.78	13.68																			56			
M-SP02	20-May-03							< .02	< .01	< .03		0.0012	0.19	< .005		< .01			< .02		< .07	0.0033		0.01				370	340
M-SP02	5-Aug-03																									23		376	
M-SP02	8-Aug-03	0.992	8.8	7.21	485	5.7	0.15	< .02	< .01	< .03		0.0008	0.05	< .005		< .01			< .02		< .07	0.0019		0.06				420	340
M-SP02	7-Oct-03	0																											
M-SP02	11-May-04	2.485	6	7.37	437	4.82	0.25																			14		379	
M-SP02	11-May-04							< .02	< .01	< .1		0.0009	0.06	< .005		< .01			< .02		< .07	0.002		0.02				370	330
M-SP02	13-May-04																												
M-SP02	26-May-06	13.4	6.3	7.67	824																								
M-SP02	28-Sep-06	4.19	8.2	7.24	772																								
M-SP02	8-Nov-06	2.26	7.8	7	765																								
M-SP02	26-Jun-07	4.16	6.7	7.49	813																								
M-SP02	11-Sep-07	0.046	12.1	7.72	898																								
M-SP02	8-Nov-07	0																											
M-SP02	13-Jun-08	5.17	6.8	7.27	917																								
M-SP02	24-Sep-08	< .1	9.1	7.47	805																								
M-SP02	7-Nov-08	0	3.3	7.93	783																								
M-SP02	27-Jun-09	2.01	10.8	7.01	829																								
M-SP02	23-Sep-09	0	10.8	7.92	881																								
M-SP02	10-Nov-09	0	4.9	8.49	676																								
M-SP02	26-Jun-10	1.19	6.7	7.15	835																								
M-SP02	23-Sep-10	0																											
M-SP02	12-Nov-10	0																											
M-SP02	27-Jun-11	6.25	5.2	7.41	799																								
M-SP02	26-Sep-11	1.76	6.8	7.52	796																								
M-SP02	29-Oct-11	0.35	7.8	7.55	826																								
M-SP02	27-Jun-12	2.05	10.2	7.55	877																								
M-SP02	6-Sep-12	0.872	11.2	7.45	841																								
M-SP02	7-Nov-12	0	2.2	7.6	1385																								
M-SP02	30-Jun-13	0.063	7.8	7.62	865																								
M-SP02	25-Sep-13	< .1	10.7	7.99	842																								
M-SP02	26-Oct-13	< .001	5.7	8.35	783																								
M-SP02	29-Jun-14	0.005	6.8	7.36	848																								
M-SP02	29-Aug-14	0	11.4	7.59	847																								
M-SP02	31-Oct-14	< .005	5.9	8.2	721																								
M-SP02	24-Jun-15	< .1	12.1	7.47	782																								
M-SP02	28-Sep-15	0.000	—	—	—																								
M-SP02	28-Sep-15	0	—	—	—																								
M-SP02	28-Oct-15	0.000	—	—	—																								
M-SP02	28-Oct-15	0	—	—	—																								
M-SP02	25-Jun-16	< .001	10.6	7.42	834																								
M-SP02	29-Sep-16	0.000	—	—	—																								
M-SP02	29-Sep-16	0	—	—	—																								
M-SP02	7-Nov-16	0.000	—	—	—																								
M-SP02	7-Nov-16	0	—	—	—																								
M-SP04	19-Jun-01	2.838	5.6	8.05	499	NM	0.62																						
M-SP04	28-Aug-01	1.832	4.7	7.73	379	NM	0.47																						
M-SP04	3-May-02	2.043	4.5	7.61	866	NM	0.00																						
M-SP04	26-Sep-02	0.900	5.3	7.41	844	6.21	0.91																						
M-SP04	12-Nov-02	1.230	4.8	7.56	885	6.64	5.40																						
M-SP04	20-May-03	3.226	4.2	7.38	929	7.69	0.00																						
M-SP04	5-Aug-03	0.849	5.4	7.40	408	7.40	0.10																						
M-SP04	6-Oct-03	0.747	5.4	7.50	861	7.30	1.02																						
M-SP04	12-May-04	2.921	4.4	7.59	512	0.69	0.69																						
M-SP04	26-Jun-15	1.81	4.9	7.68	986																								
M-SP04	30-Sep-15	0.251	6.9	7.89	872																								

		Field Measurements						Trace Metals																		Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
M-SP04	1-Nov-15	0.638	5.6	7.72	873																								
M-SP04	25-Jun-16	0.987	5.5	7.75	924																								
M-SP04	28-Sep-16	0.192	6.9	7.90	923																								
M-SP04	31-Oct-16	0.617	5.8	7.77	898																								
M-SP05	26-Sep-02	0.082	7.7	7.77	780		19.00																						
M-SP05	20-May-03	0.216	4.3	7.60	910		0.35																						
M-SP05	25-Sep-03	0.119	7.3	7.78	533		17.70																						
M-SP05	12-May-04	0.264	3.9	7.92	524		0.16																						
M-SP05	26-Jun-15	0.127	7.8	7.8	934																								
M-SP05	30-Sep-15	0.085	8.9	7.91	870																								
M-SP05	1-Nov-15	0.157	6.6	7.84	888																								
M-SP05	25-Jun-16	0.096	7.3	7.86	889																								
M-SP05	28-Sep-16	0.130	7.9	7.91	895																								
M-SP05	31-Oct-16	0.137	6.8	7.92	902																								
M-SP06	19-Jun-01	2.30	9.30	9	550		7.5																						
M-SP06	4-Oct-01	1.86	6.30	8	474		13.2																						
M-SP06	3-May-02	2.06	4.90	9	899		0.88																						
M-SP06	26-Sep-02	1.549	5.4	7.55	895		0																						
M-SP06	20-May-03	1.472	4.6	7.62	918		1.24																						
M-SP06	25-Sep-03	1.665	5.3	7.59	514		0																						
M-SP06	12-May-04	1.624	4.7	7.78	528		0.05																						
M-SP06	30-Jun-14	1.47	5.3	7.81	916																								
M-SP06	18-Sep-14	1.46	5.9	7.76	922			<0.03	<0.002	<.03	0.58	<0.01	0.05	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		<5		469	137
M-SP06	31-Oct-14	1.33	5.2	7.78	934			<0.03	<0.002	0.03	0.05	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	<5	11		472	139
M-SP06	26-Jun-15	1.45	5.5	7.82	932			<0.03	<0.002	<0.03	0.19	<0.01	0.06	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	0.01		<5		469	137
M-SP06	29-Sep-15	1.34	5.8	7.68	868			<0.03	<0.002	<0.03	0.08	<0.01	0.06	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		10		452	133
M-SP06	1-Nov-15	1.23	5.5	7.77	887			<0.03	<0.002	<0.03	0.15	<0.01	0.05	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		<5		478	133
M-SP06	25-Jun-16	1.34	5.9	7.76	886																								
M-SP06	28-Sep-16	1.32	5.[illegible]	7.78	897																								
M-SP06	31-Oct-16	1.39	5.7	7.79	906																								
M-SP07	20-Jun-01	1.137	7.8	7.37	491		1.02																						
M-SP07	29-Aug-01	0.249	7.3	7.5	541		2.25																					459	
M-SP07	3-May-02	0.409	4.6	8.37	530		11.5																					449	
M-SP07	26-Sep-02	0.211	6.5	7.45	878	5.21	1.8																			13		426	
M-SP07	26-Sep-02							< .02	< .01	0.05		0.0009	0.1	< .005		< .01			< .02		< .07	0.0034		< .01					340
M-SP07	12-Nov-02	0.273	3.9	7.46	799	4.94	3.9																			23		453	
M-SP07	12-Nov-02							< .02	< .01	0.04		0.1	0.07	< .005		< .01			< .02		< .07	0.1		0.02					320
M-SP07	20-May-03	0.601	4.6	7.36	854	6.17	6.25																			22			
M-SP07	20-May-03							< .02	< .01	< .03		0.0009	0.08	< .005		< .01			< .02		< .07	0.0025		0.01				430	310
M-SP07	5-Aug-03	0.28	6.7	7.32	442	6.03	0.95	< .02	< .01	< .03		0.0006	0.07	< .005		< .01			< .02		< .07	0.002		0.02				440	310
M-SP07	5-Aug-03																									17		415	
M-SP07	7-Oct-03	0.283	6.3	7.62	865	7.02	0.56																			9		423	
M-SP07	7-Oct-03							0.02	0.02	< .03		0.0007	0.07	< .005		< .01			< .02		< .07	0.0024		0.02					330
M-SP07	10-May-04	0.677	4	7.38	500	6.28	0.53																			32		433	
M-SP07	10-May-04							< .02	< .01	< .1		0.0008	0.08	< .005		< .01			< .02		< .07	0.0019		< .01				440	330
M-SP07	13-May-04																												
M-SP08	20-Jun-01	1.03	8.4	7.78	424		7.58																						
M-SP08	29-Aug-01	0.433	7.3	7.26	332		2.04																					279	
M-SP08	3-May-02	0.775	6.3	8.27	600		3.5																					463	
M-SP08	26-Sep-02	0.023	11.7	7.91	901	5.8	.																			7		424	
M-SP08	26-Sep-02							< .02	< .01	0.05		0.0014	0.09	< .005		< .01			< .02		< .07	0.0034		< .01					340
M-SP08	12-Nov-02	0																											
M-SP08	20-May-03	0.79	3.9	7.27	1013	2.93	0.66																			21			
M-SP08	20-May-03							< .02	< .01	< .03		0.0013	0.08	< .005		< .01			< .02		< .07	0.0044		0.01				460	330
M-SP08	5-Aug-03	0.096	10.1	7.25	541	2.86	21	< .02	0.01	< .03		0.0013	0.08	< .005		< .01			< .02		< .07	0.0028		< .01				450	310
M-SP08	5-Aug-03																									35		427	
M-SP08	7-Oct-03	0.08	7.7	7.33	896	2.54	2.08																			15		431	
M-SP08	7-Oct-03							0.07	0.02	< .03		0.0011	0.07	< .005		< .01			< .02		< .07	0.0021		0.01					320

			Field Measurements					Trace Metals																	Other parameters			
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	D-Fe mg/L	D-Mn mg/L	D-Al mg/L	Al-T mg/L	D-As mg/L	D-B mg/L	D-Cd mg/L	D-Cr mg/L	D-Cu mg/L	T-Hg ug/L	D-Hg ug/L	D-Mb mg/L	D-Ni mg/L	D-Pb mg/L	D-Se mg/L	T-Se mg/L	D-Zn mg/L	O&G mg/L	Acidty mg/L	CN mg/L	T-Alk mg/L	T-Hard mg/L
M-SP08	10-May-04	1.189	4.8	7.4	557	5.42	.																			18		462	
M-SP08	10-May-04							< .02	< .01	< .1		0.0012	0.11	< .005		< .01			< .02		< .07	0.0033		< .01				470	320
M-SP08	13-May-04																												
M-SP08	23-Jun-06	0.68	7.8	7.83	931																								
M-SP08	28-Sep-06	0.51	7.3	7.78	837																								
M-SP08	8-Nov-06	0.78	5.5	7.49	878																								
M-SP08	26-Jun-07	0.37	8.6	7.52	888																								
M-SP08	11-Sep-07	0.071	13.2	7.93	864																								
M-SP08	8-Nov-07	0.16	3.6	7.82	709																								
M-SP08	21-Jun-08	0.46	7.8	7.35	932																								
M-SP08	24-Sep-08	0.016	12.6	8.03	912																								
M-SP08	6-Nov-08	0																											
M-SP08	22-Jun-09	0.26	8.1	7.55	897																								
M-SP08	23-Sep-09	0.011	13.2	7.94	963																								
M-SP08	10-Nov-09	< .01	5.9	7.74	698																								
M-SP08	26-Jun-10	0.12	12.1	7.58	930																								
M-SP08	16-Jul-10	0.0084	27.6	7.1	951																								
M-SP08	23-Sep-10	0																											
M-SP08	12-Nov-10	0																											
M-SP08	27-Jun-11	1.04	6.2	7.72	912																								
M-SP08	27-Sep-11	0.49	7.9	7.71	930																								
M-SP08	29-Oct-11	0.73	5.5	7.77	941																								
M-SP08	27-Jun-12	0.138	10.1	7.99	954																								
M-SP08	25-Sep-12	0.021	12.9	7.99	996																								
M-SP08	7-Nov-12	0.0689	5.4	7.93	934																								
M-SP08	28-Jun-13	0.017	23.9	7.93	1037																								
M-SP08	25-Sep-13	0.01	9.5	7.67	715																								
M-SP08	26-Oct-13	0.014	13.4	7.98	953																								
M-SP08	29-Jun-14	0.015	20.8	8.34	1061																								
M-SP08	18-Sep-14	0																											
M-SP08	31-Oct-14	0.012	2.6	7.92	504																								
M-SP08	25-Jun-15	0.01	36	8.38	1125																								
M-SP08	26-Sep-15	0.094	15.2	8.05	982																								
M-SP08	1-Nov-15	0.064	7.8	7.64	988																								
M-SP08	26-Jun-16	0.074	20.4	7.8	1140																								
M-SP08	27-Sep-16	0.035	17.5	8.38	972																								
M-SP08	26-Oct-16	0.050	8.0	7.91	980																								
M-SP09	20-Jun-01	1	7.9	7.53	464		1.43																						
M-SP09	29-Aug-01	0																											
M-SP09	3-May-02	0.254	3.6	8.55	429		141																						
M-SP09	26-Sep-02	0																											
M-SP09	20-May-03	0																											
M-SP09	7-Oct-03	0																											
M-SP09	10-May-04	0																											
M-SP09	27-Sep-11	1.430	5.4	7.77	794																								
M-SP09	29-Oct-11	1.820	—	—	—																								
M-SP09	25-Jun-15	0																											
M-SP09	26-Sep-15	0																											
M-SP09	1-Nov-15	0																											
M-SP09	26-Jun-16	0.000	—	—	—																								
M-SP09	27-Sep-16	0.000	—	—	—																								
M-SP09	26-Oct-16	0.000	—	—	—																								
M-SP10	20-Jun-01	0.532	14.5	7.75	610		0.16																						
M-SP10	28-Aug-01	0.489	7.8	7.76	526		.																					351	
M-SP10	1-May-02	0.42	8.5	7.99	490		.																					352	
M-SP10	25-Sep-02	0.238	7.7	7.84	833	4.56	.																			8		330	
M-SP10	25-Sep-02							< .02	< .01	0.06		0.0014	0.06	< .005		< .01			< .02		< .07	0.0054		< .01					290
M-SP10	13-Nov-02	0.244	3.8	7.55	814	5.98	.																			14		420	
M-SP10	13-Nov-02							< .02	< .01	0.04		< .1	0.05	< .005		< .01			< .02		< .07	< .1		0.01					270
M-SP10	20-May-03	0.243	5.8	7.56	509	4.16	1.71																			18			

		Field Measurements						Trace Metals																		Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
M-SP10	20-May-03							< .02	< .01	< .03		0.001	0.06	< .005		< .01			< .02		< .07	0.0036		0.01				360	290
M-SP10	5-Aug-03	0.224	9.9	7.7	500	5.6	.	< .02	< .01	< .03		0.0008	0.05	< .005		< .01			< .02		< .07	0.0035		0.01				360	270
M-SP10	5-Aug-03																									22		335	
M-SP10	7-Oct-03	0.275	6.7	7.67	846	5.55	.																			10		340	
M-SP10	7-Oct-03							< .02	< .01	< .03		0.0007	0.05	< .005		< .01			< .02		< .07	0.0036		0.01					280
M-SP10	10-May-04	0.271	6.1	7.52	538	4.02	0.82																			14		384	
M-SP10	10-May-04							< .02	< .01	< .1		0.001	0.06	< .005		< .01			< .02		< .07	0.0031		0.01				380	300
M-SP10	13-May-04																												
M-SP11	21-Jun-01	0.408	12.8	7.50	488																								
M-SP11	4-Oct-01	0.000	—	—	—	—																							
M-SP11	2-May-02	0.548	4.4	7.72	433																								
M-SP11	28-Sep-02	0.000	—	—	—	—																							
M-SP11	22-May-03	6.275	7.6	7.83	754																								
M-SP11	25-Sep-03	0.000	—	—	—	—																							
M-SP11	4-Jun-04	5.984	6.0	8.02	396																								
M-SP11	26-Jun-15	0.932	9.3	7.78	866																								
M-SP11	30-Sep-15	Damp	—	—	—																								
M-SP11	1-Nov-15	0.000	—	—	—																								
M-SP11	25-Jun-16	<1	13.0	7.69	1,060																								
M-SP11	28-Sep-16	0.000	—	—	—																								
M-SP11	31-Oct-16	0.000	—	—	—																								
M-SP12	19-Jun-01	0.746	22.0	8.44	495																								
M-SP12	4-Oct-01	0.749	5.4	7.55	399																								
M-SP12	3-May-02	0.472	2.8	8.07	785																								
M-SP12	26-Sep-02	0.422	5.5	7.71	714																								
M-SP12	21-May-03	Immeas.	3.9	7.62	779																								
M-SP12	27-Sep-03	0.263	5.5	7.56	443																								
M-SP12	3-Jun-04	0.937	4.4	7.71	430																								
M-SP12	26-Jun-15	0.873	5.5	7.94	837																								
M-SP12	30-Sep-15	0.769	6.5	7.96	784																								
M-SP12	6-Nov-15	0.847	5.3	7.75	798																								
M-SP12	25-Jun-16	0.781	5.3	7.84	804																								
M-SP12	29-Sep-16	0.785	6.1	7.82	808																								
M-SP12	31-Oct-16	0.817	5.8	7.80	814																								
M-SP14	21-Jun-01	11.229	4.8	7.35	295																								
M-SP14	29-Aug-01	0.865	6.9	7.35	340																								
M-SP14	20-May-02	1.95	4	7.47	542																								
M-SP14	26-Sep-02	Dry	—	—	—																								
M-SP14	20-May-03	37.2	3.9	7.42	304																								
M-SP14	4-Aug-03	Dry	—	—	—																								
M-SP14	9-Oct-03	Dry	—	—	—																								
M-SP14	6-Jun-04	61.4	4.4	7.58	309																								
M-SP15	11-Jul-01	4.822	13.5	8.26	621		69.90																						
M-SP15	3-Oct-01	1.733	6.4	8.34	433		3.68																						
M-SP15	2-May-02	0.548	5.4	7.70	448		0.00																						
M-SP15	27-Sep-02				NOF																								
M-SP15	21-May-03	0.433	14.9	7.65	509		14.07																						
M-SP15	8-Oct-03				NOF																								
M-SP15	5-Jun-04	0.268	15.5	8.14	930		2.52																						
M-SP15	27-Jun-15	0.059	12.9	7.42	1073																								
M-SP15	29-Sep-15	0																											
M-SP15	7-Nov-15	0																											
M-SP15	23-Jun-16	<0.1	9.9	7.37	986																								
M-SP15	26-Sep-16	0.000	—	—	—																								
M-SP15	6-Nov-16	0.000	—	—	—																								
M-SP18	22-Jun-01	0.34	6.6	6.96	728		0.36																						
M-SP18	28-Aug-01	0.212	8.3	7.58	726		0.32																					353	

			Field Measurements					Trace Metals																		Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
M-SP18	1-May-02	0.33	6.8	7.23	1274		0.46																					284	
M-SP18	25-Sep-02	0																											
M-SP18	12-Nov-02	0																											
M-SP18	20-May-03	0.147	5.5	7.35	748	4.65	9.6																			16			
M-SP18	20-May-03							0.03	0.01	< .03		0.0015	0.06	< .005		< .01			< .02		< .07	0.0044		0.01				290	510
M-SP18	6-Aug-03																									13		282	
M-SP18	8-Aug-03	0.344	10	7.34	748	4.74	1.3	0.04	0.01	< .03		0.001	0.08	< .005		< .01			< .02		< .07	0.003		< .01				290	470
M-SP18	6-Oct-03	0.47	6.9	7.26	1276	5.16	0.38																			11		287	
M-SP18	6-Oct-03							0.08	< .01	< .03		0.0007	0.08	< .005		< .01			< .02		< .07	0.0032		0.01					470
M-SP18	11-May-04	0.463	4.2	7.47	728	5.01	2.62																			12		270	
M-SP18	11-May-04							< .02	< .01	< .1		0.0029	0.07	< .005		< .01			< .02		< .07	0.0088		0.01				290	510
M-SP18	26-May-06	0.65	4.2	7.66	1214																								
M-SP18	28-Sep-06	0.45	6	7.46	1174																								
M-SP18	8-Nov-06	0.47	4.5	7.45	1165																								
M-SP18	26-Jun-07	0.25	6	7.49	1198																								
M-SP18	11-Sep-07	0.21	8.3	7.75	1435																								
M-SP18	8-Nov-07	0.29	4.1	7.66	1428																								
M-SP18	21-Jun-08	0.2	[illegible]	7.24	1245																								
M-SP18	24-Sep-08	0.06	6.9	7.29	1227																								
M-SP18	6-Nov-08	0.252	4.3	7.41	1226																								
M-SP18	27-Jun-09	0.082	6.3	7.11	1283																								
M-SP18	23-Sep-09	0.229	7.8	7.25	1264																								
M-SP18	10-Nov-09	0.244	4.5	7.38	1259																								
M-SP18	26-Jun-10	0.227	6.9	7.17	1347																								
M-SP18	23-Sep-10	0.118	7.6	7.18	1394																								
M-SP18	12-Nov-10	0.257	2.2	7.27	1359																								
M-SP18	27-Jun-11	0.77	9.1	7.52	1228																								
M-SP18	26-Sep-11	0.431	7.8	7.44	1289																								
M-SP18	29-Oct-11	0.456	3.4	7.79	1324																								
M-SP18	27-Jun-12	0.36	16.5	7.49	1317																								
M-SP18	6-Sep-12	0.149	14.2	7.51	1528																								
M-SP18	7-Nov-12	0.128	2.2	7.6	1385																								
M-SP18	30-Jun-13	0.115	8.3	7.31	1365																								
M-SP18	25-Sep-13	0.145	8.2	7.35	1389																								
M-SP18	26-Oct-13	0.128	6.6	7.39	1302																								
M-SP18	29-Jun-14	< .05	7.4	7.51	1356																								
M-SP18	29-Aug-14	0	8.1	7.33	1364																								
M-SP18	5-Nov-14	0.299	3.6	7.53	1380																								
M-SP18	26-Jun-15	0.225	8.9	7.49	1352																								
M-SP18	28-Sep-15	0.078	8.9	7.72	1298																								
M-SP18	28-Oct-15	0.151	5.6	7.76	1323																								
M-SP18	23-Jun-16	0.131	10.1	7.54	1314																								
M-SP18	28-Sep-16	0.186	7.7	7.52	1336																								
M-SP18	7-Nov-16	0.229	5.1	7.67	1,333																								
M-SP19	11-Jul-01	2.260	10.4	8.24	508		5.90																						
M-SP19	3-Oct-01	1.976	6.1	7.83	443		0.17																						
M-SP19	2-May-02	3.031	5.1	8.28	456		0.46																						
M-SP19	27-Sep-02	2.114	5.8	7.94	457		0.35																						
M-SP19	21-May-03	2.866	5.2	7.86	449		12.30																						
M-SP19	8-Oct-03	2.555	6.1	8.21	480		0.68																						
M-SP19	5-Jun-04	3.128	6.5	8.23	851		1.34																						
M-SP19	27-Jun-15	2.56	5.7	7.97	873																								
M-SP19	29-Sep-15	1.73	6.3	8.04	824																								
M-SP19	7-Nov-15	1.95	6	7.98	829																								
M-SP19	23-Jun-16	2.53	[illegible]	8.00	835																								
M-SP19	26-Sep-16	1.74	6.4	8.00	845																								
M-SP19	6-Nov-16	2.05	6.3	8.07	840																								
M-SP20	11-Jul-01	3.507	14.2	7.84	486		3.52																						
M-SP20	3-Oct-01	0.909	12.1	7.85	435		5.20																						
M-SP20	2-May-02	0.814	10.5	7.97	432		0.00																						

			Field Measurements					Trace Metals																		Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
M-SP20	28-Sep-02	0.706	7.4	7.79	435		20.00																						
M-SP20	22-May-03	1.041	7.6	7.59	420		19.05																						
M-SP20	8-Oct-03	0.781	11.0	8.31	494		18.60																						
M-SP20	5-Jun-04	8.621	10.8	7.92	814		0.35																						
M-SP20	25-Jun-15	5.24	8.3	7.78	824																								
M-SP20	26-Sep-15	1.04	7.5	7.38	769																								
M-SP20	1-Nov-15	1.21	6.8	7.69	763																								
M-SP20	26-Jun-16	1.90	6.6	7.41	775																								
M-SP20	27-Sep-16	0.980	7.0	7.56	781																								
M-SP20	26-Oct-16	0.980	7.8	7.79	770																								
M-SP38	20-Jul-01	5.71	8.4	7.99	302																								
M-SP38	29-Aug-01	5.538	8.5	7.39	303																								
M-SP38	26-May-02	2.832	7.8	7.70	321																								
M-SP38	26-Sep-02	4.956	8.7	7.59	301																								
M-SP38	13-Nov-02	4.999	8.4	7.64	276																								
M-SP38	20-May-03	5.111	7.7	7.65	179																								
M-SP38	4-Aug-03	5.24	8.5	7.47	267																								
M-SP38	7-Oct-03	5.764	8.8	7.7	312																								
M-SP38	6-Jun-04	5.808	7.9	7.7	313																								
M-SP39	30-Aug-01	1.068	7.1	7.16	590																							453	
M-SP39	3-May-02	4.663	5.3	7.48	603		3.25																					427	
M-SP39	25-Sep-02	0.441	6.5	7.56	1011	5.63																				15		413	
M-SP39	25-Sep-02							< .02	< .01	0.06		0.002	0.09	< .005		< .01			< .02		< .07	0.0073		0.06					400
M-SP39	13-Nov-02	0.566	5.8	7.36	986	5.04	0.15																			23		330	
M-SP39	13-Nov-02							< .02	< .01	0.05		< .1	0.08	< .005		< .01			< .02		< .07	< .1		0.01					380
M-SP39	20-May-03	2.374	5.7	7.43	573	7.39	9.24																			23			
M-SP39	20-May-03							< .02	< .01	< .03		0.0013	0.06	< .005		< .01			< .02		< .07	0.0051		0.01				420	410
M-SP39	6-Aug-03																									13		413	
M-SP39	9-Aug-03	0.509	6.4	7.4	585	5.78	0.11	< .02	< .01	< .03		0.0007	0.07	< .005		< .01			< .02		< .07	0.0032		< .01				450	370
M-SP39	7-Oct-03	0.268	6.2	7.39	1035	4.5	0.13																			16		425	
M-SP39	7-Oct-03							0.06	0.01	< .03		0.0005	0.07	< .005		< .01			< .02		< .07	0.0035		0.07					390
M-SP39	12-May-04	0.446	5.7	7.54	604	4.86	0.24																			18		400	
M-SP39	12-May-04							< .02	< .01	< .1		0.0014	0.08	< .005		< .01			< .02		< .07	0.0044		0.02				430	410
M-SP39	30-Aug-01	1.068	7.1	7.16	590																								
M-SP39	3-May-02	4.663	5.3	7.48	603																								
M-SP39	25-Sep-02	0.441	6.5	7.56	1011	5.63																							
M-SP39	13-Nov-02	0.566	5.8	7.36	986	5.04																							
M-SP39	20-May-03	2.374	5.7	7.43	573	7.39																							
M-SP39	9-Aug-03	0.509	6.4	7.40	585	5.78																							
M-SP39	7-Oct-03	0.268	6.2	7.39	1035	4.50																							
M-SP39	12-May-04	0.446	5.7	7.54	604	4.86																							
M-SP39	23-Jun-06	1.84	5.4	7.59	982																								
M-SP39	28-Sep-06	0.66	6.2	7.87	931																								
M-SP39	8-Nov-06	0.64	5.9	7.64	960																								
M-SP39	26-Jun-07	0.72	6.7	7.67	983																								
M-SP39	11-Sep-07	0.94	7.8	8.31	1080																								
M-SP39	8-Nov-07	1.38	5.9	7.74	1048																								
M-SP39	13-Jun-08	2.04	6.1	7.39	1086																								
M-SP39	24-Sep-08	0.89	6.1	7.72	954																								
M-SP39	6-Nov-08	1.2	5.8	7.5	941																								
M-SP39	27-Jun-09	2.04	6.8	7.22	975																								
M-SP39	23-Sep-09	1.11	7.1	7.39	1058																								
M-SP39	10-Nov-09	1.9	6.2	7.51	858																								
M-SP39	26-Jun-10	0.24	11.2	7.29	1054																								
M-SP39	23-Sep-10	0.753	5.8	7.65	1029																								
M-SP39	12-Nov-10	1.12	4.6	7.29	994																								
M-SP39	27-Jun-11	2.71	4.1	7.67	981																								
M-SP39	26-Sep-11	0.962	4.8	7.53	782																								
M-SP39	29-Oct-11	1.38	6.2	7.72	1007																								
M-SP39	27-Jun-12	1.03	9.2	7.63	1024																								

			Field Measurements					Trace Metals																		Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
M-SP39	6-Sep-12	0.221	5.2	7.55	1013																								
M-SP39	7-Nov-12	1.29	6.2	7.77	1007																								
M-SP39	28-Jun-13	1.44	6.1	7.64	997																								
M-SP39	25-Sep-13	1.06	6.8	7.53	984																								
M-SP39	26-Oct-13	1.17	6.5	7.51	942																								
M-SP39	29-Jun-14	0.61	6.3	7.51	982																								
M-SP39	29-Aug-14	0.987	6.5	7.5	1002																								
M-SP39	31-Oct-14	0.769	6.2	7.52	1021																								
M-SP39	26-Jun-15	1.27	6.2	7.59	1026																								
M-SP39	28-Sep-15	0.581	6.9	7.65	947																								
M-SP39	28-Oct-15	0.67	6.7	7.58	964																								
M-SP39	25-Jun-16	0.87	6.6	7.44	960																								
M-SP39	29-Sep-16	0.434	7.2	7.49	969																								
M-SP39	7-Nov-16	0.434	6.6	7.65	970																								
M-SP40	26-Sep-01	0.657	7.9	7.64	497		30.40																						
M-SP40	2-May-02	0.455	7.5	7.92	865		11.60																						
M-SP40	28-Sep-02	0.336	8.4	7.72	483		0.70																						
M-SP40	22-May-03	0.314	6.9	7.77	538		15.03																						
M-SP40	9-Oct-03	0.180	8.3	7.76	900		19.00																						
M-SP40	6-Jun-04	0.447	7.7	8.10	545		0.68																						
M-SP40	25-Jun-15	0.102	7.4	7.82	959																								
M-SP40	26-Sep-15	0.082	9.5	7.77	905																								
M-SP40	1-Nov-15	0.093	8	7.78	925																								
M-SP40	26-Jun-16	0.107	8.0	7.74	930																								
M-SP40	27-Sep-16	0.068	9.1	7.85	956																								
M-SP40	26-Oct-16	0.087	8.4	7.93	943																								
M-SP41	26-Sep-01	0.422	5.3	7.85	285		1.25																						
M-SP41	2-May-02	2.253	10.2	8.53	616		28.90																						
M-SP41	28-Sep-02	0.427	5.1	7.97	323		4.50																						
M-SP41	22-May-03	0.472	3.9	7.99	429		24.03																						
M-SP41	9-Oct-03	0.402	4.9	7.67	799		0.86																						
M-SP41	6-Jun-04	0.509	6.0	8.14	452		0.48																						
M-SP41	25-Jun-15	0.974	9.7	7.52	897																								
M-SP41	26-Sep-15	0.313	5.5	7.94	765																								
M-SP41	1-Nov-15	0.321	5	7.87	789																								
M-SP41	26-Jun-16	0.210	4.7	7.80	786																								
M-SP41	27-Sep-16	0.193	5.4	7.97	795																								
M-SP41	26-Oct-16	0.245	5.2	7.98	796																								
M-SP44	3-Oct-01	0.561	9.2	7.52	314		5.39																						
M-SP44	2-May-02	2.018	4.8	7.66	269		0.00																						
M-SP44	28-Sep-02	0.196	10.3	7.66	376		110.00																						
M-SP44	22-May-03	13.029	6.1	7.65	276		11.91																						
M-SP44	24-Sep-03	0.197	12.1	7.93	721		15.30																						
M-SP44	5-Jun-04	4.900	5.4	7.65	542		0.00																						
M-SP44	29-Jun-14	3.18	5.9	7.64	554			<0.03	<0.002	<0.03	<0.03	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		0.001	<0.01	<0.02	<0.02	<0.004		8		283	298
M-SP44	18-Sep-14	0.588	8.7	7.78	610			<0.03	<0.002	<0.03	0.33	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		<5		296	259
M-SP44	31-Oct-14	0.595	8.2	7.58	611			<0.03	0.002	<0.03	0.24	<0.01	<0.01	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		12		304	261
M-SP44	25-Jun-15	4.21	6	7.67	570			<0.03	<0.002	<0.03	0.48	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	0.004		7		297	303
M-SP44	26-Sep-15	0.493	9.2	7.54	581			<0.03	<0.002	<0.03	0.2	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		0.002	<0.01	<0.02	<0.02	<0.004		5		297	267
M-SP44	1-Nov-15	0.45	8.3	7.59	594			<0.03	<0.002	<0.03	0.21	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		<5		308	270
M-SP44	26-Jun-16	3.74	6.3	7.52	547			<0.03	<0.002	<0.03	0.48	<0.01	0.02	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	0.004		7		297	303
M-SP44	27-Sep-16	0.530	8.9	7.55	593																								
M-SP44	26-Oct-16	0.495	8.6	7.65	597																								
M-SP45	4-Oct-01	2.230	5.9	7.32	508		0.60																						
M-SP45	3-May-02	1.837	3.5	7.85	969		0.00																						
M-SP45	25-Sep-02	1.713	6.0	7.58	977		0.00																						
M-SP45	21-May-03	1.824	3.7	7.30	977		1.67																						
M-SP45	27-Sep-03	1.541	5.9	7.30	545		0.29																						

			Field Measurements					Trace Metals																		Other parameters				
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
M-SP45	3-Jun-04	0.673	5.0	7.42	369		1.08																						
M-SP45	26-Jun-15	1.26	5.1	7.47	996																								
M-SP45	30-Sep-15	1.21	6.5	7.47	923																								
M-SP45	6-Nov-15	1.21	5.9	7.38	933																								
M-SP45	25-Jun-16	1.28	5.4	7.53	931																								
M-SP45	29-Sep-16	1.29	6.3	7.38	952																								
M-SP45	31-Oct-16	1.03	6.1	7.46	940																								
M-SP53	24-Oct-01																												
M-SP53	24-Oct-01	0.092	2.9	7.82	368																								
M-SP53	2-May-02	0.109	4.5	7.81	15		0.17																						
M-SP53	27-Sep-02	0.090	7.2	7.61	402																								
M-SP53	21-May-03	0.101	6.7	7.66	381		0.75																						
M-SP53	27-Sep-03	0.48	8.5	7.68	694		0.84																						
M-SP53	6-Jun-04	0.087	6.9	7.77	417																								
M-SP53	23-Jun-06	0.11	10.4	7.79	696																								
M-SP53	28-Sep-06	0.104	8.5	7.93	639																								
M-SP53	4-Nov-06	0.11	3.8	7.49	648																								
M-SP53	25-Jun-07	0.079	10.2	7.95	697																								
M-SP53	24-Sep-07	0.087	5	7.58	580																								
M-SP53	29-Oct-07	0.084	5.9	7.51	592																								
M-SP53	21-Jun-08	0.072	9.2	7.52	692																								
M-SP53	24-Sep-08	0.27	8.7	7.63	687																								
M-SP53	6-Nov-08	0.081	3.2	7.75	644																								
M-SP53	19-Jun-09	0.062	8.6	7.55	683																								
M-SP53	23-Sep-09	0.065	8.6	7.67	686																								
M-SP53	10-Nov-09	0.064	5.5	7.46	682																								
M-SP53	26-Jun-10	0.057	9.8	7.51	734																								
M-SP53	16-Jul-10	0.058	14.3	7.75	698																								
M-SP53	23-Sep-10	0.059	9.1	7.69	713																								
M-SP53	12-Nov-10	0.058	3.1	7.52	682																								
M-SP53	27-Jun-11	0.124	6.2	7.87	663																								
M-SP53	26-Sep-11	0.117	12.9	7.63	728																								
M-SP53	29-Oct-11	0.126	6.4	7.78	703																								
M-SP53	27-Jun-12	0.11	8.3	7.85	730																								
M-SP53	25-Sep-12	0.116	6	7.69	723																								
M-SP53	7-Nov-12	0.113	6.3	7.79	713																								
M-SP53	28-Jun-13	0.091	9.5	7.79	728																								
M-SP53	25-Sep-13	0.078	9.5	7.67	715																								
M-SP53	26-Oct-13	0.08	8.6	7.66	684																								
M-SP53	21-Jun-14	0.07	11.6	7.75	701																								
M-SP53	18-Sep-14	0.063	13.8	7.75	714																								
M-SP53	31-Oct-14	0.063	9.5	7.67	722																								
M-SP53	25-Jun-15	0.055	14.3	7.9	722																								
M-SP53	26-Sep-15	0.056	14.5	7.76	684																								
M-SP53	1-Nov-15	0.06	9.6	7.67	686																								
M-SP53	26-Jun-16	0.053	19.2	7.68	711																								
M-SP53	27-Sep-16	0.054	14.3	7.59	708																								
M-SP53	26-Oct-16	0.054	7.6	7.76	699																								
M-SP59	24-Oct-01	0.372	3.4	7.58	446		1.13																						
M-SP59	2-May-02	0																											
M-SP59	27-Sep-02	0.117	6.4	7.6	451		1.1																						
M-SP59	21-May-03	0.216	8.5	8.04	478		1.53																						
M-SP59	27-Sep-03	0.69	7.1	7.92	859		13.9																						
M-SP59	6-Jun-04	0.173	7.4	8.08	509		0.67																						
M-SP59	27-Jun-15	0.014	13.7	7.87	836																								
M-SP60	2-May-02	0.888	5.7	7.64	403		5.70																						
M-SP60	27-Sep-02	0.728	8.0	7.52	512		0.10																						
M-SP60	21-May-03	0.761	6.5	7.63	491		14.25																						
M-SP60	8-Oct-03	0.600	7.8	7.63	428		0.81																						

		Field Measurements						Trace Metals																		Other parameters				
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
M-SP60	4-Jun-04	0.676	9.6	7.79	943		0.76																						
M-SP60	30-Jun-14	0.72	11.5	7.68	931			<0.03	<0.002	<0.03	0.14	<0.01	0.07	<0.001	<0.001	<0.01		<0.2		0.001	<0.01	<0.02	<0.02	<0.004		<5		439	299
M-SP60	23-Sep-14	0.57	8.4	7.67	935			<0.03	<0.002	0.03	0.03	<0.01	0.07	<0.001	<0.001	<0.01		<0.2			<0.01	<0.02	<0.02	<0.004		<5		419	322
M-SP60	6-Nov-14	0.56	6.9	7.61	932			<0.03	<0.002	<0.03	0.05	<0.01	0.12	<0.001	<0.001	<0.01		<0.2		0.001	<0.01	<0.02	<0.02	0.009		8		421	325
M-SP60	27-Jun-15	0.545	6.9	7.61	960			0.04	0.004	<0.03	0.23	<0.01	0.05	<0.001	0.009	<0.01		<0.2		0.002	<0.01	<0.02	<0.02	0.096		<5		416	312
M-SP60	29-Sep-15	0.348	8.5	7.8	876			<0.03	<0.002	0.03	0.91	<0.01	0.07	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	0.03	<0.004		<5		425	306
M-SP60	7-Nov-15	0.39	6.7	7.47	893			<0.03	<0.002	<0.03	0.89	<0.01	0.06	<0.001	<0.001	<0.01		<0.2		0.001	<0.01	<0.02	0.03	<0.004		<5		435	300
M-SP60	23-Jun-16	0.424	7.4	7.72	889																								
M-SP60	26-Sep-16	0.330	8.3	7.51	909																								
M-SP60	6-Nov-16	0.299	7.3	7.63	896																								
M-SP82	25-May-02	2.383	6.8	7.65	667		0.00																						
M-SP82	7-Oct-02	1.303	4.9	8.01	370		0.00																						
M-SP82	3-Jun-03	5.384	5.1	7.70	629		16.95																						
M-SP82	23-Sep-03	1.259	5.9	7.98	471		1.47																						
M-SP82	4-Jun-04	3.601	5.0	7.87	491		0.00																						
M-SP87	26-May-02	2.193	5.2	8.32	681		0.25																						
M-SP87	29-Sep-02	2.313	5.2	8.13	627		0.05																						
M-SP87	22-May-03	3.079	4.1	7.86	699		16.17																						
M-SP87	7-Oct-03	2.52	6.1	8.14	770	6.6	5.020																						
M-SP87	13-May-04	2.907	3.6	8.39	1,277		0.59																						
M-SP87	20-Nov-09	1.65	3.3	7.10	1,203																								
M-SP87	30-Jun-14	1.14	7.1	7.78	1,282			<0.03	0.003	<0.03	0.21	<0.01	0.12	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		<5		362	470
M-SP87	18-Sep-14	0.92	7.6	7.84	1,259			<0.03	0.002	0.04	0.04	<0.01	0.12	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	0.02	0.03	<0.004		<5		361	470
M-SP87	5-Nov-14	1.15	3.8	7.85	1,301			<0.03	<0.002	<0.03	0.51	<0.01	<0.01	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		<5		225	210
M-SP87	26-Jun-15	1.08	6.6	7.78	1,311			<0.03	0.003	<0.03	0.03	<0.01	0.12	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		<5		370	460
M-SP87	29-Sep-15	0.8	7.6	7.77	1,224			<0.03	<0.002	<0.03	0.07	<0.01	0.12	<0.001	<0.001	<0.01		<0.2		0.001	<0.01	<0.02	0.03	<0.004		<5		361	471
M-SP87	28-Oct-15	0.58	5.1	7.78	1,262			<0.03	0.005	<0.03	0.16	<0.01	0.1	<0.001	<0.001	<0.01		<0.2		0.002	<0.01	<0.02	0.03	<0.004		5		364	474
M-SP87	23-Jun-16	0.980	6.6	7.75	1,254																								
M-SP87	28-Sep-16	0.962	7.7	7.52	1,336																								
M-SP87	7-Nov-16	1.05	5.0	7.73	1,254																								
M-SP100	27-Sep-02	0.774	6.8	7.25	388		0.20																						
M-SP100	21-May-03	0.840	7.9	7.35	373		38.78																						
M-SP100	8-Oct-03	0.794	6.7	7.38	292		0.83																						
M-SP100	5-Jun-04	1.076	9.4	7.47	683		0.51																						
M-SP100	27-Jun-15	0.802	6.3	7.51	695																								
M-SP100	29-Sep-15	0.777	7	7.47	651																								
M-SP100	7-Nov-15	0.754	6.8	7.46	661																								
M-SP100	23-Jun-16	0.826	6.4	7.48	689																								
M-SP100	26-Sep-16	0.838	7.4	7.59	677																								
M-SP100	6-Nov-16	0.872	7.1	7.53	673																								
M-SP103	21-May-03	1.193	10.3	8.28	377		35.67																						
M-SP103	8-Oct-03	0.939	16.5	8.27	416		1.23																						
M-SP103	5-Jun-04	1.506	9.2	7.67	706		0.12																						
M-SP103	27-Jun-15	1.16	9.4	7.59	703																								
M-SP103	29-Sep-15	0.878	10.9	7.55	669																								
M-SP103	7-Nov-15	0.963	8.6	7.58	675																								
M-SP103	23-Jun-16	1.30	9.9	7.85	682																								
M-SP103	26-Sep-16	0.591	10.7	7.77	690																								
M-SP103	6-Nov-16	1.13	9.6	7.79	680																								
M-SP104	21-May-03	0.115	11.5	8.51	327																								
M-SP104	8-Oct-03	NOF																											
M-SP104	5-Jun-04	0.382	20.4	8.26	686																								
M-SP104	27-Jun-15	0.279	12.4	7.94	678																								
M-SP104	29-Sep-15	0.279	12.9	7.88	577																								
M-SP104	7-Nov-15	0.355	5.7	7.95	665																								
M-SP104	23-Jun-16	0.421	11.4	7.89	691																								
M-SP104	26-Sep-16	0.3080082	10.3	8.02	624																								

			Field Measurements					Trace Metals																		Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
M-SP104	6-Nov-16	0.313	9.3	8.24	673																								
M-SP105	21-May-03	0.795	8.0	8.18	363		18.20																						
M-SP105	8-Oct-03	0.617	12.8	8.09	381		0.00																						
M-SP105	5-Jun-04	0.945	10.3	7.78	696		0.35																						
M-SP105	27-Jun-15	0.652	9.3	7.67	700			0.011																					
M-SP105	29-Sep-15	0.475	11.1	7.98	646			0.025																					
M-SP105	7-Nov-15	0.568	8.9	7.89	665			0.009																					
M-SP105	23-Jun-16	0.682	9.6	7.88	663																								
M-SP105	26-Sep-16	0.586	10.3	7.97	667																								
M-SP105	6-Nov-16	0.579	9.7	8.04	670																								
M-SP106	21-May-03	0.685	4.7	7.84	451		9.42																						
M-SP106	8-Oct-03	1.095	7.3	7.68	430		6.80																						
M-SP106	5-Jun-04	0.476	7.6	7.70	878		116																						
M-SP106	27-Jun-15	0.345	6.1	7.67	884																								
M-SP106	29-Sep-15	0.339	7	7.65	824																								
M-SP106	7-Nov-15	0.325	5.5	7.64	834																								
M-SP106	23-Jun-16	0.377	6.2	7.74	849																								
M-SP106	26-Sep-16	0.586	6.8	7.74	860																								
M-SP106	6-Nov-16	0.334	5.0	7.78	863																								
GW-13	5-Jun-95	0.52	9	7.72	1344			< .1	< .1																			460	330
GW-13	23-Aug-95	0.41	10	7.85	1325			< .1	< .1																			470	340
GW-13	3-Oct-95	0.45	10	7.5	1353			< .1	< .1																			480	343
GW-13	26-Aug-96	0.449	12.8	8.22	1351			< .1	< .1																			471	352
GW-13	3-Jun-97	0.6	8.45	7.95	1318																								
GW-13	18-Aug-97	0.269	16.13	7.85	1335			< .1	< .1																			476	340
GW-13	8-Oct-97	0.898	6.65	6.86	1320			< .1	< .1																			479	330
GW-13	20-Jun-98	1.76	13.62	8.11	1292			< .1	< .1																			472	384
GW-13	5-Aug-98	1.5	15.27	7.61	1335																								
GW-13	3-Oct-98	0.804	7.09	7.25	1292																								
GW-13	30-Jun-99	0.003	10.89	7.65	1334																								
GW-13	12-Aug-99	1.795	11.17	7.69	1337																								
GW-13	4-Oct-99	0.898	9.91	7.58	1328																								
GW-13	22-Jun-00	0.002	7	7.61	1302																								
GW-13	1-Aug-00	0.583	10	7.86	1333																								
GW-13	6-Oct-00	0.583	7	7.24	1310																								
GW-13	12-Jun-01	0.882	6	7.89	1351																								
GW-13	22-Aug-01	0.597	11.7	7.62	135																								
GW-13	1-Oct-01	0.316	7.6	7.86	1205																								
GW-13	8-May-02	0.519	4.2	7.96	1187																								
GW-13	21-Sep-02	0.361	6.9	8.25	1335																								
GW-13	9-Oct-02	0.332	5.7	7.58	1347																								
GW-13	6-Jun-03	0.125	8.8	8.47	1209																								
GW-13	4-Aug-03	0.353	9.9	8.18	1243																								
GW-13	17-Oct-03	0.359	6.8	7.73	1346																								
GW-13	25-Jun-04	0.331	9.6	8.19	1315																								
GW-13	12-Aug-04	1.58	10.8	8.19	1358																								
GW-13	2-Nov-04	0.247	1.0	7.46	1253																								
GW-13	27-Jun-05	0.439	8.8	8.16	1134																								
GW-13	29-Sep-05	0.65	7.8	7.98	1467																								
GW-13	27-Oct-05	0.72	4.8	8.16	1437																								
GW-13	23-Jun-06	0.35	8.1	8.05	1227																								
GW-13	28-Sep-06	0.38	6.1	8.03	1450																								
GW-13	8-Nov-06	0.46	4.5	7.95	1420																								
GW-13	26-Jun-07	0.44	7.4	8.24	1475																								
GW-13	10-Sep-07	0.38	9.7	8.14	1493																								
GW-13	6-Nov-07	0.45	2.1	8.21	1442																								
GW-13	13-Jun-08	0.234	6.1	8.06	1531																								
GW-13	24-Sep-08	0.31	6.2	8.07	1522																								
GW-13	11-Dec-08	0.323	2.7	7.82	1258																								

			Field Measurements											Trace Metals													Other parameters			
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
GW-13	27-Jun-09	0.289	8.8	8.03	1576																								
GW-13	18-Sep-09	0.361	8.1	8.05	1557																								
GW-13	26-Oct-09	0.16	2.8	8.06	1262																								
GW-13	26-Jun-10	0.45	14.2	8	1501																								
GW-13	23-Sep-10	0.43	6	7.89	1386																								
GW-13	12-Nov-10	0.59	5.2	7.21	1367																								
GW-13	27-Jun-11	0.83	5.2	7.91	1333																								
GW-13	26-Sep-11	0.754	5.6	7.84	1409																								
GW-13	29-Oct-11	0.9	5.5	7.72	1309																								
GW-13	27-Jun-12	0.84	5.6	7.66	1474																								
GW-13	25-Sep-12	0.76	6.2	7.45	1399																								
GW-13	7-Nov-12	0.688	5.7	7.66	1413																								
GW-13	28-Jun-13	0.84	5.8	7.64	1603																								
GW-13	25-Sep-13	0.87	6.2	7.49	1578																								
GW-13	26-Oct-13	0.83	6.3	7.48	1537																								
GW-13	29-Jun-14	0.77	5.9	7.52	1584																								
GW-13	29-Aug-14	0.755	6.4	7.48	1637																								
GW-13	31-Oct-14	0.688	5.4	7.5	1663																								
GW-13	24-Jun-15	0.701	5.8	7.51	1670																								
GW-13	28-Sep-15	0.59	11.5	7.64	1621																								
GW-13	28-Oct-15	0.62	4.6	7.71	1648																								
GW-13	25-Jun-16	0.62	13.4	7.54	1677																								
GW-13	29-Sep-16	0.63	9.5	7.55	1687																								
Sufco 006A Spring	28-Jun-2010	0.28	5.3	7.39	1,302																								
Sufco 006A Spring	15-Sep-2010	0.19	6.5	7.29	1,255																								
Sufco 006A Spring	1-Nov-2010	0.27	5.6	7.17	1,227			<0.02	<0.005																				
Sufco 006A Spring	17-Jun-2011	0.44	[illegible]	7.66	1261			<0.02	<0.005																				
Sufco 006A Spring	21-Sep-2011	0.30	6.5	7.47	1277			<0.02	<0.005																				
Sufco 006A Spring	12-Oct-2011	0.37	6.1	7.68	1298																								
Sufco 006A Spring	1-Jun-2012	0.39	4.4	7.36	1253			<0.02	<0.005																				
Sufco 006A Spring	12-Sep-12	0.18	7.1	7.56	1216																								
Sufco 006A Spring	1-Nov-12	0.29	6.1	7.50	1247																								
Sufco 006A Spring	27-Jun-13	0.19	6.5	7.61	1271																								
Sufco 006A Spring	26-Sep-13	0.203	7.1	7.65	1246																								
Sufco 006A Spring	23-Oct-13	0.303	4.7	7.60	1210																								
Sufco 006A Spring	28-May-14	0.495	4	7.57	1267																								
Sufco 006A Spring	23-Sep-14	0.373	6.6	7.44	1254																								
Sufco 006A Spring	28-Oct-14	0.439	5.6	7.53	1273																								
Sufco 006A Spring	23-Jun-15	0.493	8.5	7.48	1293																								
Sufco 006A Spring	21-Sep-15	0.36	6.7	7.49	1174																								
Sufco 006A Spring	8-Nov-15	0.40	5.1	7.53	1221																								
Sufco 006A Spring	28-Jun-16	0.376	6.0	7.37	1247																								
Sufco 006A Spring	25-Sep-16	0.292	6.8	7.48	1250																								
Sufco 006A Spring	11-Nov-16	0.379	5.8	7.47	1237																								
Spring 94-110	11-Nov-13	0.115	5.2	7.59	724																								
Spring 94-110	30-Jun-14	0.299	6.1	7.52	744			<0.03	0.002	<0.03	0.39	<0.01	0.04	<0.001	<0.001	<0.01		<0.2		0.001	<0.01	<0.02	<0.02	<0.004	NM	<5		398	282
Spring 94-110	25-Sep-14	0.205	9.2	7.6	775			<0.03	<0.002	<0.03	0.13	<0.01	0.04	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	NM	15		395	291
Spring 94-110	11-Nov-14	0.181	4.4	7.54	777			<0.03	<0.002	<0.03	0.8	<0.01	0.03	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	NM	11		408	282
Spring 94-110	29-Jul-15	0.253	7.1	7.47	756			<0.03	<0.002	<0.03	0.34	<0.01	0.05	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	0.03	0.012	<5	15		390	300
Spring 94-110	9-Nov-15	0.179	5.9	7.50	758			0.09	0.007	0.24	0.45	<0.01	0.04	<0.001	<0.001	<0.01		<0.2		0.001	<0.01	<0.02	<0.02	0.011		5		412	289
Spring 94-110	9-Jul-16	0.192	7.3	7.48	748																								
Spring 94-110	14-Nov-16	0.126	5.9	7.62	771																								
Spring 94-113	1-Jun-12	0																											
Spring 94-113	27-Jun-13	0																											
Spring 94-113	26-Sep-13	<.01	7.1	7.99	1808			0.02	0.043	<0.05	8.8	<0.05	0.13	<0.005	<0.005	<0.005		<0.2	<0.01	<0.005	0.02	0.02	0.02	<0.01		<5		545	421
Spring 94-113	23-Oct-13	<0.01	5.3	7.69	1,830																								
Spring 94-113	28-May-14	<0.05	11.2	7.74	1,761																								
Spring 94-113	23-Sep-14	0																											
Spring 94-113	28-Oct-14	0.000																											

			Field Measurements					Trace Metals																		Other parameters			
	Date	Flow gpm	T °C	pH S.U.	Cond. µS/cm	D.O. mg/l	Turb NTU	D-Fe mg/L	D-Mn mg/L	D-Al mg/L	Al-T mg/L	D-As mg/L	D-B mg/L	D-Cd mg/L	D-Cr mg/L	D-Cu mg/L	T-Hg ug/L	D-Hg ug/L	D-Mb mg/L	D-Ni mg/L	D-Pb mg/L	D-Se mg/L	T-Se mg/L	D-Zn mg/L	O&G mg/L	Acidty mg/L	CN mg/L	T-Alk mg/L	T-Hard mg/L
Spring 94-113	21-Jun-15	0.000																											
Spring 94-113	21-Sep-15	0.000																											
Spring 94-113	8-Nov-15	Damp																											
Spring 94-113	28-Jun-16	0																											
Spring 94-113	25-Sep-16	0.000																											
Spring 94-113	11-Nov-16	0.000																											
A Spring	8-Nov-13	1.47	6.7	7.47	882																								
A Spring	31-Jul-14	1.76	6.4	7.5	946																								
A Spring	21-Nov-14	1.42	6.2	7.54	944			<0.03	<0.002	<0.03	0.06	<0.01	0.07	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	NM	10		458	292
A Spring	31-Jul-15	1.60	6.7	7.52	904			<0.03	<0.002	<0.03	0.11	<0.01	0.09	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	0.02	0.007	NM	<5		454	305
A Spring	14-Nov-15	0.83	6.8	7.45	997			<0.03	<0.002	0.09	<0.03	<0.01	0.08	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004		5		472	302
A Spring	23-Jul-16	1.01	7.0	7.58	953																								
A Spring	15-Nov-16	1.06	7.0	7.51	947																								
B Spring	8-Nov-13	4.31	6.4	7.5	717																								
B Spring	31-Jul-14	5.37	6.0	7.54	753																								
B Spring	21-Nov-14	0.773	5.3	7.59	782			<0.03	<0.002	<0.03	0.14	<0.01	0.03	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	NM	<5		383	346
B Spring	31-Jul-15	6.020	6.1	7.52	738			<0.03	<0.002	<0.03	0.05	<0.01	0.05	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	0.03	<0.004	NM	<5		379	363
B Spring	14-Nov-15	0.340	6.2	7.48	717			<0.03	<0.002	0.63	0.63	<0.01	0.04	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	0.03	<0.004		<5		385	345
B Spring	23-Jul-16	3.04	6.5	7.59	733																								
B Spring	15-Nov-16	0.000	—	—	—																								
D Spring	11-Nov-13	0.545	7.7	9.44	235			3.25	0.014	7.3	61.7	<0.05	0.09	<0.005	0.006	<0.005		<0.2	<0.01	<0.005	<0.02	<0.02	0.39	0.02		<5		151	18
D Spring	30-Jun-14	0																											
D Spring	25-Sep-14	0																											
D Spring	29-Jul-15	0																											
D Spring	9-Nov-15	0																											
A2S-1	11-Nov-13	0																											
A2S-1	30-Jun-14	0.106	9.5	7.98	832			<0.03	<0.002	<0.03	2.13	<0.01	0.05	<0.001	<0.001	<0.01		<0.2		0.001	<0.01	<0.02	<0.02	<0.004	NM	<5		410	77
A2S-1	25-Sep-14	0.028	12.9	7.97	882			0.11	0.003	0.26	1.16	<0.01	0.07	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	NM	<5		438	75
A2S-1	11-Nov-14	0.063	5.9	7.97	909			<0.03	<0.002	<0.03	4.17	<0.01	0.06	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	NM	<5		459	73
A2S-1	29-Jul-15	0.062	12.1	7.37	832			<0.03	<0.002	<0.03	3.93	<0.01	0.07	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	0.014	NM	<5		421	81
A2S-1	9-Nov-15	0.045	7.2	8.03	902			0.28	0.246	4.24	4.24	<0.01	0.07	.001<0.001		<0.01		<0.2		0.001	<0.01	<0.02	<0.02	0.009		<5		487	75
A2S-1	9-Jul-16	0.100	11.9	7.99	819																								
A2S-1	14-Nov-16	0.054	8.3	8.24	878																								
Divide Spring	1-Jul-14	1.63	7.4	7.59	743			<0.03	<0.002	<0.03	0.04	<0.01	0.06	<0.001	<0.001	<0.01		<0.2		0.001	<0.01	<0.02	<0.02	<0.004	NM	11		330	312
Divide Spring	25-Sep-14	DAMP																											
Divide Spring	11-Nov-14	0																											
Divide Spring	29-Jul-15	0.268	7.9	7.78	703			<0.03	<0.002	<0.03	0.06	<0.01	0.07	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	0.03	<0.004	NM	8		300	331
Divide Spring	9-Nov-15	0.000	—	—	—																								
Divide Spring	14-Nov-15	0	—	—	—																								
Divide Spring	9-Jul-16	2.36	10.7	7.52	720																								
Divide Spring	14-Nov-16	0.000	—	—	—																								
Hansen Seep	23-Apr-12	0.356	11.3	7.63	1489			0.48	0.279	0.4	1.7	<0.05	0.11	<0.005	<0.005	<0.005		<0.2	<0.01	<0.005	<0.02	0.02	0.02	<0.01		<5		411	475
Hansen Seep	27-Jun-13	<0.1	14.9	7.41	1461																								
Hansen Seep	26-Sep-13	0.284	8.4	7.85	1452			<0.02	0.041	<0.05		<0.05	0.09	<0.005	<0.005	<0.005		<0.2	<0.01	<0.005	<0.02	<0.02		<0.01				383	435
Hansen Seep	23-Oct-13	0.242	5.0	7.57	1,418																								
Hansen Seep	28-May-14	0.266	8.8	7.68	1,431																								
Hansen Seep	17-Sep-14	0.196	10.9	7.64	4,590																								
Hansen Seep	28-Oct-14	0.226	6.1	7.44	1,473			<0.03	0.081	<0.03	0.33	<0.01	0.07	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	0.01	NM	17		383	430
Skutumpah Spring	8-Nov-13	12.2	7.0	7.53	785																								
Skutumpah Spring	31-Jul-14	14.9	6.6	7.59	805																								
Skutumpah Spring	21-Nov-14	13.4	6.8	7.63	819			<0.03	<0.002	<0.03	0.12	<0.01	0.05	<0.001	<0.001	<0.01		<0.02		<0.001	<0.01	<0.02	<0.02	<0.004	NM	7		371	264
Skutumpah Spring	31-Jul-15	14.0	6.7	7.39	786			<0.03	<0.002	<0.03	<0.03	<0.01	0.07	<0.001	<0.001	<0.01		<0.2		<0.001	<0.01	<0.02	<0.02	<0.004	NM	6		373	271
Skutumpah Spring	14-Nov-15	13.2	17.0	7.50	777			<0.03	<0.002	<0.03	0.07	<0.01	0.06	<0.001	<0.001	<0.01		<0.02		<0.001<0.01		<0.02	0.03	).00453.76		6		371	270
Skutumpah Spring	23-Jul-16	13.3	7.0	7.59	785																								
Skutumpah Spring	15-Nov-16	12.0	7.2	7.58	793																								

			Field Measurements					Trace Metals																	Other parameters				
		Flow	T	pH	Cond.	D.O.	Turb	D-Fe	D-Mn	D-Al	Al-T	D-As	D-B	D-Cd	D-Cr	D-Cu	T-Hg	D-Hg	D-Mb	D-Ni	D-Pb	D-Se	T-Se	D-Zn	O&G	Acidty	CN	T-Alk	T-Hard
	Date	gpm	°C	S.U.	µS/cm	mg/l	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
USP-1	20-Nov-09	0.18	4.2	7.59	1,146																								
USP-2	20-Nov-09	0.43	5.5	7.46	1,287																								
Spg 99	11-Nov-14	0.200	5.0	7.61	660																								
Spg 99	29-Jul-15	0.337	8.3	7.38	584																								
Spg 99	9-Nov-15	0.229	5.5	7.51	620																								
Spg 99	9-Jul-16	0.265	8.2	7.74	560																								
Spg 99	14-Nov-16	0.130	5.5	7.79	637																								

Table 3 Precipitation data from the Salina 24E Weather Station.

	Monthly total precipitation (inches)												
YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	TOTAL
1984-85	2.87	0.00	0.90	0.69	0.59	2.07	2.13	0.99	0.99	2.74	0.05	0.99	**15.01**
1985-86	1.00	1.69	1.40	0.61	1.80	0.96	2.27	1.94	0.31	1.86	1.80	1.47	**17.11**
1986-87	1.05	1.34	0.18	0.99	0.82	1.52	0.45	2.45	0.60	2.21	1.38	0.65	**13.64**
1987-88	1.95	1.86	1.41	1.58	0.10	1.12	1.98	0.73	0.50	1.78	2.31	1.24	**16.56**
1988-89	1.05	0.91	1.35	0.84	0.81	1.38	0.29	1.11	0.40	1.35	1.82	0.89	**12.20**
1989-90	0.20	0.06	0.70	0.41	0.83	0.90	1.23	0.08	0.87	0.59	1.08	2.20	**9.15**
1990-91	1.36	0.32	0.87	0.88	0.41	1.78	1.47	1.14	0.48	1.76	3.02	2.17	**15.66**
1991-92	0.60	1.08	0.94	0.15	1.04	2.27	0.70	2.86	0.65	0.56	1.16	1.16	**13.17**
1992-93	1.01	1.77	1.04	2.13	2.61	1.80	0.07	1.79	1.03	0.23	1.29	0.23	**15.00**
1993-94	2.44	1.48	0.52	0.53	0.98	0.31	1.57	0.15	0.09	0.41	1.43	1.17	**11.08**
1994-95	1.56	2.17	0.37	1.08	0.44	2.33	1.52	3.28	1.27	0.54	1.92	0.58	**17.06**
1995-96	0.14	0.67	1.59	2.22	1.31	1.12	0.30	0.66	0.42	0.85	0.80	1.68	**11.76**
1996-97	1.24	1.74	1.52	1.95	1.34	0.27	2.10	1.33	0.95	1.64	3.16	4.79	**22.03**
1997-98	0.76	0.51	0.33	1.07	2.62	0.98	0.45	0.79	1.76	1.89	2.34	4.47	**17.97**
1998-99	3.08	0.74	0.17	0.95	0.76	0.14	2.23	1.32	1.55	1.75	1.89	1.40	**15.98**
1999-00	0.14	0.06	0.47	0.99	1.32	0.77	0.02	1.22	0.86	0.84	2.28	0.98	**9.95**
2000-01	2.94	0.25	0.47	1.45	1.49	0.67	0.39	1.24	1.32	0.74	1.31	0.16	**12.43**
2001-02	0.32	1.77	0.40	0.60	0.57	0.51	0.04	0.05	0.40	1.16	0.21	3.47	**9.50**
2002-03	1.52	1.64	0.52	0.23	0.79	0.77	0.34	0.92	0.14	0.90	2.86	0.51	**11.14**
2003-04	0.53	0.95	1.34	0.43	1.69	0.08	2.03	0.18	0.47	1.14	0.80	0.47	**10.11**
2004-05	2.09	1.98	0.75	1.69	0.81	0.66	0.47	1.45	4.05	0.28	1.87	0.95	**17.05**
2005-06	0.85	0.75	0.72	1.21	0.45	1.92	1.22	0.13	0.00	1.21	1.60	1.64	**11.70**
2006-07	4.44	0.52	0.75	0.08	0.54	0.60	0.45	0.34	0.20	0.60	0.95	1.12	**10.59**
2007-08	0.66	0.04	2.02	1.58	1.55	0.57	0.18	0.70	0.37	0.10	0.84	0.32	**8.93**
2008-09	0.82	0.64	0.86	0.84	0.62	0.88	1.17	2.16	1.47	0.64	0.22	0.76	**11.08**
2009-10	0.43	0.31	1.51	1.03	1.08	1.07	1.56	0.92	0.76	1.96	1.38	0.00	**12.01**
2010-11	4.39	1.22	3.28	0.32	1.05	1.11	2.16	2.68	0.78	2.82	1.45	1.04	**22.30**
2011-12	1.13	0.39	0.64	0.86	0.80	0.82	0.59	0.00	0.00	2.75	1.04	0.62	**9.64**
2012-13	1.14	0.20	1.54	0.69	0.28	0.83	0.72	1.25	0.00	0.53	2.50	5.17	**14.85**
2013-14	1.16	1.79	0.51	0.49	1.35	0.41	0.31	1.00	0.24	1.67	3.08	2.49	**14.50**
2014-15	0.26	0.69	3.50	1.02	0.46	0.52	1.11	2.52	1.24	2.05	1.65	0.84	**15.86**
2015-16	1.66	0.38	1.36	1.33	0.30	0.38	1.32	1.11	0.09	0.74	1.42	2.72	**12.81**

Field monitoring summary for Greens Hollow tract surface water monitoring stations.										
Station ID	**M_STR 1**	**M_STR 2**	**M_STR 3**	**M_STR 4**	**M_STR 5**	**M_STR 6**	**M_STR7**	**M_STR8**	**Sufco 006 M_STR9**	**Sufco 007 M_STR10**
Location	Greens Canyon	Greens Canyon	Lower Cowboy Creek	Upper Cowboy Creek	Cowboy Creek	Greens Hollow	Unnamed Drainage	South Fork Muddy Ck.	S. Fork of N. Fork Quitchupah Ck.	Upper N. Fork Quitchupah Ck.
Start	6/6/01	8/7/02	6/6/01	6/7/01	8/8/02	6/7/01	9/25/02	9/26/02	10/5/79	10/5/79
End	5/10/04	5/10/04	5/10/04	9/25/12	5/11/04	5/11/04	5/13/04	5/13/04	9/12/12	9/26/12
# Visits	16	8	16	37	8	16	6	6	94	98
Flow (GPM)										
# NOF	13	1	2	21	1	5	6	0	1	0
# Samples	3	7	14	16	7	11	0	6	90	91
Maximum	672	460	491	717	598	27	0	15,644	1,116	6,032
Minimum	9.7	1.2	0.5	0.7	1.4	1.9	0.0	967.7	0.1	0.2
Median	50.1	2.9	2.6	12.6	2.0	5.7	0.0	2,767.0	112.2	188.5
Average	243.9	78.1	44.2	69.2	95.6	10.0	0.0	5,225.5	196.5	715.9
pH - Criteria: 6.5-9.0										
# Samples	3	7	13	15	7	10	0	6	90	91
Maximum	8.92	8.84	8.73	8.87	8.82	8.77	0.00	8.90	8.89	9.20
Minimum	8.48	7.97	7.72	8.48	6.50	7.92	0.00	8.69	7.10	7.30
Median	8.61	8.25	8.01	8.72	8.47	8.52	0.00	8.73	8.34	8.40
Average	8.7	8.3	8.1	8.7	8.3	8.5	0.00	8.8	8.3	8.3
Dissolved Oxygen (mg/l) - Criteria >4 (or >8 when early life stages are present)										
# Samples	3	7	13	14	7	10	0	6	43	44
Maximum	8.65	11.19	9.70	10.40	9.04	8.73	0.00	13.66	10.60	10.60
Minimum	7.53	5.84	3.58	5.23	7.23	3.14	0.00	7.51	5.00	5.65
Median	8.6	8.4	5.6	7.9	8.2	7.1	0.0	9.5	7.4	7.7
Average	8.3	8.3	6.1	7.8	8.2	6.8	0.0	9.9	7.5	7.8
Water Temperature (Degree C) - Criteria: <20										
# Samples	3	7	13	15	7	10	0	6	90	91
Maximum	13.6	14.9	13.0	21.2	10.3	23.3	0.0	16.2	22.8	22.5
Minimum	0.7	0.8	3.6	0.3	6.0	2.7	0.0	1.0	0.3	0.0
Median	9.9	9.3	8.4	12.1	9.5	12.1	0.0	4.9	14.7	12.5
Average	8.1	8.8	8.4	12.6	8.4	12.8	0.0	6.6	13.5	12.5
Specific Conductivity (uS/cm)										
# Samples	2	7	13	7	7	10	0	6	58	63
Maximum	567	722	659	869	616	822	0	371	1,300	1,384
Minimum	448	416	202	386	346	439	0	65	398	294
Median	507.7	509.0	404.7	514.0	445.8	572.0	0.0	240.4	710.0	490.0
Average	507.7	554.5	434.6	582.1	475.9	615.3	0.0	250.0	729.6	500.8

Table 4 Summary of stream monitoring data from the Greens Hollow Tract collected by Cirrus for 2001-2004 (USFS, 2005).

Table 5 Average discharge rates, chemical compositions, and mineral saturation indices of groundwaters and surface-waters.

	Field measurements					Major ions								Solids and total metals				Mineral saturation indices				
	Flow gpm	T °C	pH S.U.	Sp. Cond. µS/cm	D.O. mg/L	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	SI Calcite	SI Dolomite	SI Gypsum	SI Halite	Ratio Cl:Na
Groundwater																						
North Horn Formation Springs																						
M-SP04	1.41	5.3	7.66	777	—	—	—	—	—	—	—	—	—	566	91	0.68	0.04	—	—	—	—	—
M-SP05	0.14	6.9	7.83	813	—	—	—	—	—	—	—	—	—	568	90	0.91	0.07	—	—	—	—	—
M-SP06	1.55	5.7	7.88	808	—	27.4	16.6	169.5	1.3	563	<5	15.0	14.4	560	23	0.18	0.01	0.27	0.36	-2.77	-7.15	0.06
M-SP07	0.46	5.7	7.54	656	—	62.2	40.8	83.3	1.9	530	<5	29.1	30.0	508	—	0.86	0.01	0.25	0.35	-2.18	-7.15	0.23
M-SP08	0.25	11.0	7.77	863	—	67.2	37.2	98.6	2.3	523	<5	29.8	47.0	513	—	—	—	0.58	1.04	-2.17	-6.90	0.31
M-SP09	0.30	5.6	7.95	562	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M-SP10	0.33	7.9	7.70	630	—	48.5	39.3	87.3	2.4	436	<5	27.3	70.6	471	—	0.01	0.00	0.26	0.50	-2.31	-6.76	0.52
M-SP11	1.09	8.9	7.76	666	—	—	—	—	—	—	—	—	—	534	46	0.27	0.06	—	—	—	—	—
M-SP12	0.65	6.5	7.83	684	—	—	—	—	—	—	—	—	—	489	19	0.12	0.00	—	—	—	—	—
M-SP14	16.1	4.8	7.43	358	—	78.0	24.5	16.0	0.8	417	<5	6.4	2.9	336	—	0.00	0.00	0.16	-0.18	-2.68	-8.87	0.12
M-SP15	0.71	11.2	7.84	714	—	—	—	—	—	—	—	—	—	552	23	0.26	0.05	—	—	—	—	—
M-SP19	2.35	6.3	8.05	668	—	—	—	—	—	—	—	—	—	521	19	0.25	0.01	—	—	—	—	—
M-SP20	2.13	9.0	7.76	631	—	—	—	—	—	—	—	—	—	470	29	0.32	0.02	—	—	—	—	—
M-SP40	0.24	8.1	7.82	787	—	—	—	—	—	—	—	—	—	582	195	1.23	0.12	—	—	—	—	—
M-SP41	0.56	5.9	7.94	644	—	—	—	—	—	—	—	—	—	589	133	0.81	0.05	—	—	—	—	—
M-SP44	2.35	7.9	7.64	517	—	65.8	28.2	22.2	0.5	363	<5	20.3	1.4	349	31	0.24	0.02	0.28	0.27	-2.26	-9.04	0.04
M-SP45	1.43	5.5	7.46	835	—	—	—	—	—	—	—	—	—	578	25	0.47	0.01	—	—	—	—	—
M-SP53	0.10	8.7	7.70	644	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M-SP59	0.26	6.6	7.84	549	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M-SP60	0.56	7.8	7.65	786	—	55.6	41.8	93.7	1.8	519	<5	25.8	38.3	529	26	0.18	0.01	0.33	0.62	-2.29	-7.00	0.27
M-SP100	0.84	7.2	7.45	578	—	—	—	—	—	—	—	—	—	396	39	0.17	0.01	—	—	—	—	—
M-SP103	1.07	10.6	7.82	622	—	—	—	—	—	—	—	—	—	394	86	0.45	0.03	—	—	—	—	—
M-SP104	0.27	11.7	8.09	615	—	—	—	—	—	—	—	—	—	355	136	0.81	0.09	—	—	—	—	—
M-SP105	0.66	10.0	7.94	606	—	—	—	—	—	—	—	—	—	381	106	1.31	0.16	—	—	—	—	—
M-SP106	0.51	6.4	7.72	764	—	—	—	—	—	—	—	—	—	527	83	1.22	0.04	—	—	—	—	—
Spring 94-110	0.19	6.4	7.54	757	—	69.7	28.4	59.8	1.3	470	<5	8.2	10.8	445	28	0.14	0.01	0.28	0.22	-2.65	-7.73	0.12
A2S-1	0.06	9.7	7.94	865	—	18.1	7.6	188	1.4	513	<5	23.8	12.0	550	194	1.69	0.10	0.18	0.10	-2.75	-7.19	0.04
Divide Spring	0.53	8.7	7.63	722	—	54.7	45.2	39.5	1.3	384	<5	80.0	7.5	436	150	0.02	0.00	0.19	0.40	-1.80	-8.08	0.12
GW-13	0.60	7.7	7.80	1,385	—	67.0	42.0	189	3.0	569	5	155	56.0	803	—	1.40	0.00	0.54	0.97	-1.51	-6.54	0.19
Spg 99	0.23	6.5	7.61	612	—	—	—	—	—	—	—	—	—	340	37	0.61	0.04	—	—	—	—	—
D Spring	0.11	7.7	9.44	235	—	3.4	2.3	43.3	2.8	171	7	3.0	2.0	133	848	26.60	1.48	0.43	0.81	-4.25	-8.57	0.03
North Horn Fm. Avg.	***1.23***	***7.67***	***7.81***	***689***		***51.5***	***29.5***	***90.9***	***1.73***	***455***	***<5***	***35.3***	***24.4***	***481***	***107***	***1.53***	***0.09***	***0.31***	***0.45***	***-2.47***	***-7.58***	***0.17***

	Field measurements					Major ions								Solids and total metals				Mineral saturation indices				
	Flow gpm	T °C	pH S.U.	Sp. Cond. µS/cm	D.O. mg/L	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	SI Calcite	SI Dolomite	SI Gypsum	SI Halite	Ratio Cl:Na
Price River Formation Springs																						
M-SP01	0.41	8.1	7.40	771	—	83.5	41.3	46.2	1.8	479	<5	27.1	42.1	474	—	0.00	0.00	0.23	0.24	-2.10	-7.26	0.59
M-SP02	1.57	8.1	7.56	772	—	79.3	33.7	56.7	2.0	467	<5	36.2	39.0	480	—	0.00	0.00	0.36	0.43	-1.99	-7.21	0.45
M-SP18	0.25	6.9	7.44	1,241	—	125.0	43.0	92.5	5.2	356	<5	295	201	867	—	6.62	0.06	0.20	0.02	-1.02	-6.30	1.41
M-SP38	5.11	8.3	7.65	286	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M-SP39	1.14	6.3	7.53	908	—	77.0	48.5	86.2	2.1	509	<5	69.3	60.4	661	—	0.05	0.00	0.30	0.45	-1.75	-6.84	0.45
M-SP82	2.79	5.5	7.84	525	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hansen Seep	0.22	9.3	7.60	1,902	—	117.0	36.9	153	2.8	478	<5	243	120	930	47	0.62	0.24	0.50	0.63	-1.13	-6.32	0.51
Sufco 006A Spring	0.33	6.0	7.49	1,252	—	61.1	24.1	202	3.4	648	<5	143	37.0	811	—	0.28	0.00	0.22	0.10	-1.56	-6.69	0.12
Skutumpah Spring	13.3	8.3	7.54	793	—	54.3	32.3	78.7	1.2	426	<5	49.3	11.0	478	9	0.02	0.00	0.15	0.16	-1.99	-7.61	0.09
Spring 94-113	0.00	7.9	7.81	1,800	—	114.0	33.0	263	4.2	665	<5	306	122	1,120	1,040	4.75	0.04	0.78	1.13	-1.08	-6.08	0.30
A Spring	1.31	6.7	7.51	939	—	59.0	37.3	108	1.7	528	<5	48.3	15.0	581	22	0.26	0.01	0.20	0.26	-1.99	-7.34	0.09
B Spring	2.84	6.1	7.54	740	—	72.6	42.1	34.4	1.4	438	<5	31.7	4.0	429	22	0.12	0.00	0.25	0.31	-2.06	-8.40	0.08
Price River Fm. Avg.	***2.44***	***7.29***	***7.58***	***994***		***84.3***	***37.2***	***112***	***2.59***	***500***	***<5***	***125***	***65.1***	***683***	***228***	***1.27***	***0.04***	***0.32***	***0.37***	***-1.67***	***-7.00***	***0.41***
Castlegate Sandstone Springs																						
M-SP87	1.55	5.6	7.85	1,116	—	90.3	48.7	92.9	3.5	410	<5	230.7	56.0	766	17	0.18	0.01	0.53	0.85	-1.21	-6.85	0.39
USP-1	0.18	4.2	7.59	1,146	—	71.0	47.7	90.6	4.8	434	<5	191.0	44.2	—	—	—	—	0.19	0.23	-1.36	-6.95	0.32
USP-2	0.43	5.5	7.46	1,287	—	90.5	55.9	75.6	4.5	335	<5	222.0	83.9	—	—	—	—	0.06	-0.03	-1.23	-6.76	0.72
Castlegate SS Avg.	**0.72**	**5.1**	**7.63**	1,183		**83.9**	**50.8**	**86.4**	**4.25**	**393**	**<5**	**215**	**61.4**	**766**	**17**	**0.18**	**0.01**	**0.26**	**0.35**	**-1.27**	**-6.85**	**0.48**
Surface Water																						
Cowboy Creek																						
M-STR03	39	8.4	8.13	435	6.2	54.6	30.0	39.7	2.6	347	<5	39	24.4	382	41	0.43	0.03	0.66	1.15	-2.07	-7.56	0.40
M-STR04	22	13.0	8.70	624	7.7	53.3	28.7	51.7	1.9	364	12	38	31.4	420	19	0.27	0.02	1.28	2.48	-2.13	-7.34	0.39
M-STR05	96	7.5	8.26	458	8.6	52.6	31.8	34.8	2.0	327	<5	31	21.8	342	84	0.25	0.01	0.73	1.32	-2.18	-7.66	0.41
Greens Hollow Creek																						
M-STR06	5.0	13.6	8.49	647	6.7	56.9	34.9	77.2	4.8	483	7	40	41.6	522	249	1.25	0.08	1.21	2.40	-2.12	-7.06	0.35
Greens Hollow Creek in Greens Canyon																						
M-STR01	32	8.7	8.64	505	8.2	46.0	27.0	42.7	2.0	328	11	27	16.5	450	11	0.36	0.01	1.08	2.03	-2.30	-7.69	0.25
M-STR02	68	8.8	8.49	554	8.3	64.7	38.0	43.5	3.3	355	<5	61	25.0	438	28	0.48	0.02	1.06	2.00	-1.84	-7.51	0.37

	Field measurements					Major ions								Solids and total metals				Mineral saturation indices				
	Flow gpm	T °C	pH S.U.	Sp. Cond. µS/cm	D.O. mg/L	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	TDS mg/L	TSS mg/L	T-Fe mg/L	T-Mn mg/L	SI Calcite	SI Dolomite	SI Gypsum	SI Halite	Ratio Cl:Na
Unnamed ephemeral tributary to Muddy Creek																						
M-STR07	0.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Muddy Creek (Main Fork)																						
U-Mud	14,414	9.8	8.73	390	8.7	50.7	28.3	23.0	1.1	264	8	36	11.0	297	11	0.12	0.01	1.13	2.13	-2.14	-8.14	0.31
PINES 405	20,615	8.2	8.62	386	8.5	41.3	22.8	8.0	<1	268	<5	11	1.8	220	199	2.78	0.02	0.93	1.70	-2.67	-9.38	0.14
Muddy Creek (South Fork)																						
M-STR08	5,225	6.6	8.77	250	9.9	48.7	24.5	9.0	0.6	261	5	9	2.1	238	13	0.17	0.01	1.11	1.98	-2.71	-9.25	0.15
Quitchupah Creek (South Fork)																						
S. Fk. Quitch. Up.	245	8.0	8.58	532	9.1	51.7	31.6	10.8	1.1	224	<5	94	2.0	343	15	0.14	0.01	0.86	1.61	-1.71	-9.20	0.12
Sufco 006A	207	10.1	8.56	622	8.5	53.2	30.9	29.3	1.6	297	<5	102	8.6	394	30	0.59	0.03	0.99	1.88	-1.69	-8.15	0.19
Sufco 006	211	12.7	8.34	656	7.7	58.4	34.3	26.7	1.9	302	6	97	12.5	410	80	1.53	0.06	0.88	1.72	-1.69	-8.03	0.30
Quitchupah Creek (South Fork)																						
Sufco 007	712	11.4	8.42	456	8.1	49.5	17.2	17.3	0.7	254	<5	34	8.8	269	10	1.58	0.06	0.83	1.36	-2.13	-8.35	0.33
Skutumpah Creek																						
Skutumpah Ck. Up.	68	9.0	8.49	532	9.0	42.8	30.2	22.2	1.8	240	11	67	5.0	323	30	0.36	0.01	0.79	1.55	-1.93	-8.49	0.15

Note: For laboratory results where a "less then" value was reported, a zero value was used in the average calculations.

Table 6 Isotopic compositions of groundwaters and surface waters.

		δ^2H (‰)	$\delta^{18}O$ (‰)	Tritium (TU)	$\delta^{13}C$ (‰)	^{14}C (pmC)	Groundwater "age" radiocarbon years
Springs, Muddy Tract Area							
M-SP07	9/26/2001	-123	-16.4	12.7	-10.8	93.31	modern
M-SP08	9/26/2001	-120	-16.4	13.3	-11.2	95.69	modern
M-SP10	10/4/2001	-125	-17.1	11.6	-12.2	91.15	modern
M-SP39	10/4/2001	-123	-16.6	7.7	-10.5	88.34	modern
M-SP01	10/4/2001	-120	-16.1	5	-11.9	96.27	modern
M-SP02	10/4/2001	-120	-16.1	14.6	-12.6	98.15	modern
M-SP04	10/4/2001	-124	-16.3	7.7	-11.1	84.4	modern
M-SP14	9/26/2001	-117	-15.7	8	-14.1	107.73	modern
M-SP18	10/4/2001	-129	-17.4	-0.7	-12.4	78.89	modern
M-SP38	10/5/2001	-127	-17.2	9.6	-12.5	62.11	modern
USP-1	11/20/2009	---	---	2.8	-10.98	63.02	modern
USP-2	11/20/2009	---	---	4.2	-11.48	67.67	modern
GW-13	10/3/1995	---	---	8.57	---	---	modern
GW-13	6/10/1996	---	---	5.63	---	---	modern
Streams, Muddy Tract Area							
Sufco 007 (North Fork Quit)	10/3/1995	---	---	15.6	---	---	modern
Sufco Mine underground							
Greens Hollow Area							
XC51 2 South Bleeder	5/6/2015	---	---	<0.5	-10.3	28.31	5,000
3 Right 2 South Bleeder	5/6/2015	---	---	<0.5	-9.0	12.15	12,200
5 West #4 Entry R.D.	5/6/2015	---	---	<0.5	-9.0	9.00	13,300
XC51 2 South Bleeder	9/1/2015	---	---	0.03	-9.9	28.39	4,600
3R 2S Bleeder Gob Drain	9/1/2015	---	---	0.05	-4.8	24.2	---
5 West #4 Entry R.D.	9/1/2015	---	---	0.00	-8.9	9.87	12,500
Big Ridge Area							
5 Left XC57 Roof Drip	1/25/2010	---	---	0.1	-10.37	28.45	5,000
6 Left XC16 Roof Drip	1/25/2010	---	---	0.1	-10.39	22.36	7,000
Box Canyon Area							
14 Left Setup Room	9/20/2000	---	---	0.07	-9.9	31.42	4,000
14 Left E2 XC101	9/20/2000	---	---	0.01	-10.2	24.45	6,000
Quitchupah Area							
12L 4E E3 C74 1/2	9/18/1997	-120.06	-16.22	-0.07	-11.2	21.07	7,500
12L 4E fault	9/18/1997	-118.55	-16.12	-0.02	-7.1	20.38	7,500
13L 4E E2 C53	12/7/1998	---	---	-0.02	-7.2	6.28	15,000
2 Right 2 South Fracture	12/16/2011	---	---	-0.01	---	---	---
2 South Bleeder 16	12/16/2011	---	---	0.09	---	---	---
1RT 2STH E1XC45 Fault	2/23/2012	---	---	0.00	---	---	---

Table 7 Results of gain/loss study of Muddy Creek, 28-29 October 2015.

Station	Site	Date/Time	Discharge (cfs)	Discharge (gpm)	T (°C)	pH (S.U.)	Sp. Cond. (µS/cm)
1	Upper Muddy Creek (U-Mud)	10/28/2015 12:30	9.63	4,320	3.6	8.65	412
2	Muddy Creek above Horse Creek	10/28/2015 16:00	10.20	4,580	3.8	8.68	407
2a	Horse Creek tributary to Muddy Creek	10/28/2015 15:00	1.56	700	4.8	8.7	488
2b	Cowboy Creek and Greens Hollow Creek tributaries to Muddy Creek	10/28/2015 18:30	0.00	0.00	---	---	---
2c	Box Canyon Creek tributary to Muddy Creek (Pines 403)	10/29/2015 11:20	0.17	75	5.1	8.42	951
3	Muddy Creek below Box Canyon Creek (Pines 405)	10/29/2015 12:00	11.92	5,350	4.6	8.67	411
3a	Last Water Canyon tributary to Muddy Creek (Pines 302)	10/29/2015 13:30	0.00	0.04	7.2	8.85	446
4	Muddy Creek at USGS gauging station 09330500 (Pines 406b)	10/29/2015 8:00	10.90	4,890	4.5	8.57	422

Table 8 Recommended hydrologic monitoring protocols.

Discharge and water level measurements

Protocol	Applies to	Parameter	Frequency
D	Springs	Discharge	Quarterly when reasonably accessible
C	Streams	Discharge	Quarterly when reasonably accessible
J	Streams	Discharge	Quarterly when reasonably accessible for one year prior to commencement of longwall mining in area, continuing until one year after longwall mining in the area is complete

Water quality

Protocol	Applies to	Parameters	Table	Frequency
1	Stream	Quarterly surface-water quality field measurements only	11	Quarterly when reasonably accessible
2	Stream	Quarterly surface water quality operational laboratory measurements		
3	Spring	Quarterly groundwater quality field measurements only	10	Quarterly when reasonably accessible
9	Stream	Quarterly surface-water field and operational laboratory water quality measurements	11	Quarterly when reasonably accessible for one year prior to commencement of longwall mining in area, continuing until one year after longwall mining in the area is complete

Table 9 Recommended discharge, water level, and water quality plan for springs and wells.

Site	Protocols	Comments
Springs		
M-SP01	D, 3	Price River spring in Greens Hollow Canyon, previously cabin supply (currently in Sufco mon. plan)
M-SP02	D, 3	Price River spring in Greens Hollow Canyon, developed with trough (currently in Sufco mon. plan)
M-SP04	D, 3	North Horn spring in Greens Hollow Canyon
M-SP05	D, 3	North Horn spring in Greens Hollow Canyon
M-SP06	D, 3	North Horn spring in Greens Hollow Canyon
M-SP08	D, 3	North Horn spring on Big Ridge (currently in Sufco mon. plan)
M-SP09	D, 3	North Horn spring on Big Ridge
M-SP11	D, 3	North Horn spring on flanks of White Mountain
M-SP12	D, 3	North Horn spring in Greens Hollow Canyon
M-SP15	D, 3	North Horn spring in Greens Hollow Canyon
M-SP18	D, 3	Price River spring in the Muddy Creek drainage (currently in Sufco mon. plan)
M-SP19	D, 3	North Horn spring in N. Fork of Quitchupah drainage
M-SP20	D, 3	North Horn spring in N. Fork of Quitchupah drainage
M-SP39	D, 3	Price River spring at base of Big Ridge (currently in Sufco mon. plan)
M-SP40	D, 3	North Horn spring in Cowboy Creek drainage
M-SP41	D, 3	North Horn spring in Cowboy Creek drainage
M-SP44	D, 3	North Horn spring in N. Fork of Quitchupah drainage
M-SP45	D, 3	North Horn spring
M-SP53	D, 3	North Horn spring on Big Ridge (currently in Sufco mon plan)
M-SP60	D, 3	North Horn spring in N. Fork of Quitchupah Creek
M-SP87	D, 3	Castlegate spring in Muddy Creek Canyon
M-SP103	D, 3	North Horn spring in N. Fork Quitchupah Canyon
M-SP104	D, 3	North Horn spring in N. Fork Quitchupah Canyon
M-SP105	D, 3	North Horn spring in N. Fork Quitchupah Canyon

Site	Protocols	Comments
M-SP106	D, 3	North Horn spring in Greens Hollow Canyon
GW-13	D, 3	North Horn spring on Big Ridge
Streams		
M-STR04	C, 1	Cowboy Creek (currently in Sufco mon. plan)
M-STR06	C, 1	Top Greens Canyon
U-Mud	C, 1	Confluence N&S Forks Muddy Creek
Pines 405	C, 1	Cowboy Creek (currently in Sufco mon. plan)
Sufco 006	C, 2	South Fork of Quitchupah Creek (currently in Sufco mon. plan)
Sufco 007	C, 2	North Fork of Quitchupah Creek (currently in Sufco mon. plan)

Table 10 Recommended field and laboratory operational water quality monitoring parameters for groundwater.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductivity	µS/cm @ 25°C
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Total Hardness (as $CaCO_3$)	mg/L
Total Alkalinity (as $CaCO_3$)	mg/L
Bicarbonate (as $CaCO_3$)	mg/L
Carbonate(as $CaCO_3$)	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Cations	meq/l
Anions	meq/l
Cation/Anion Balance	%

Table 11 Recommended field and laboratory operational water quality monitoring parameters for surface water.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductance	µS/cm @ 25°C
Temperature	°C
Dissolved Oxygen	mg/L
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Total Suspended Solids	mg/L
Total Hardness (as $CaCO_3$)	mg/L
Total Alkalinity (as $CaCO_3$)	mg/L
Bicarbonate (as $CaCO_3$)	mg/L
Carbonate(as $CaCO_3$)	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Oil and Grease	mg/L
Cations	meq/l
Anions	meq/l
Cation/Anion Balance	%

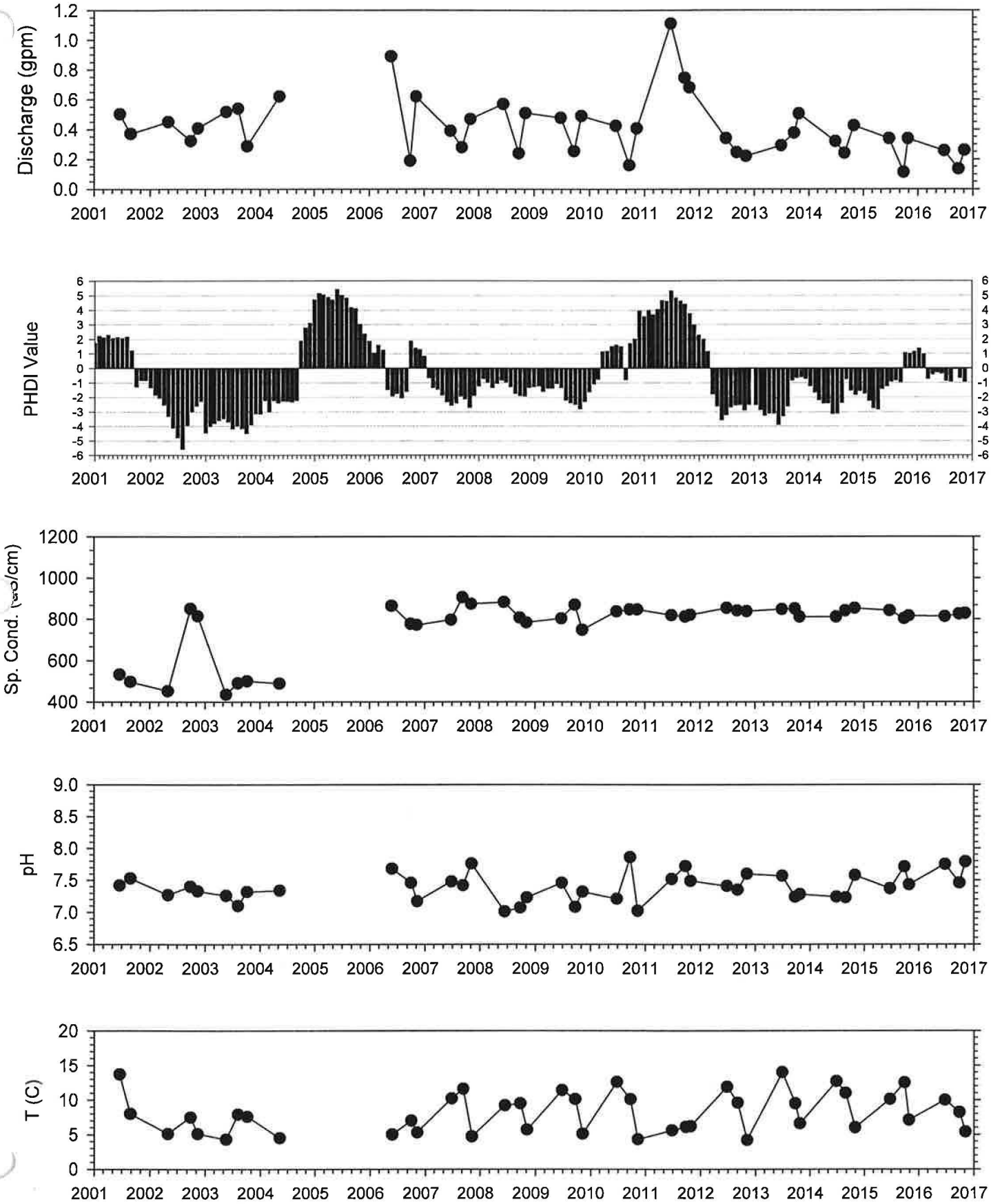
Attachment A

Discharge hydrographs for selected springs

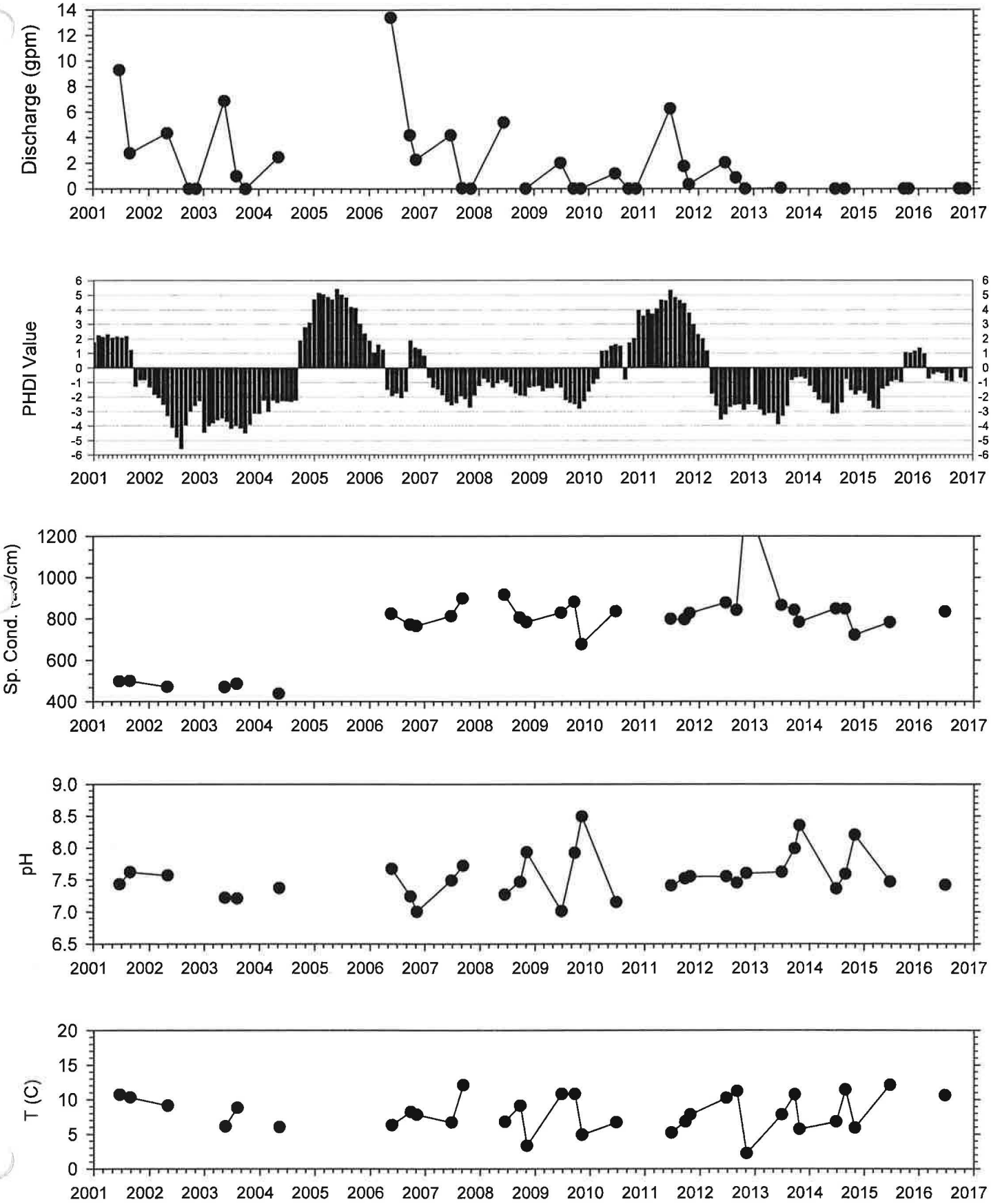
Plots of temperature, pH, specific conductance,

and Palmer Hydrologic Drought Index.

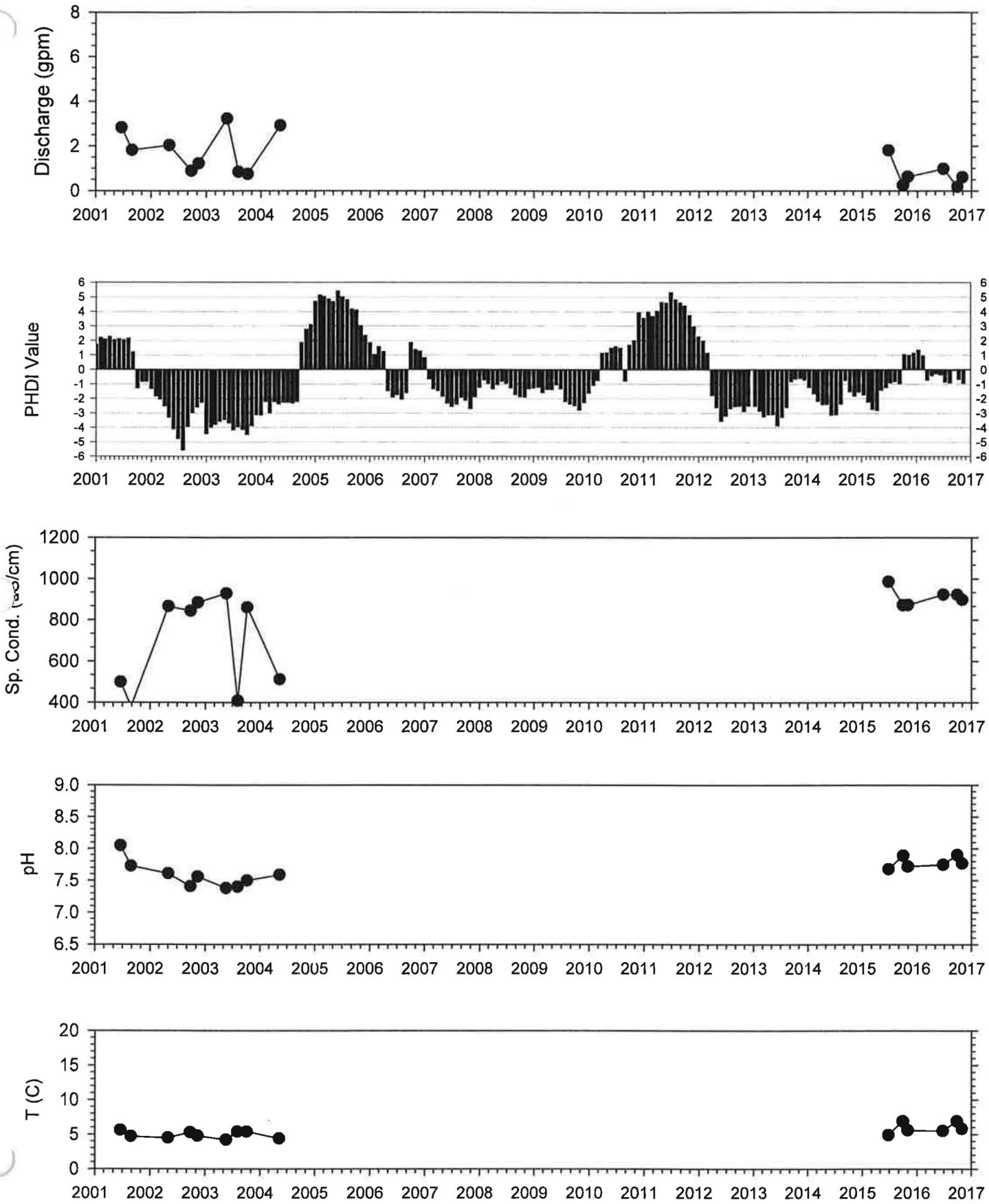
Spring M-SP01



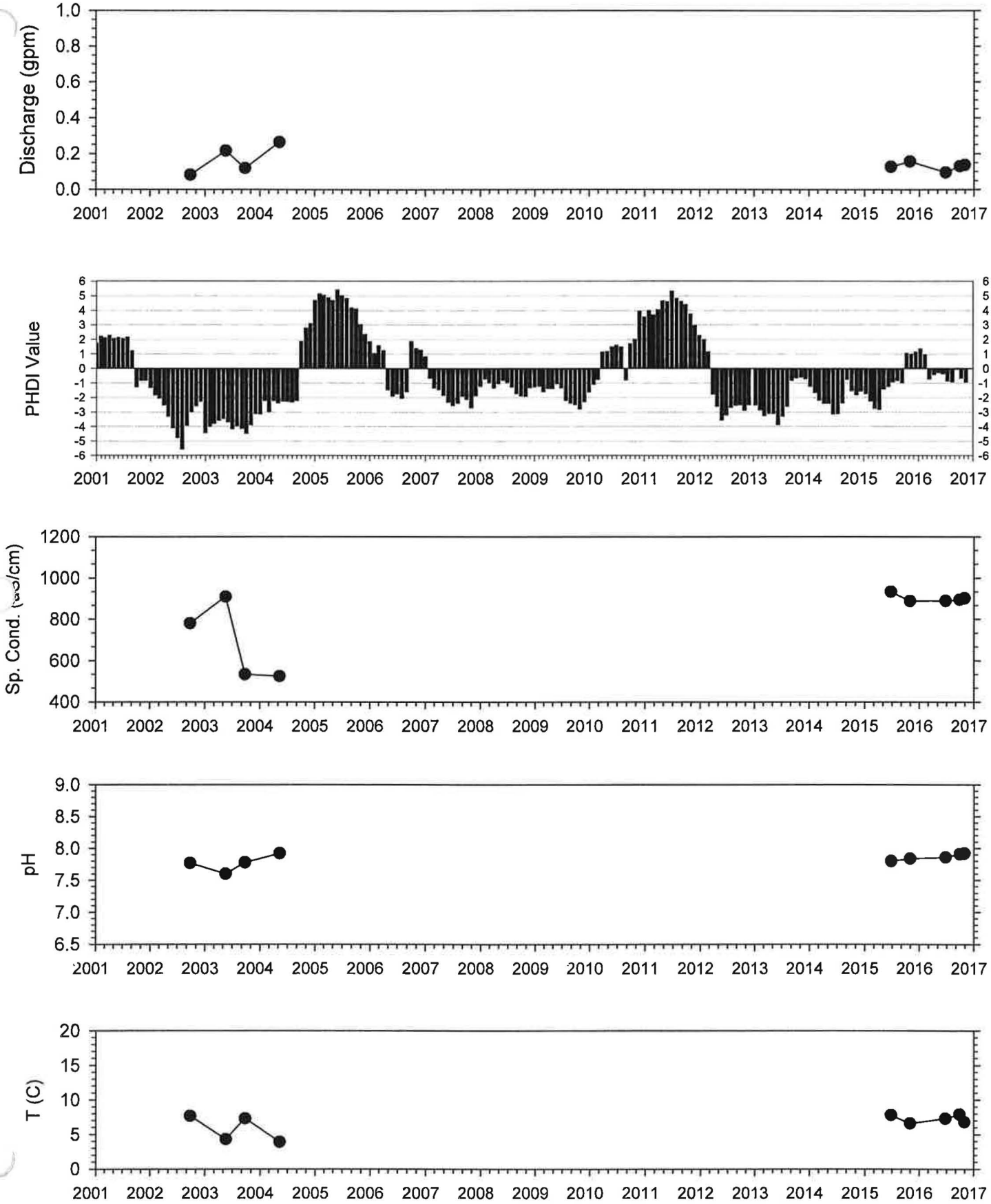
Spring M-SP02



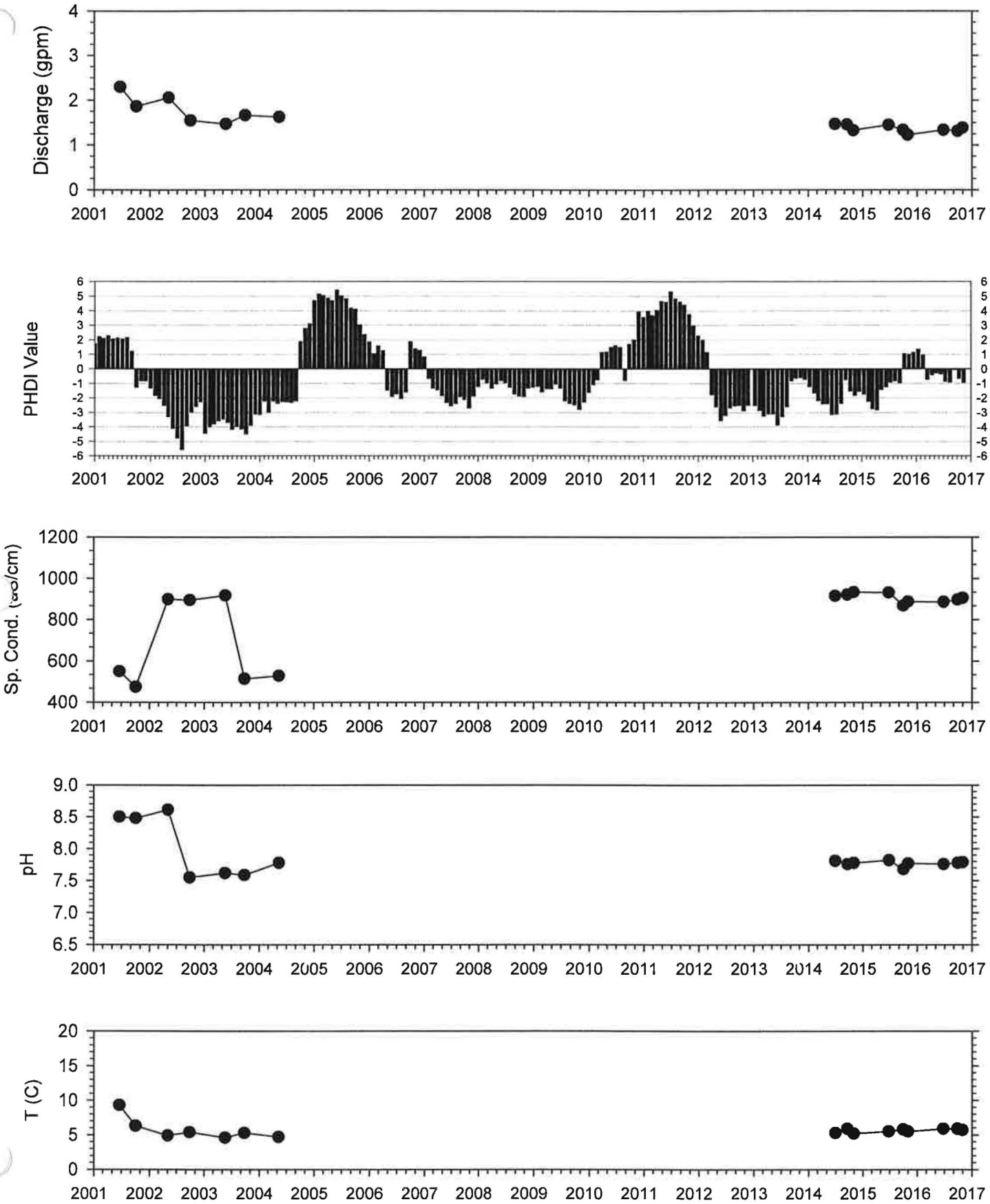
Spring M-SP04



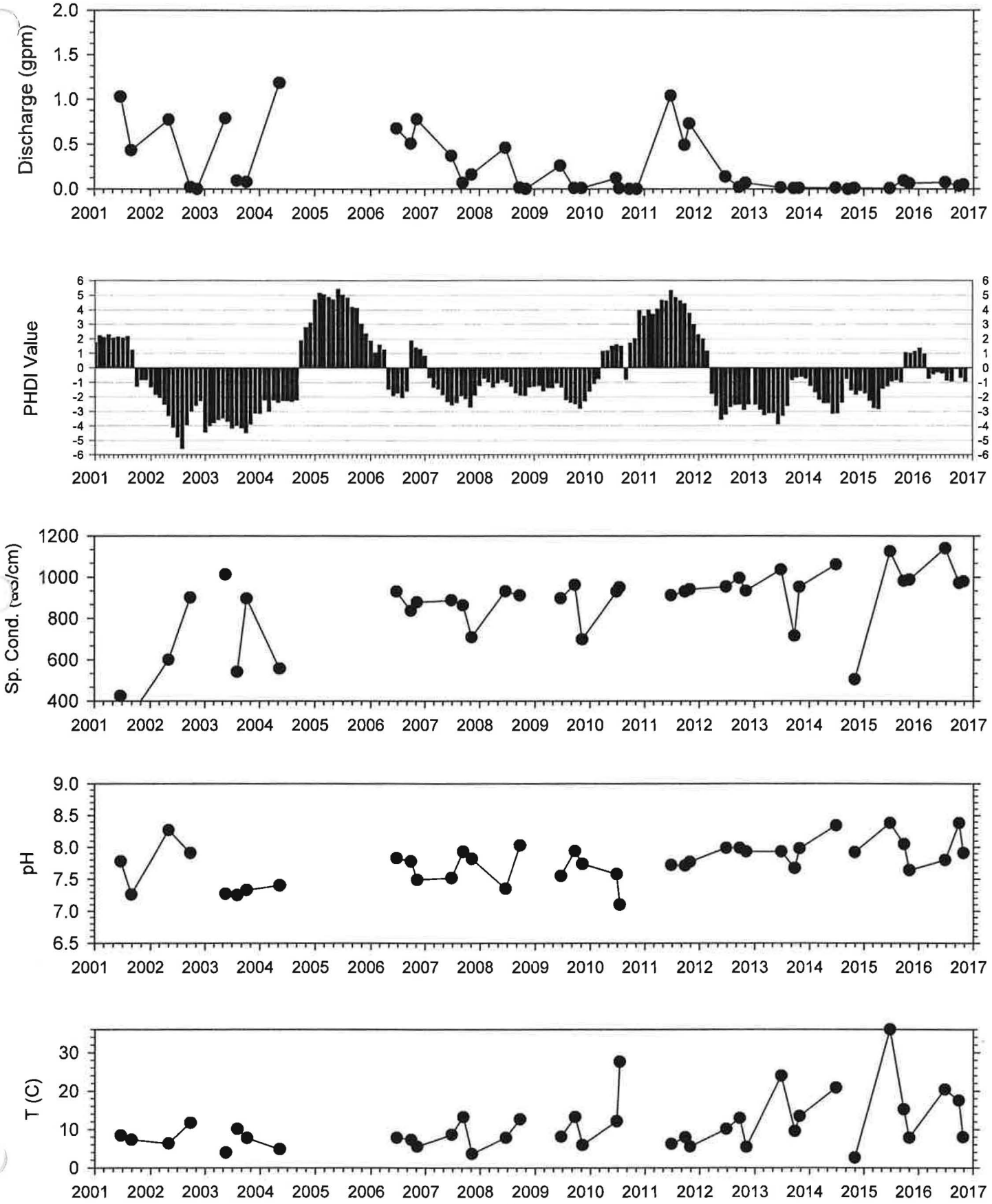
Spring M-SP05



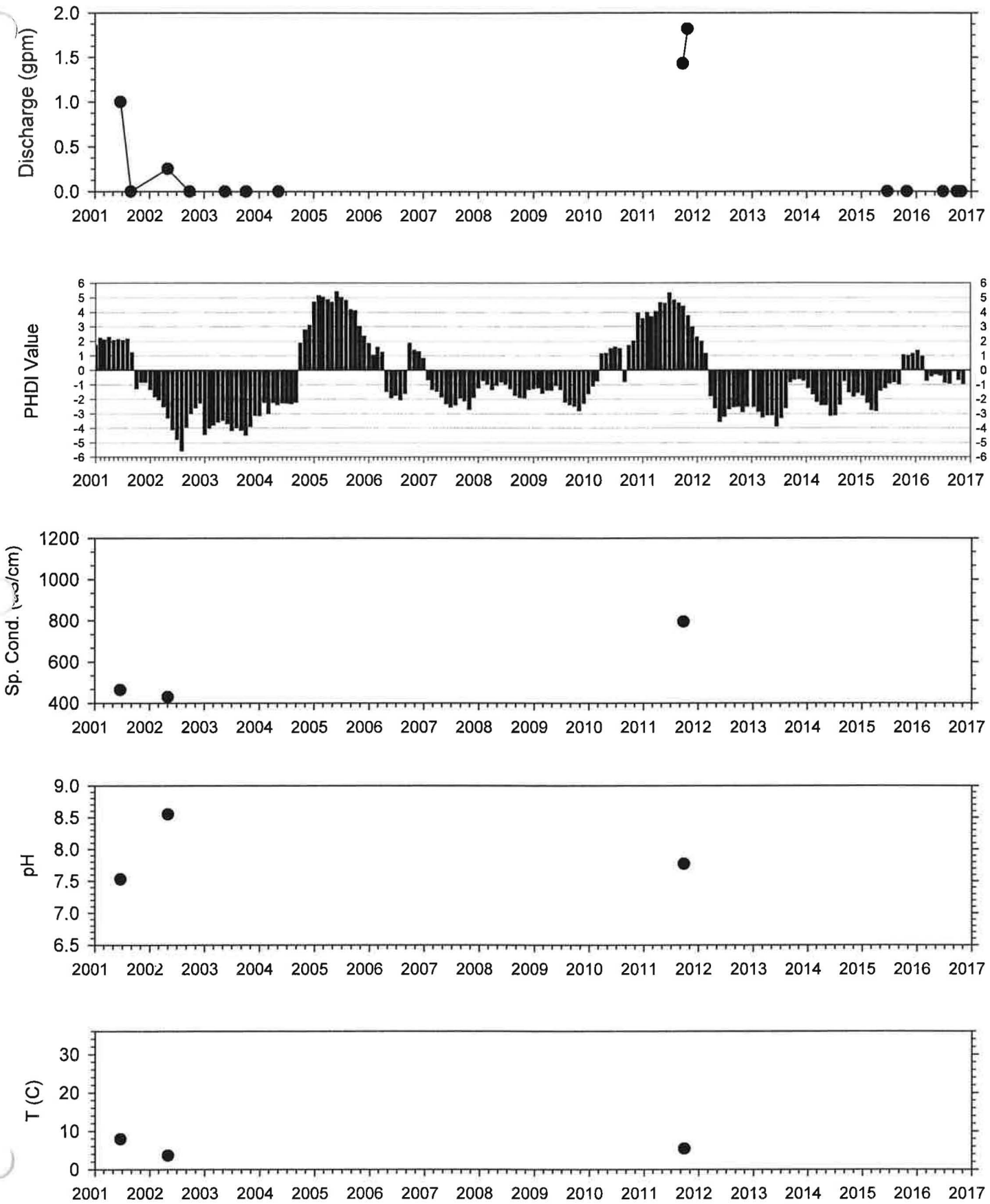
Spring M-SP06



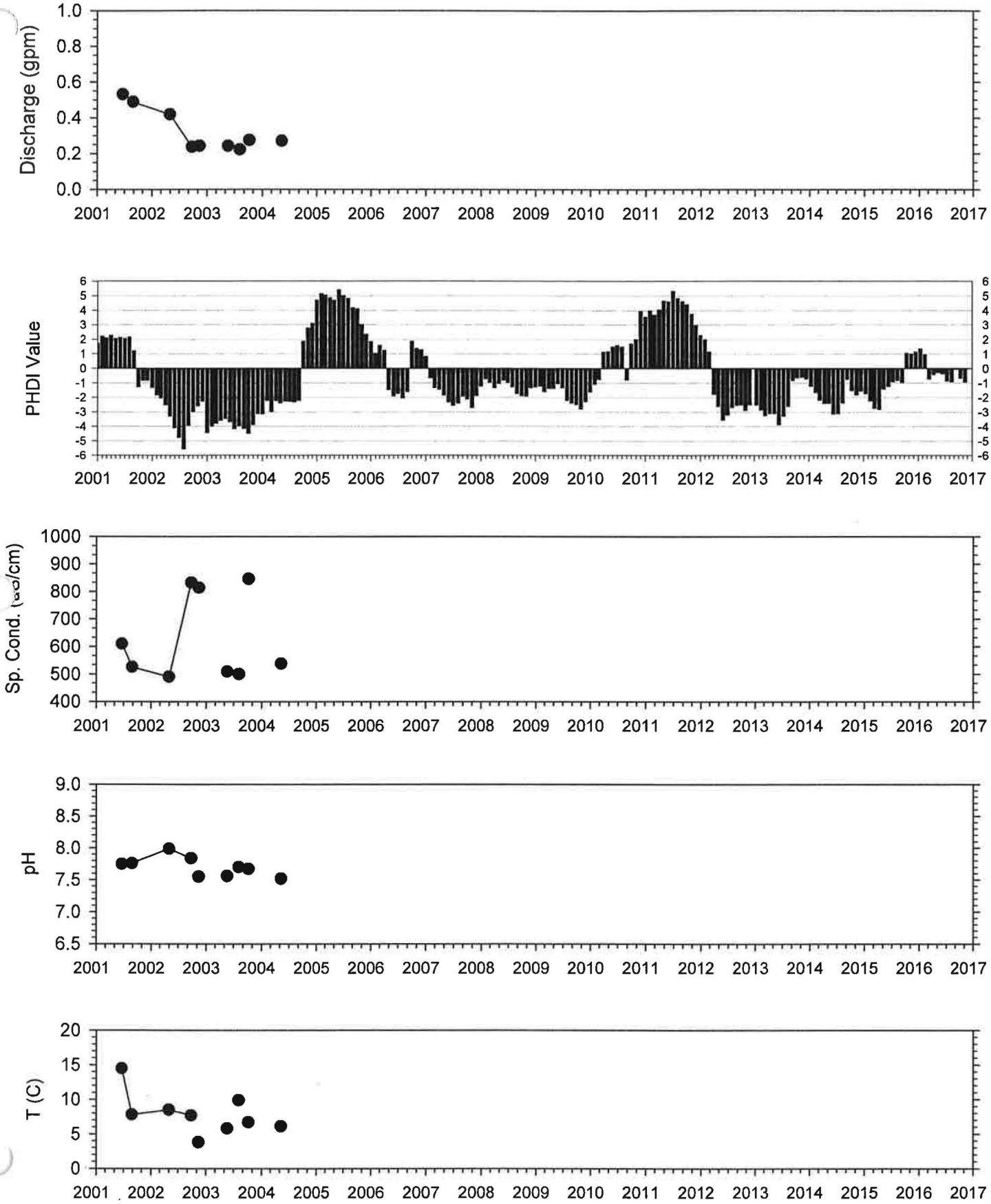
Spring M-SP08



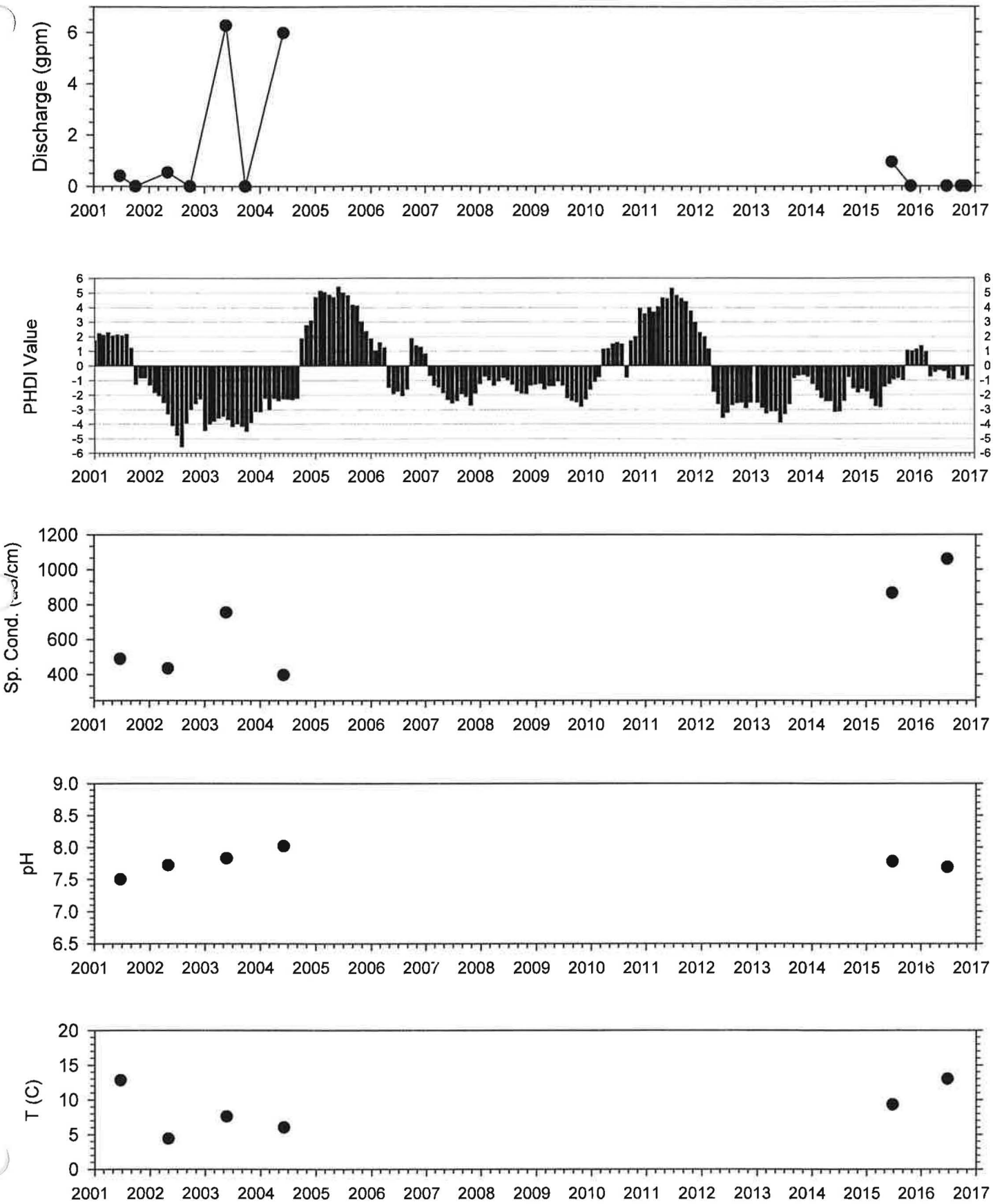
Spring M-SP09



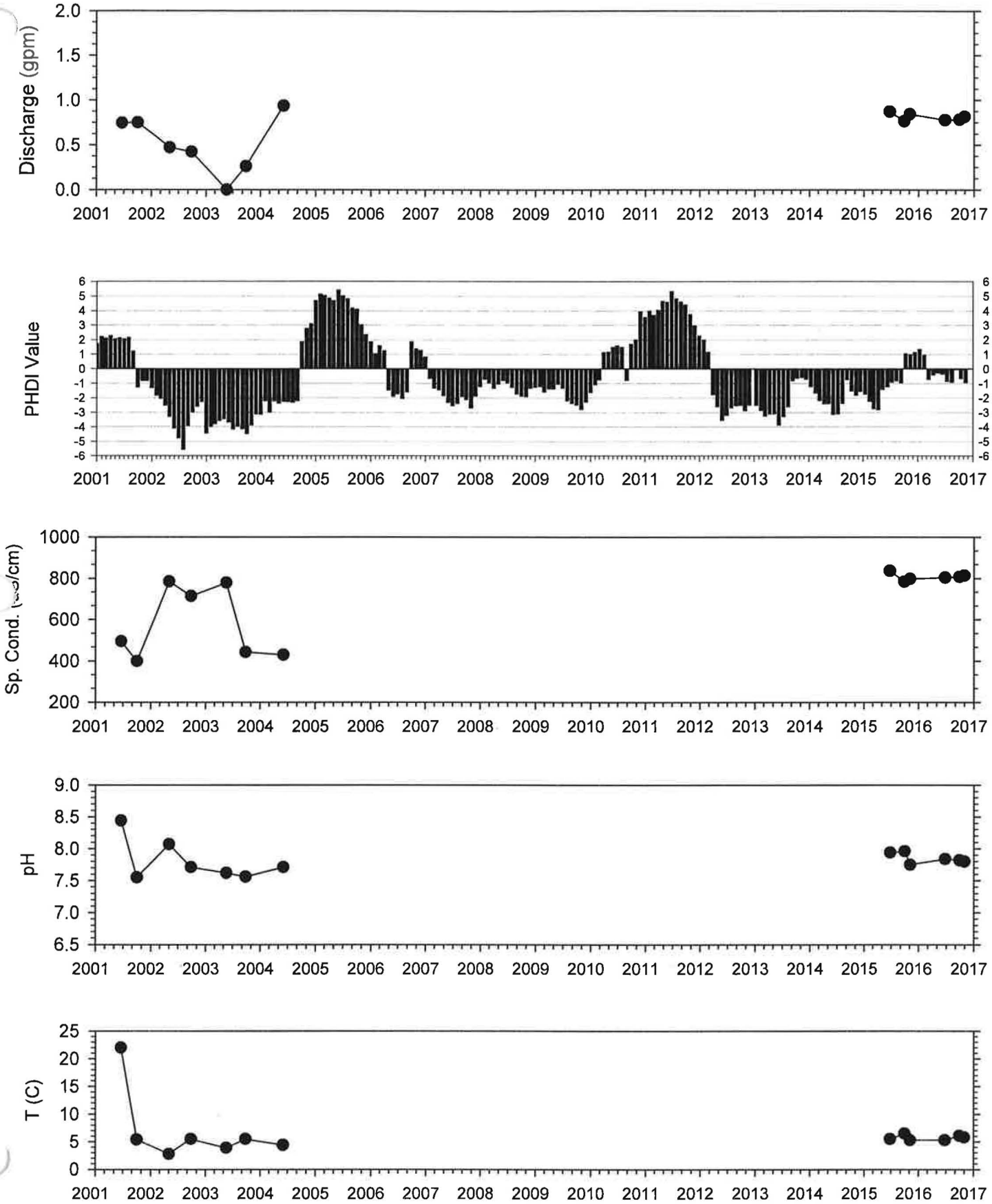
Spring M-SP10



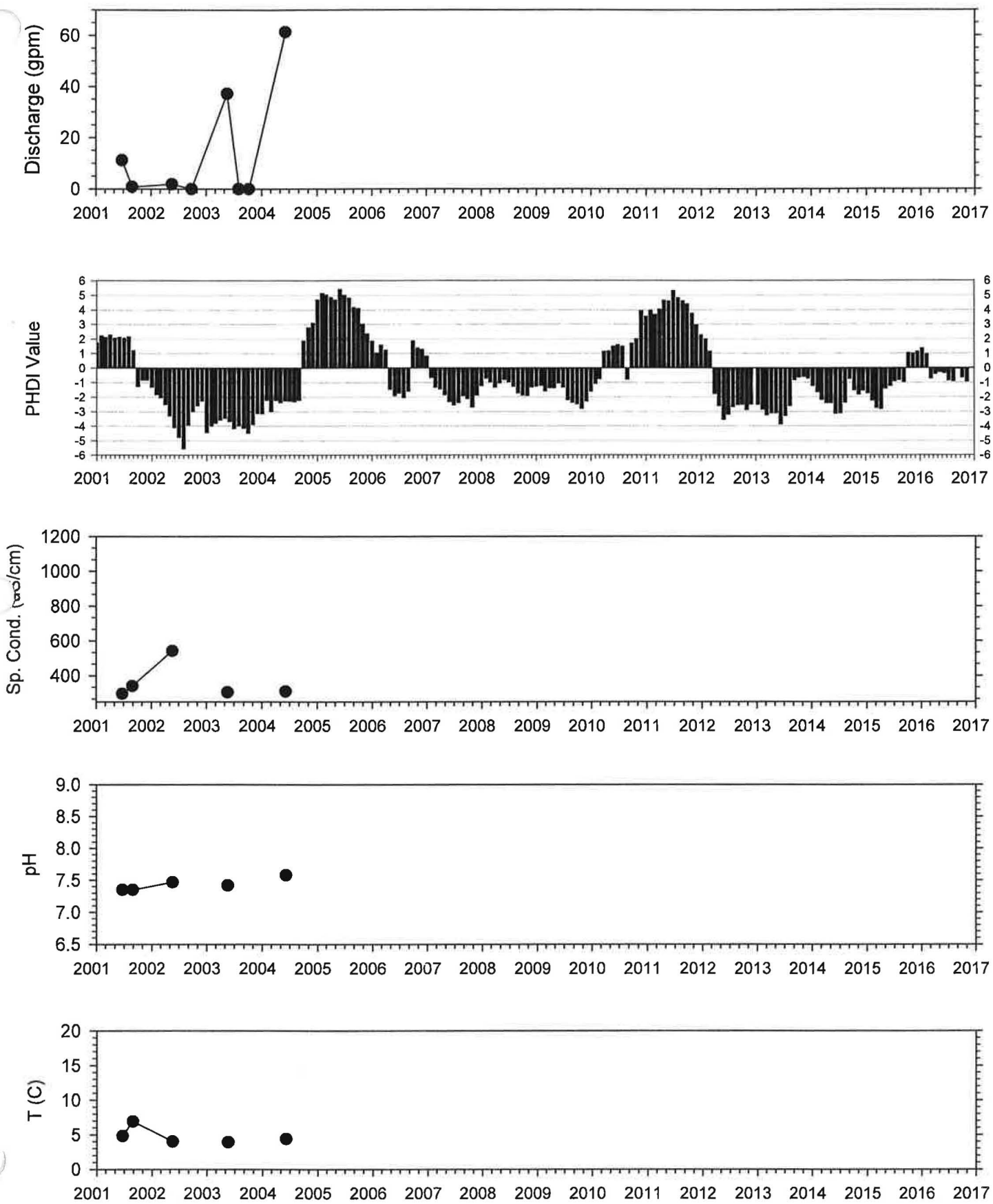
Spring M-SP11



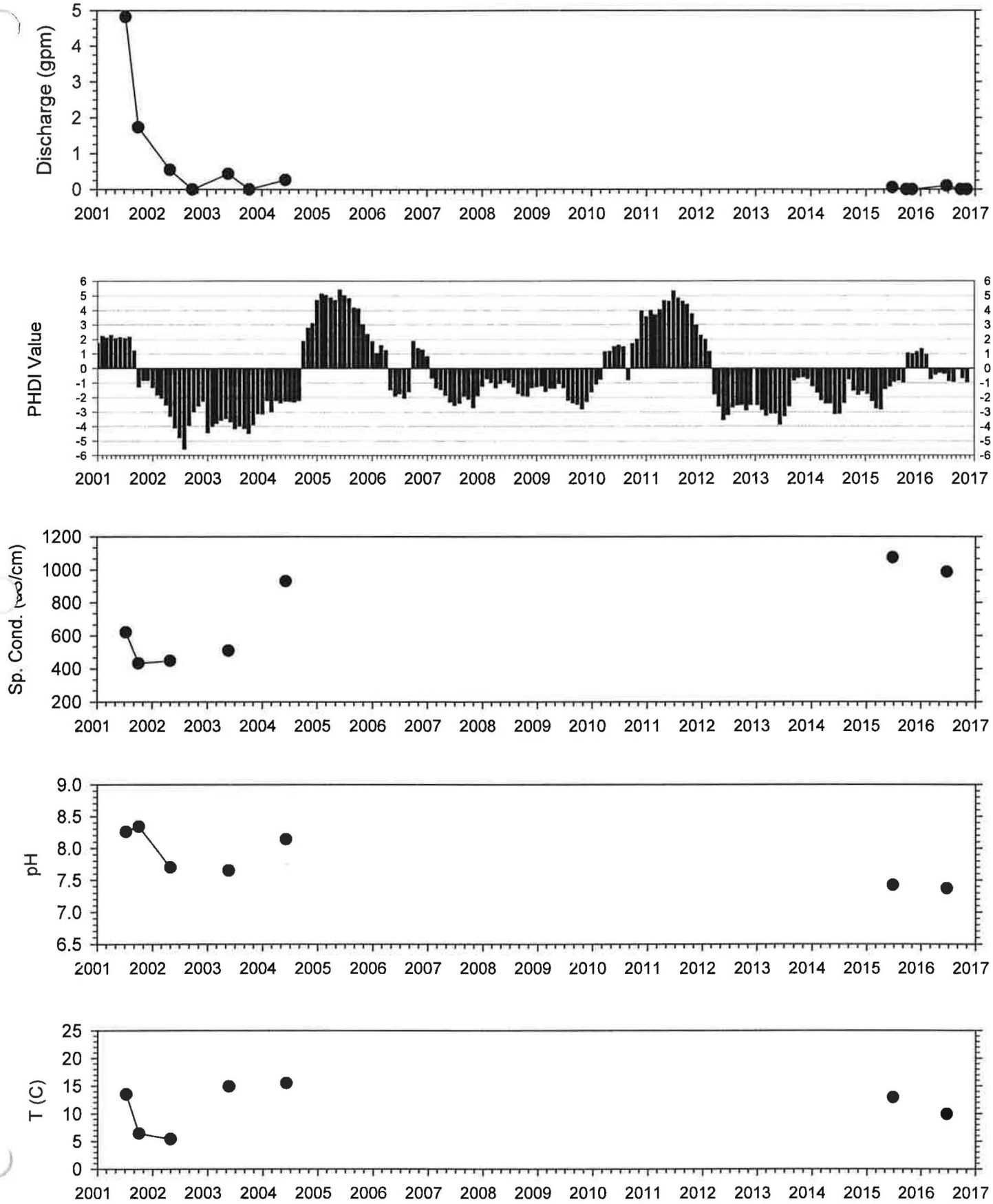
Spring M-SP12



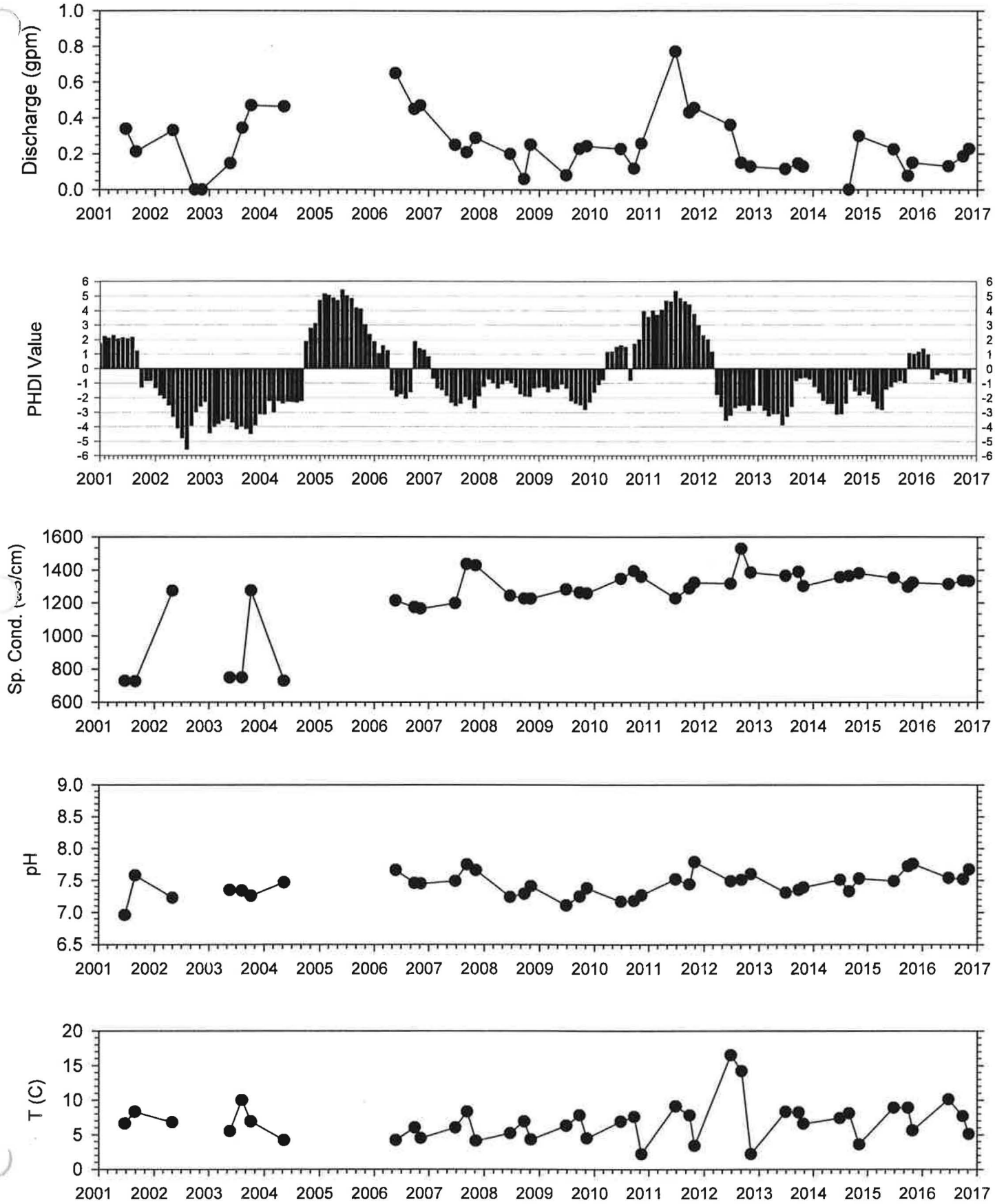
Spring M-SP14



Spring M-SP15



Spring M-SP18



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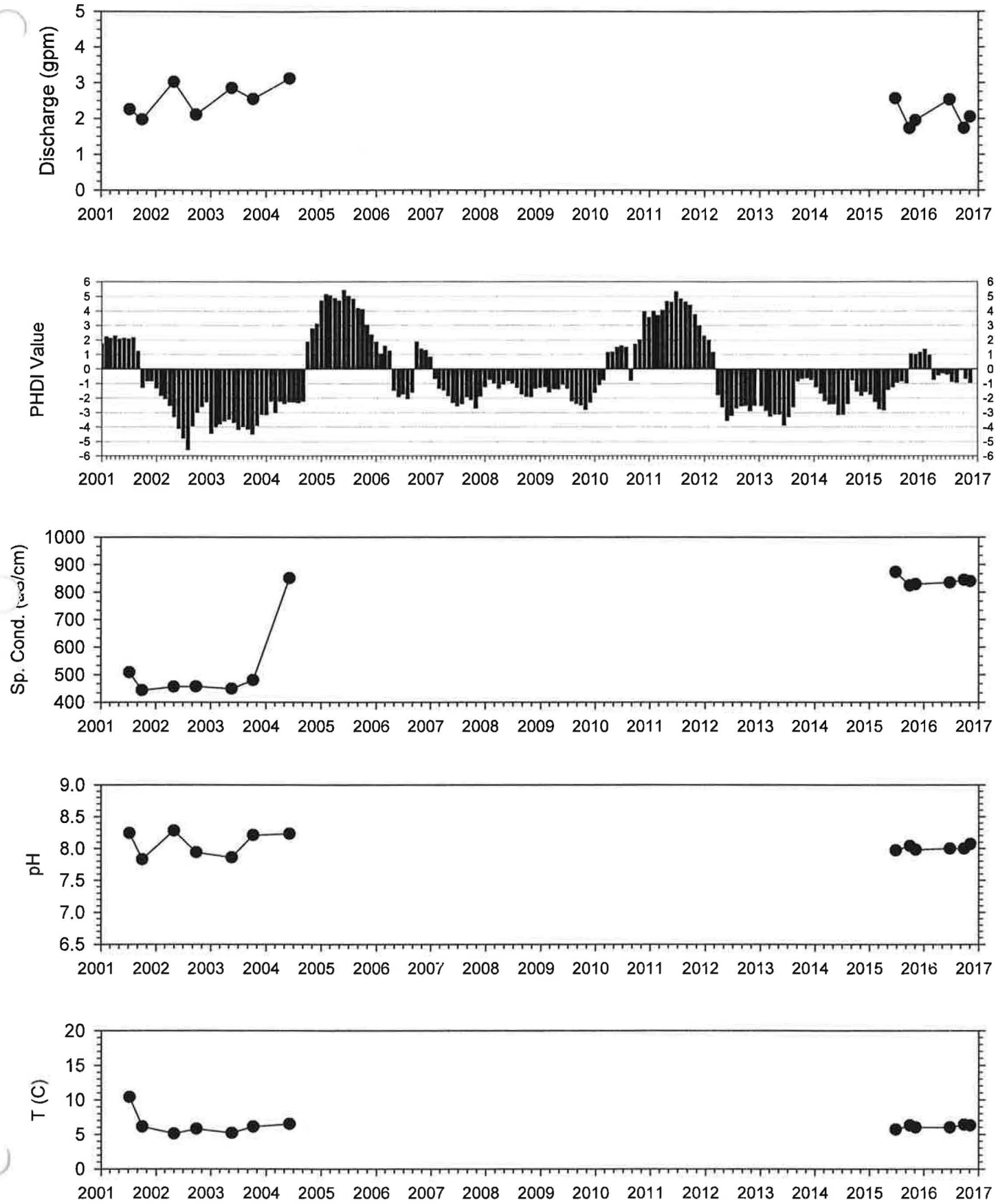
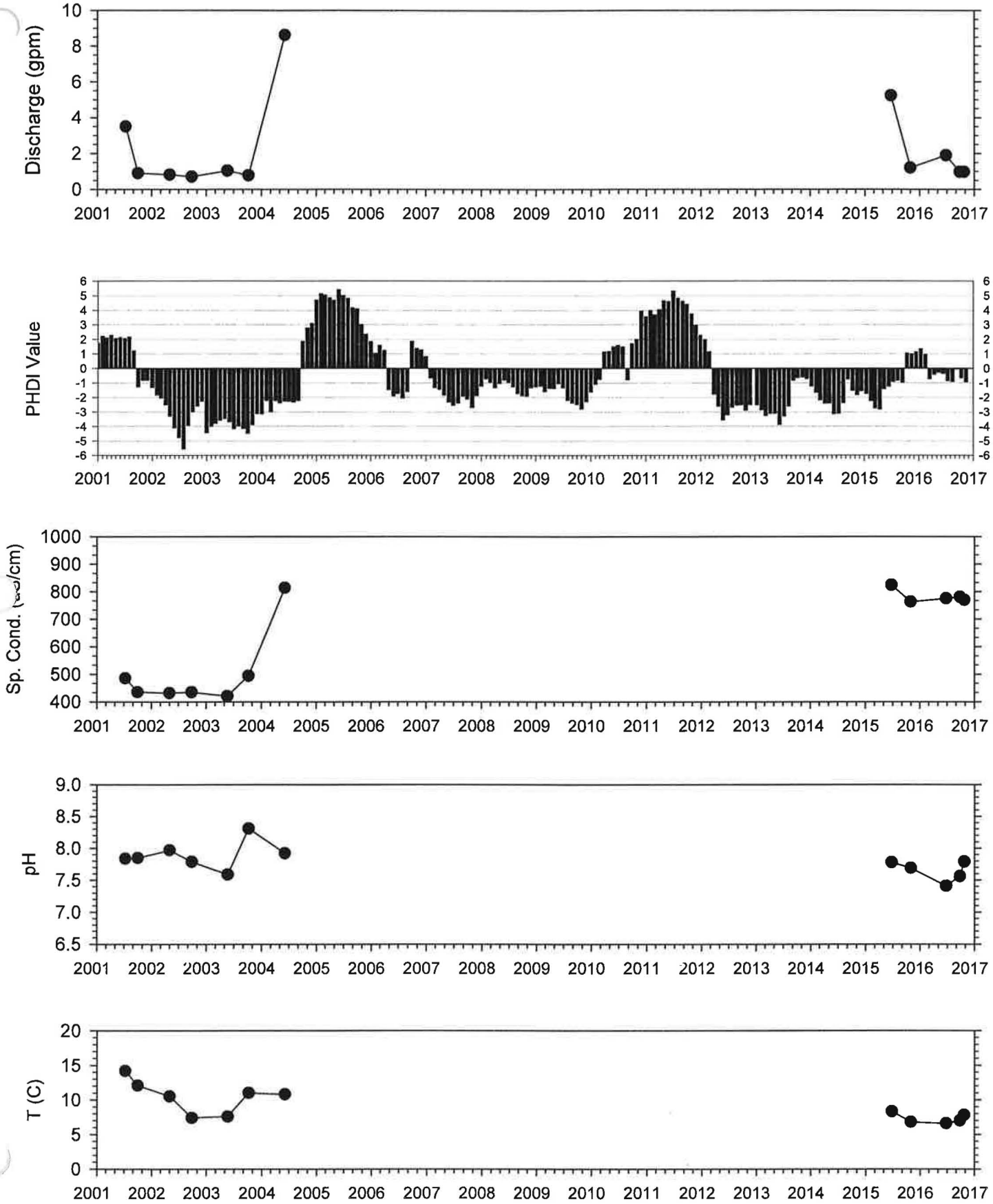


Spring M-SP20



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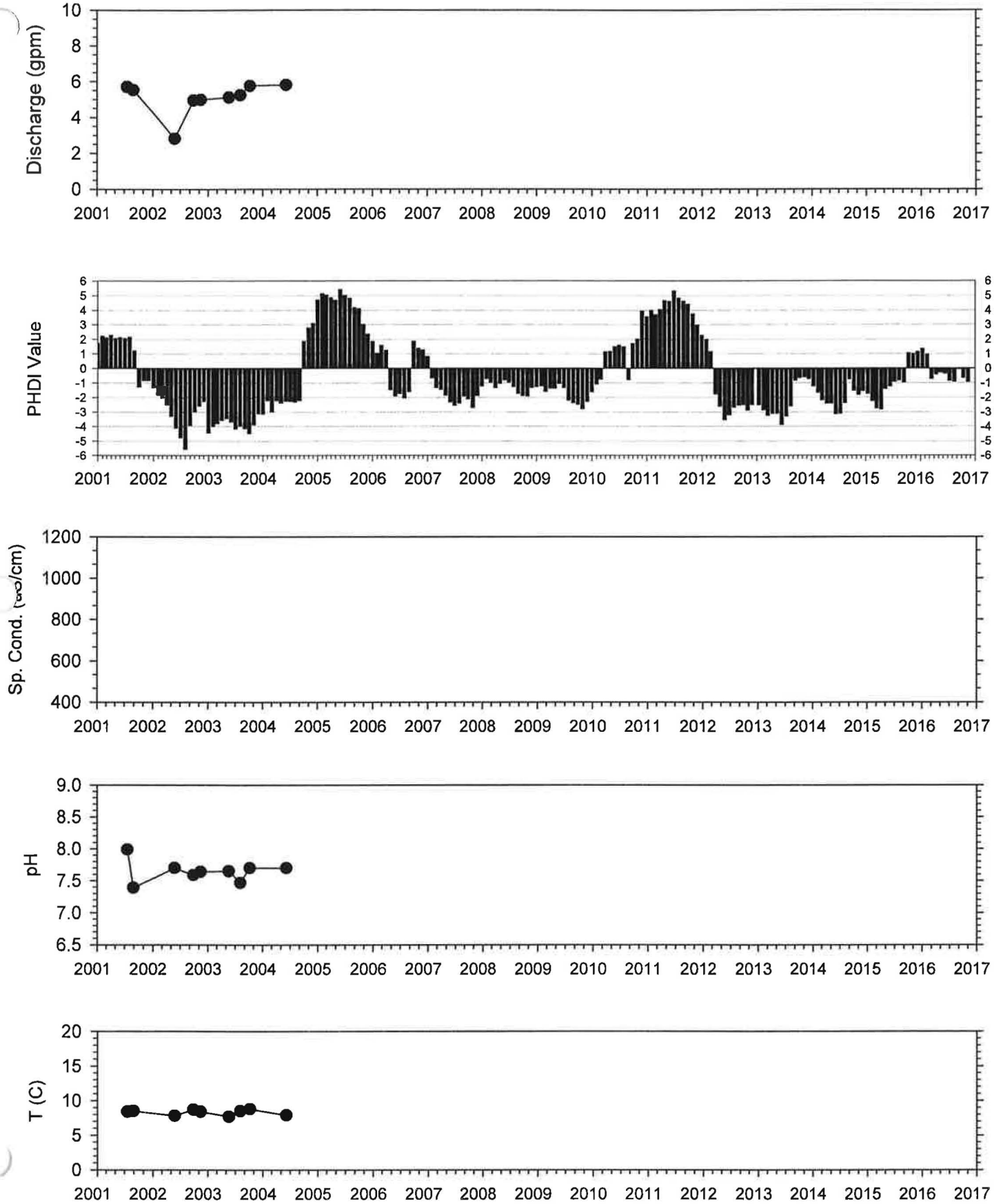
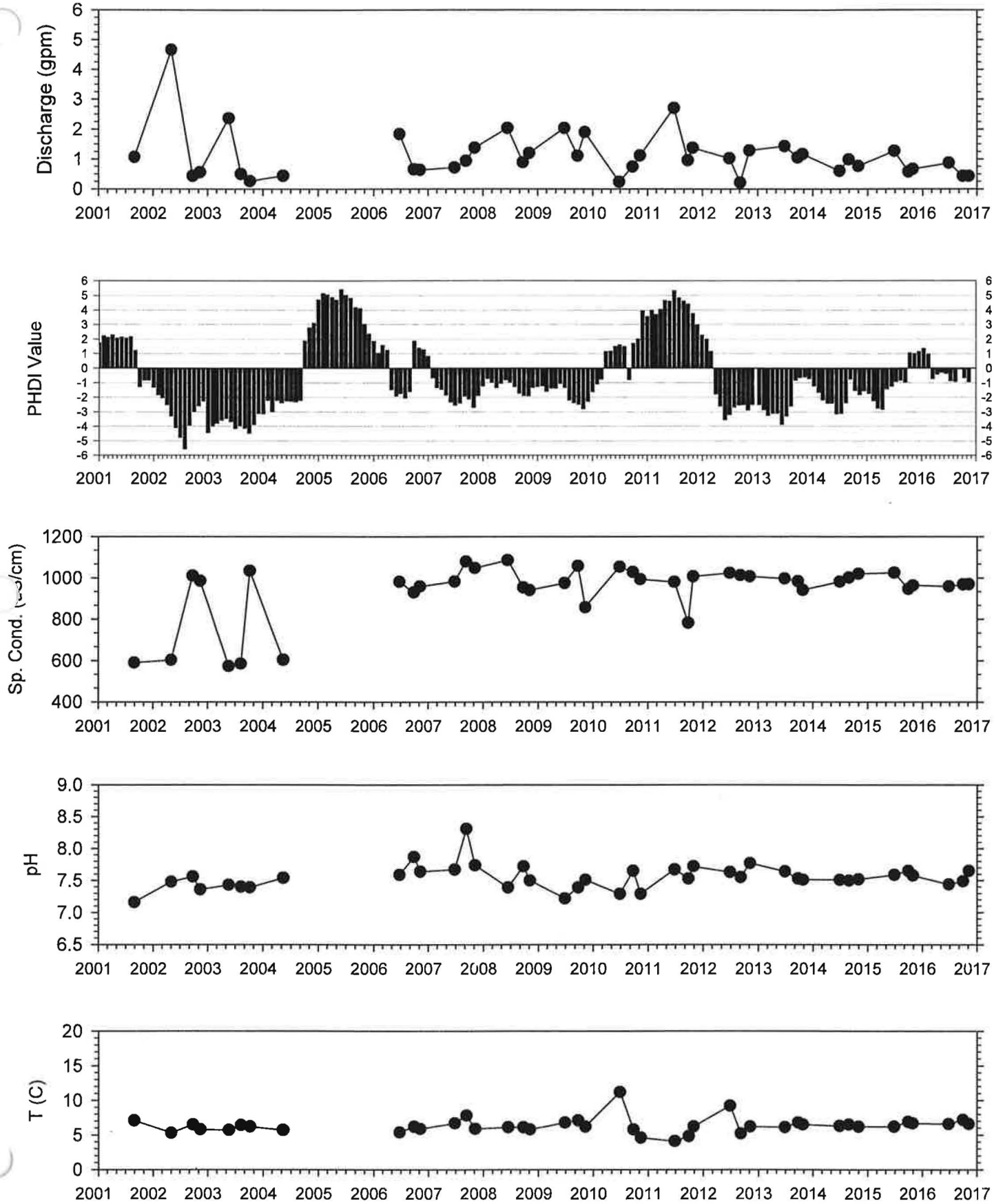


Spring M-SP39



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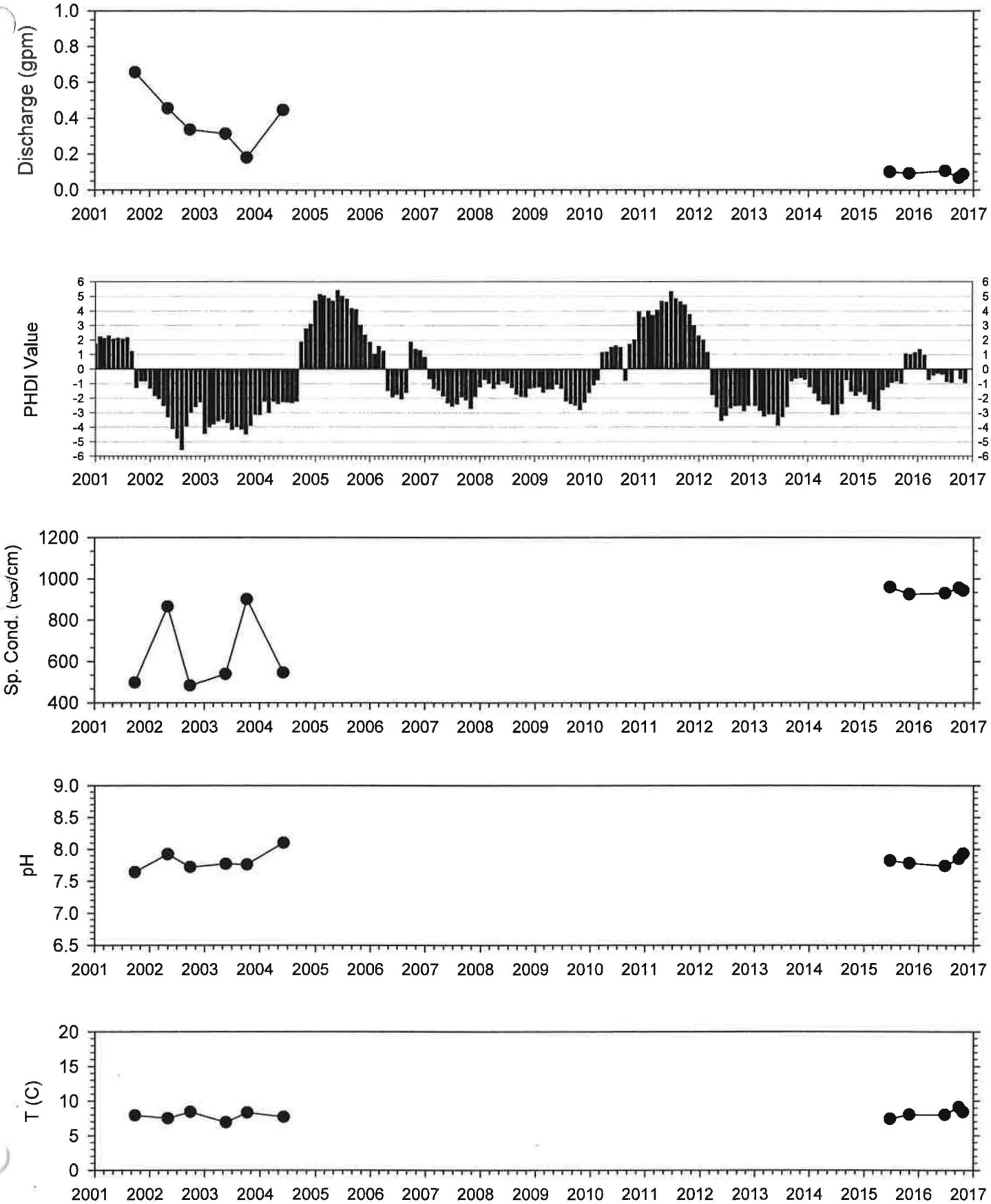
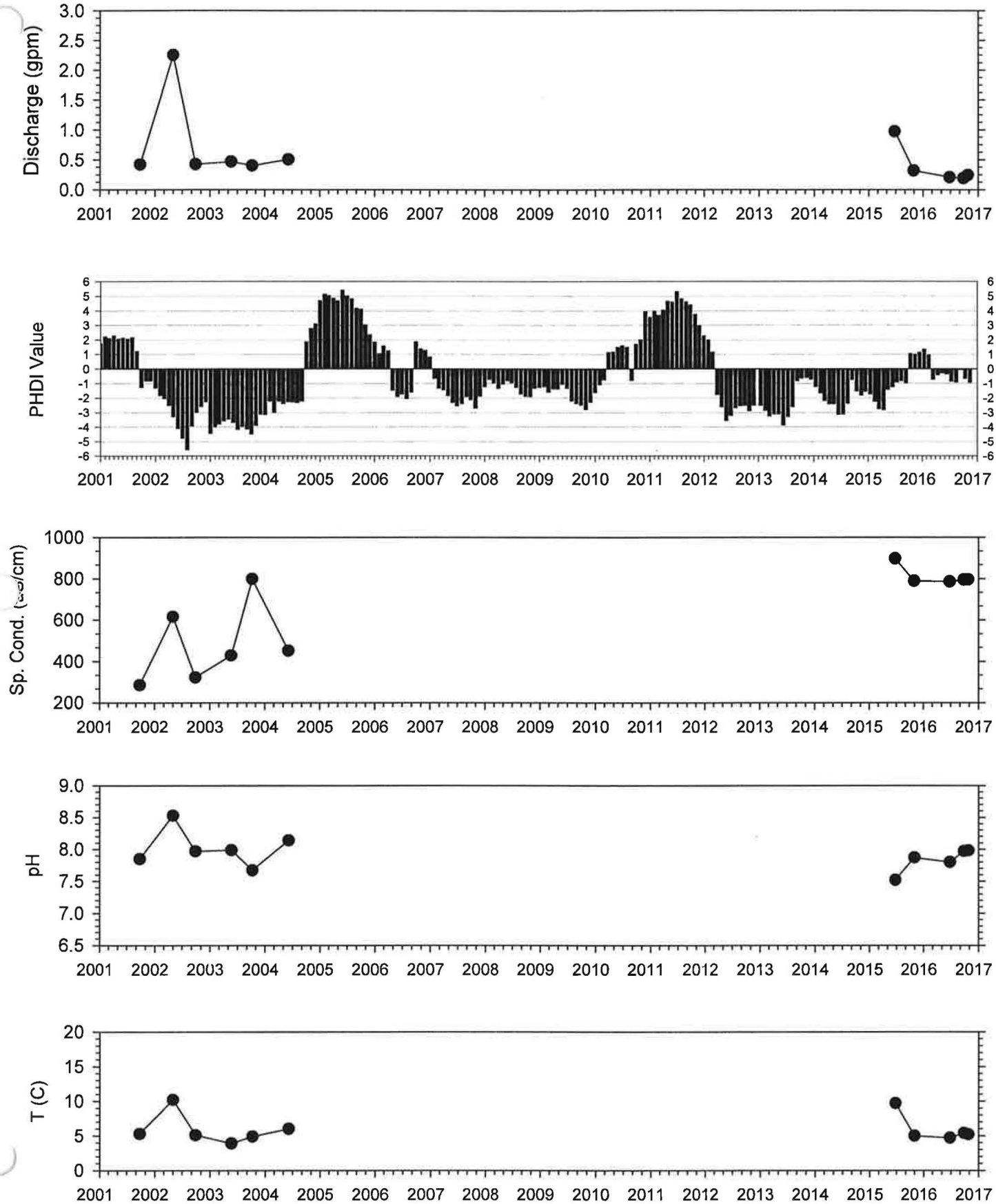


Spring M-SP41



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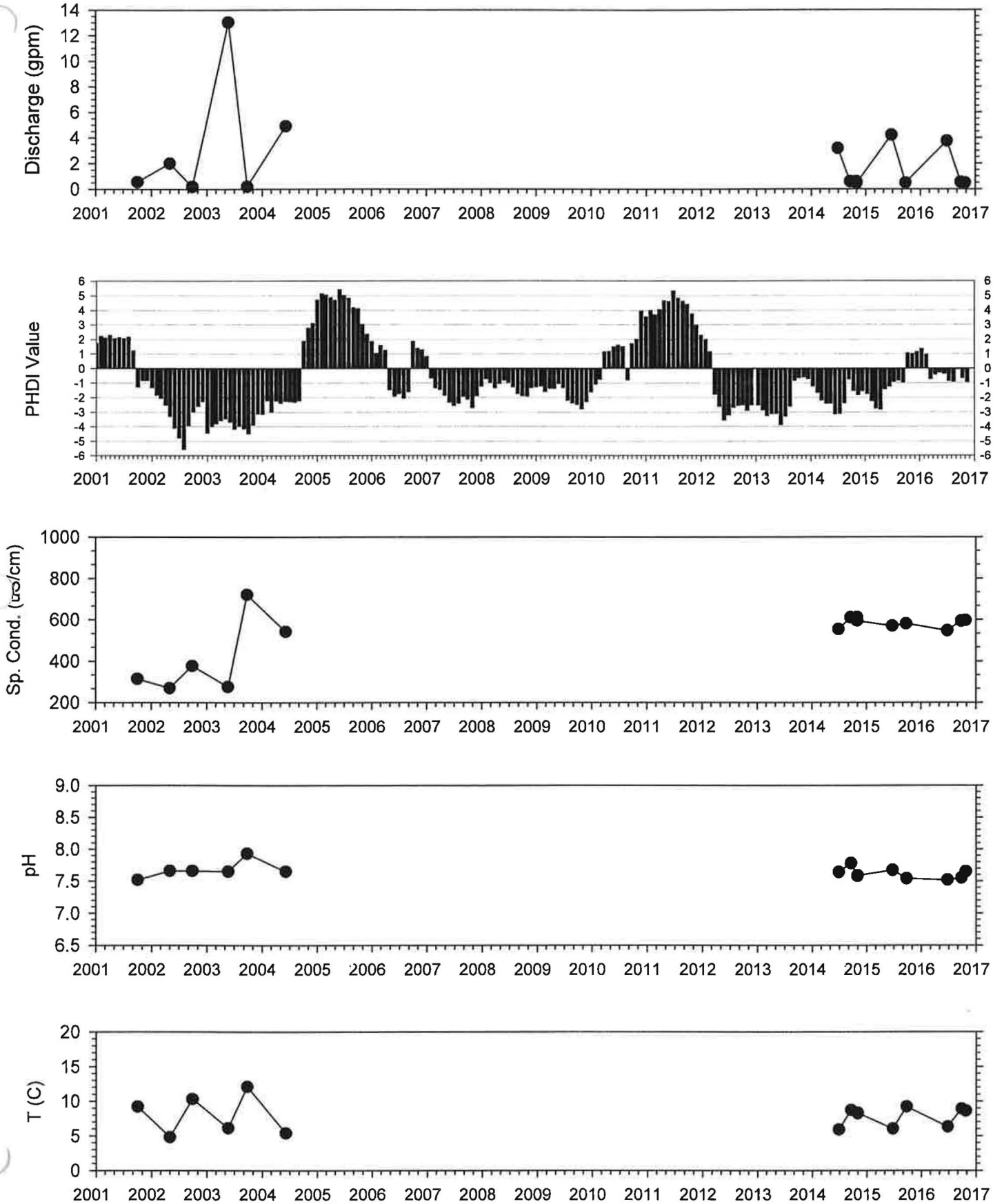

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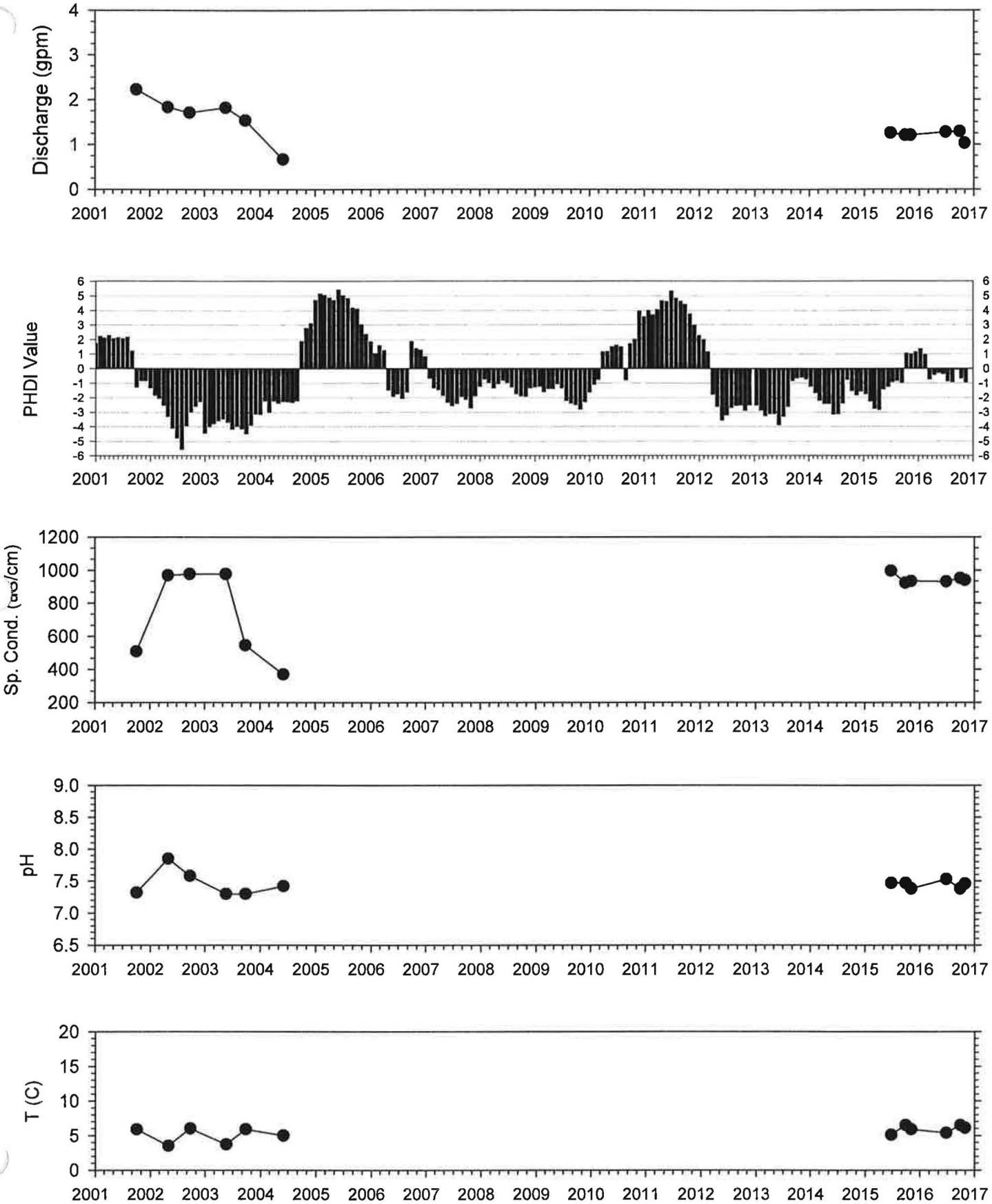

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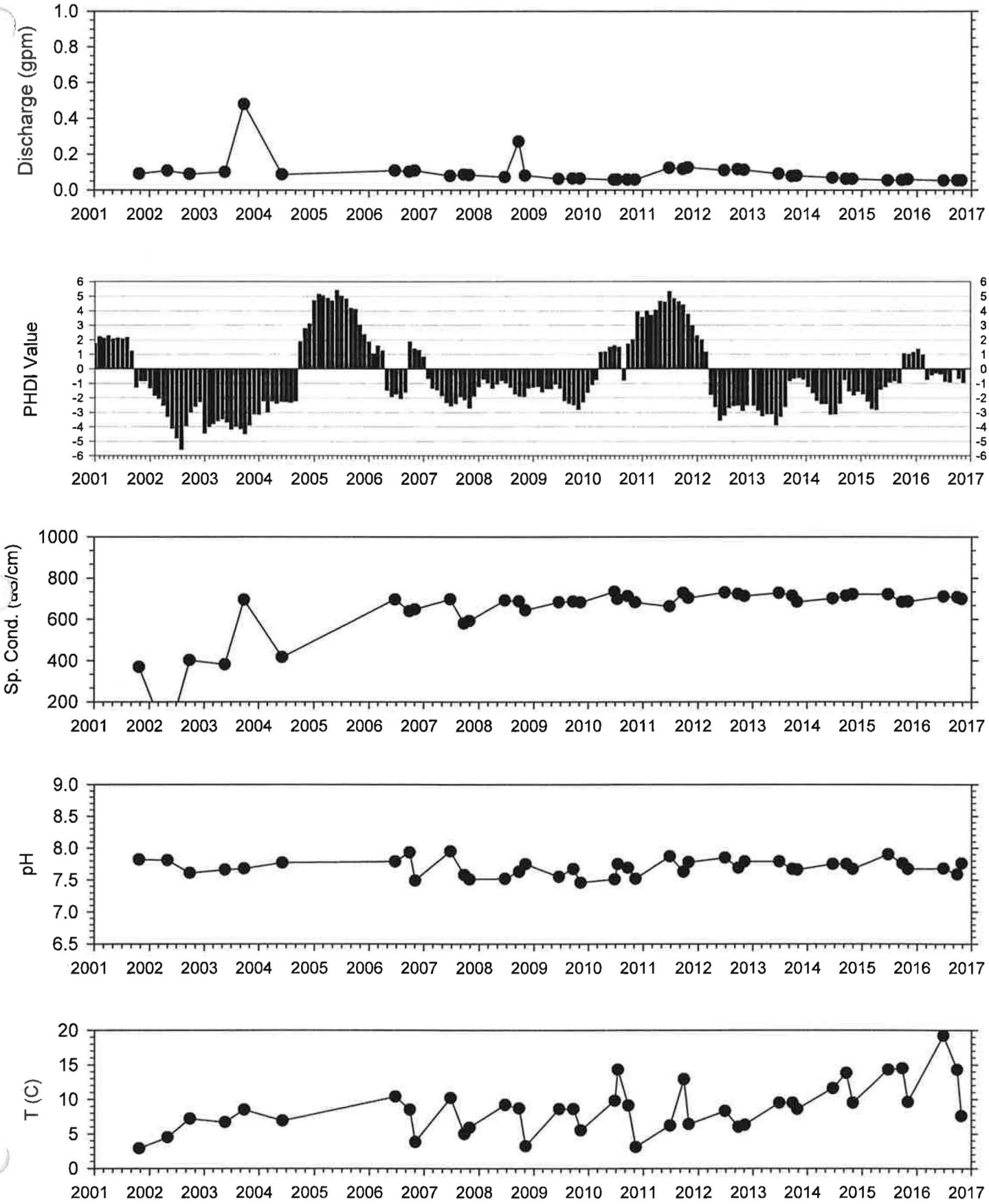

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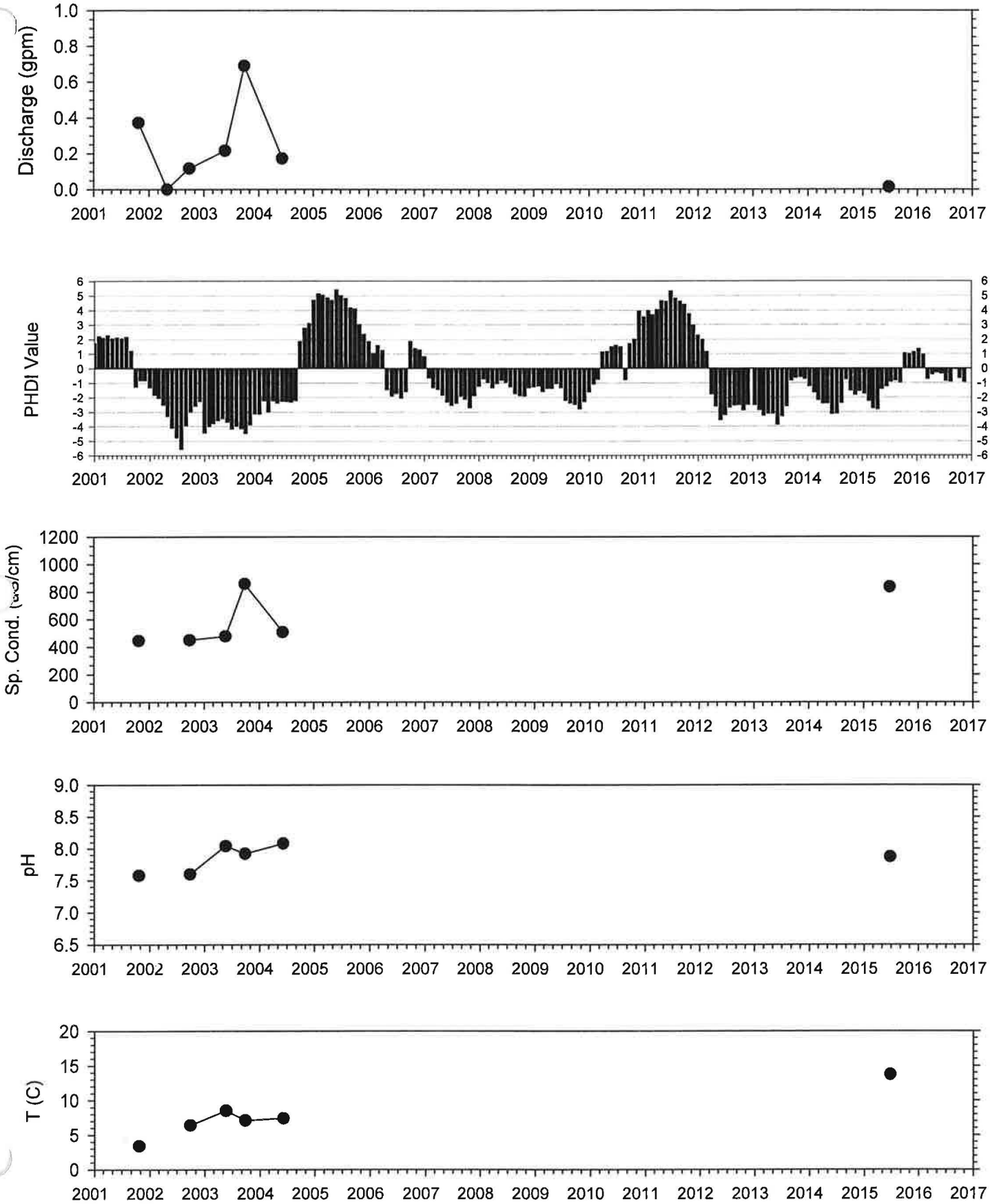

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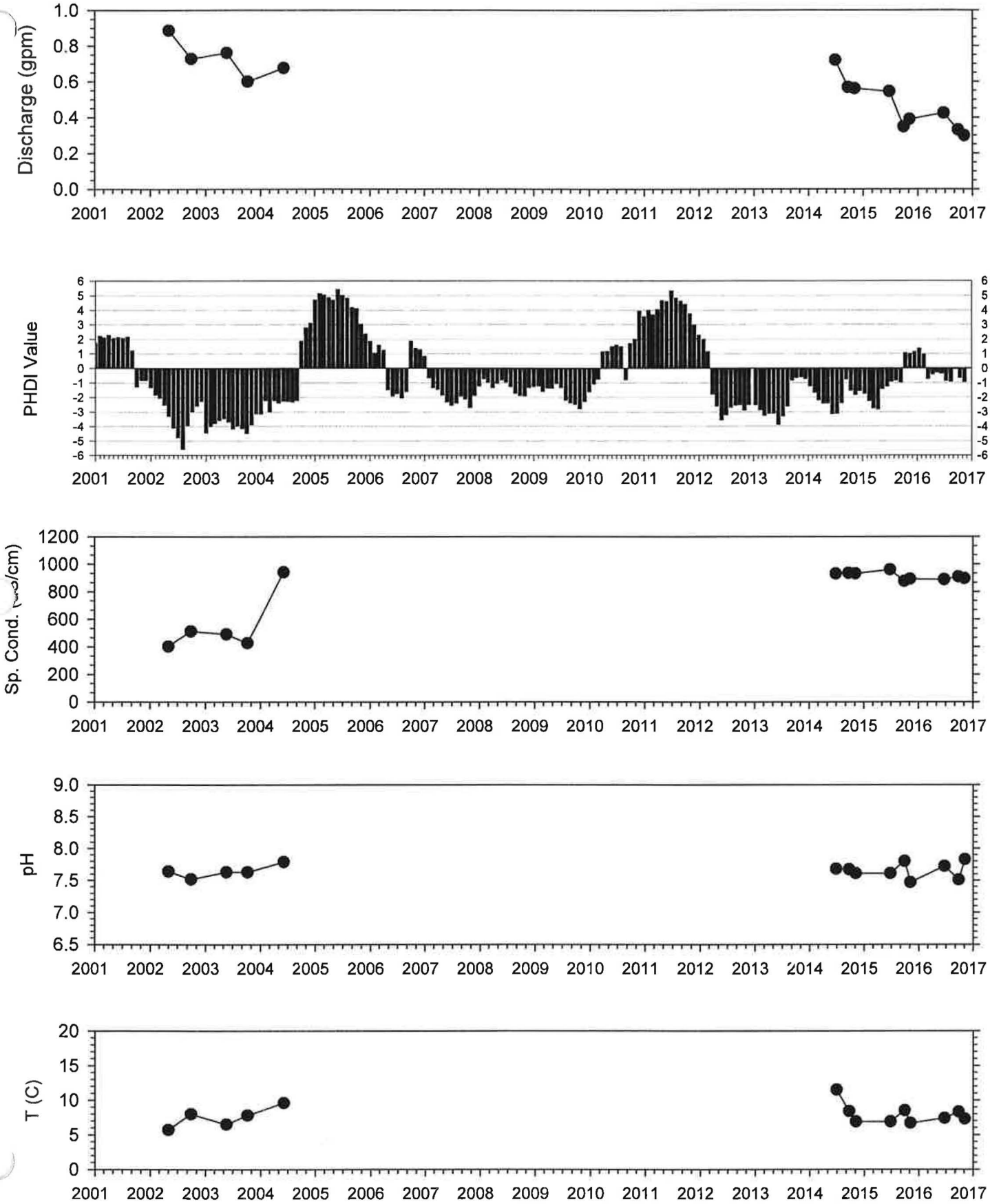
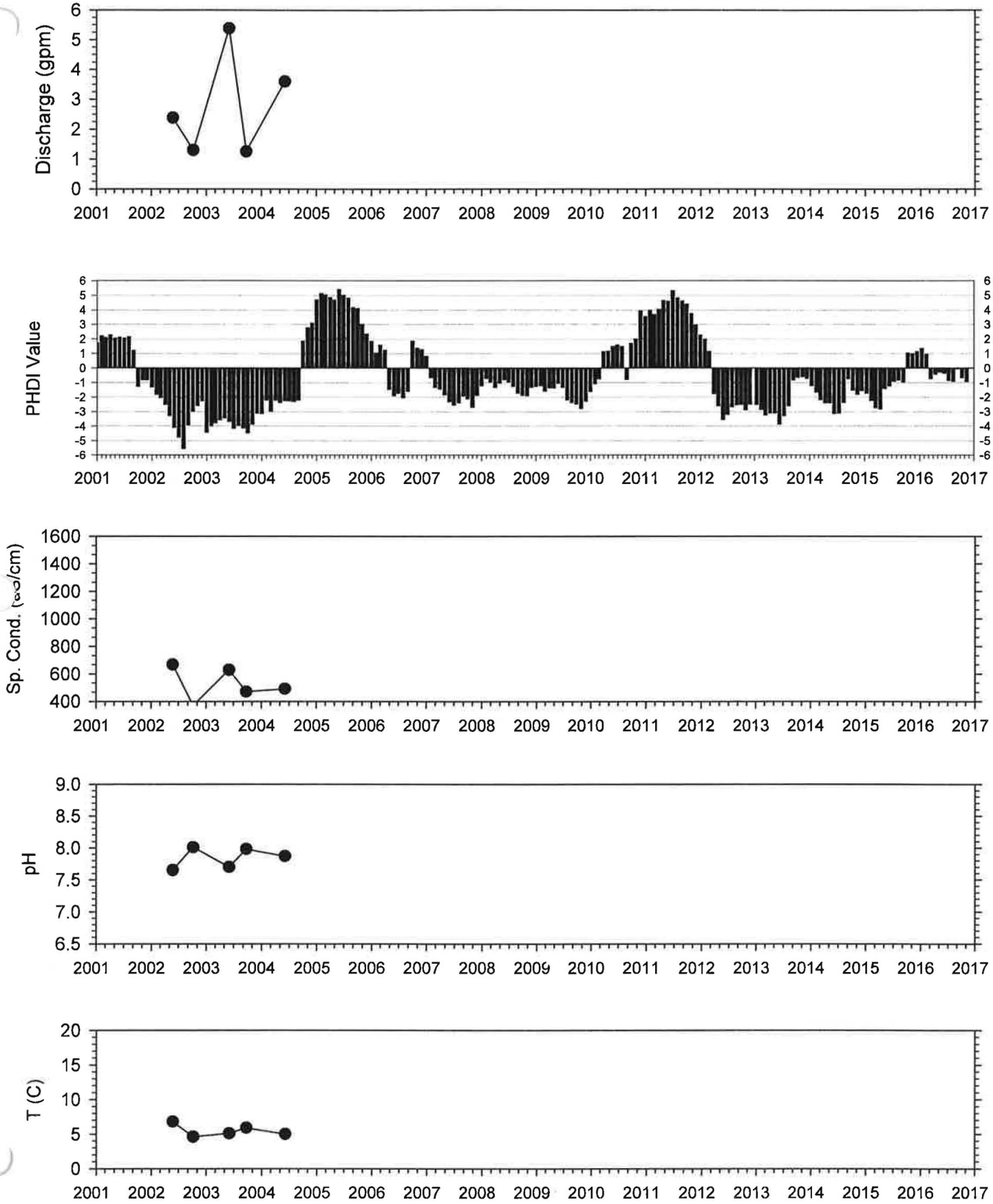
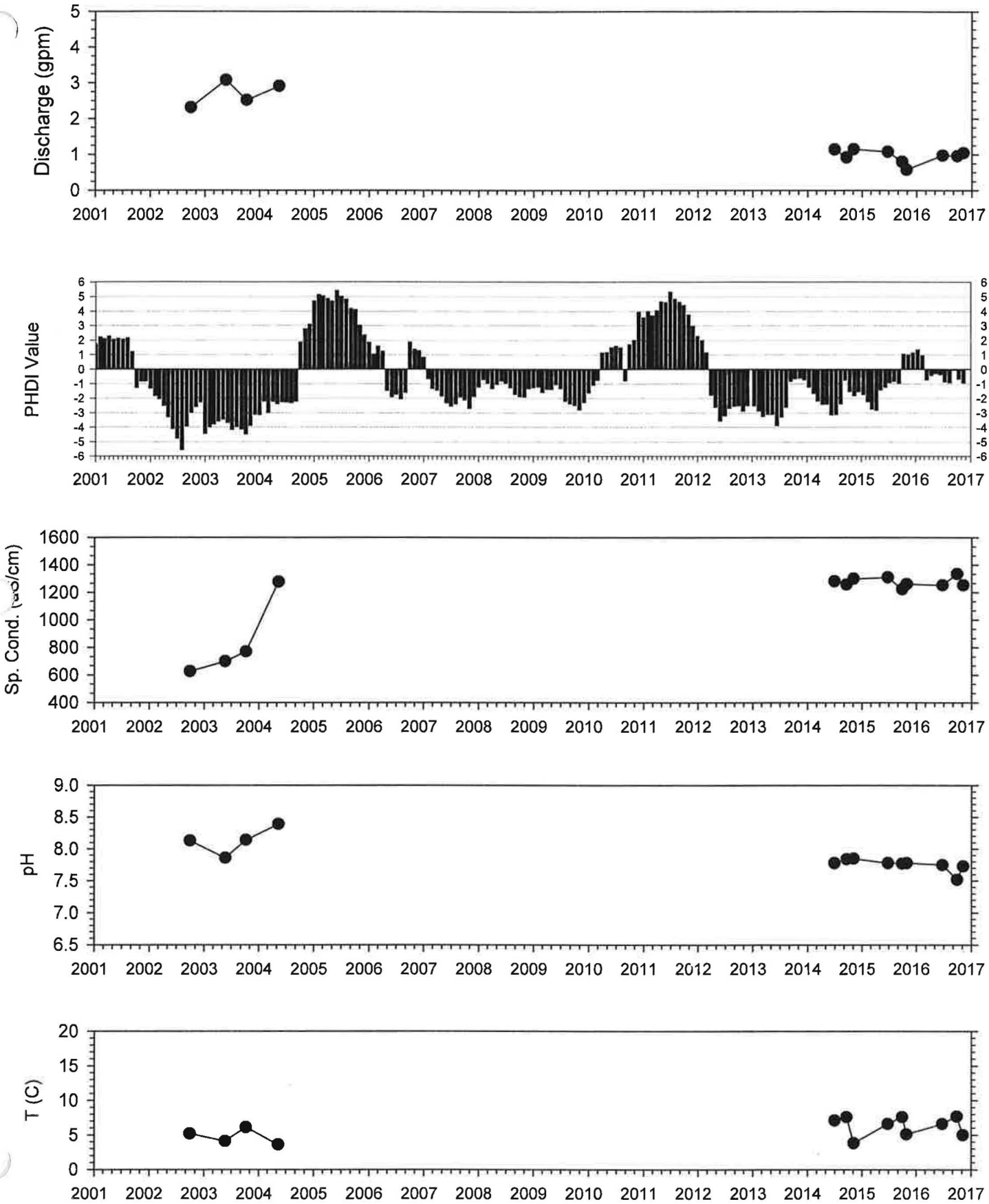


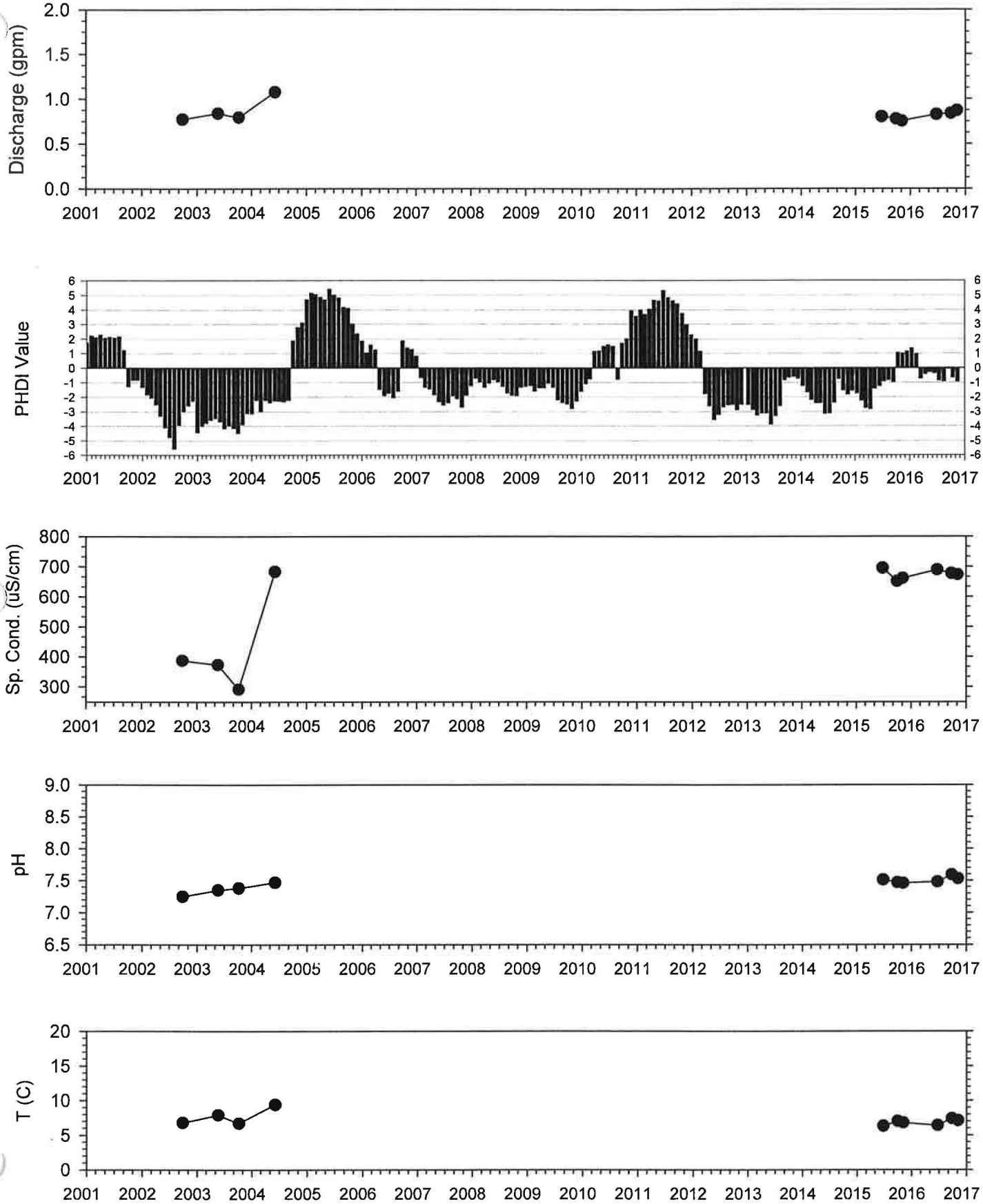
Spring M-SP82



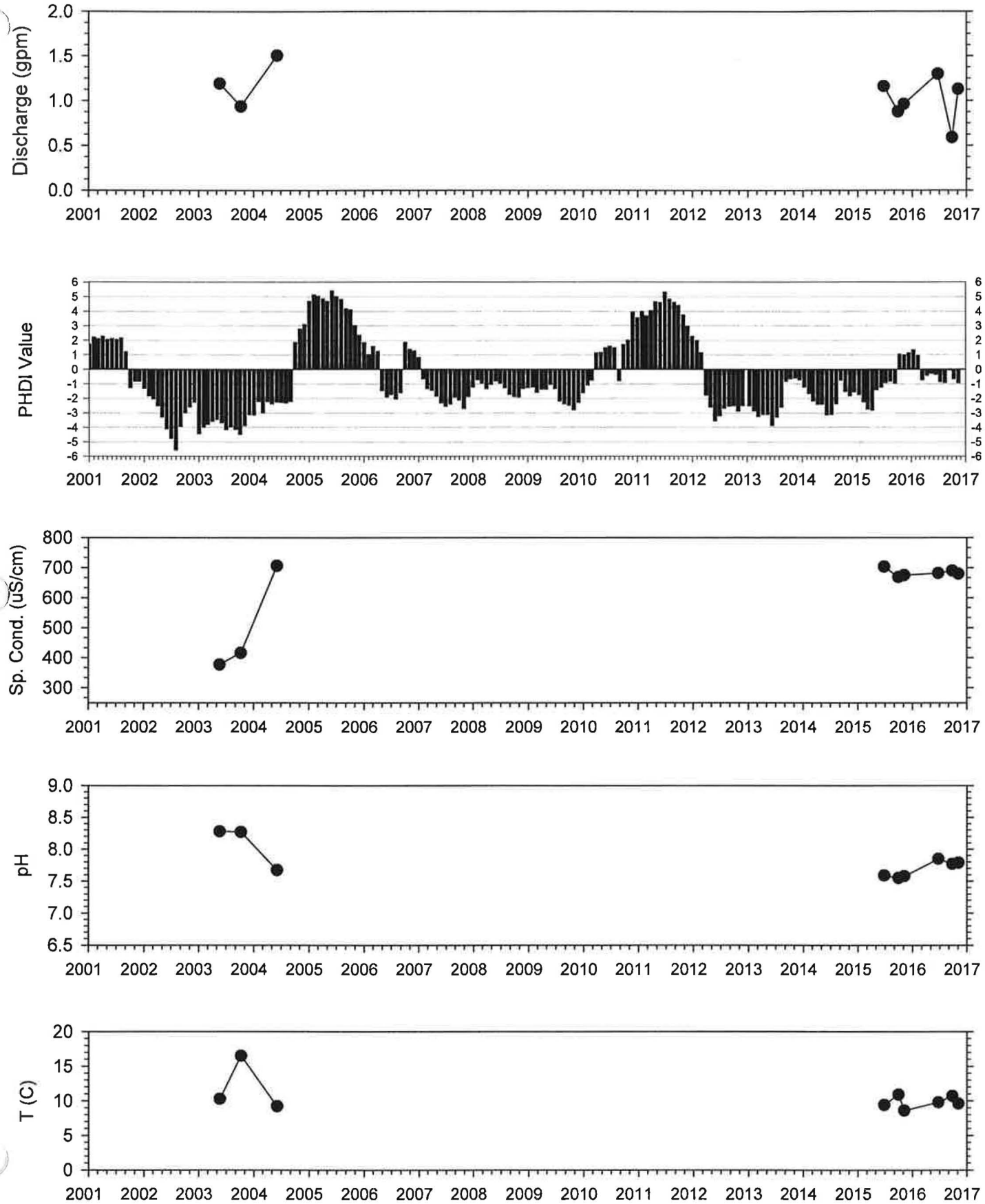
Spring M-SP87



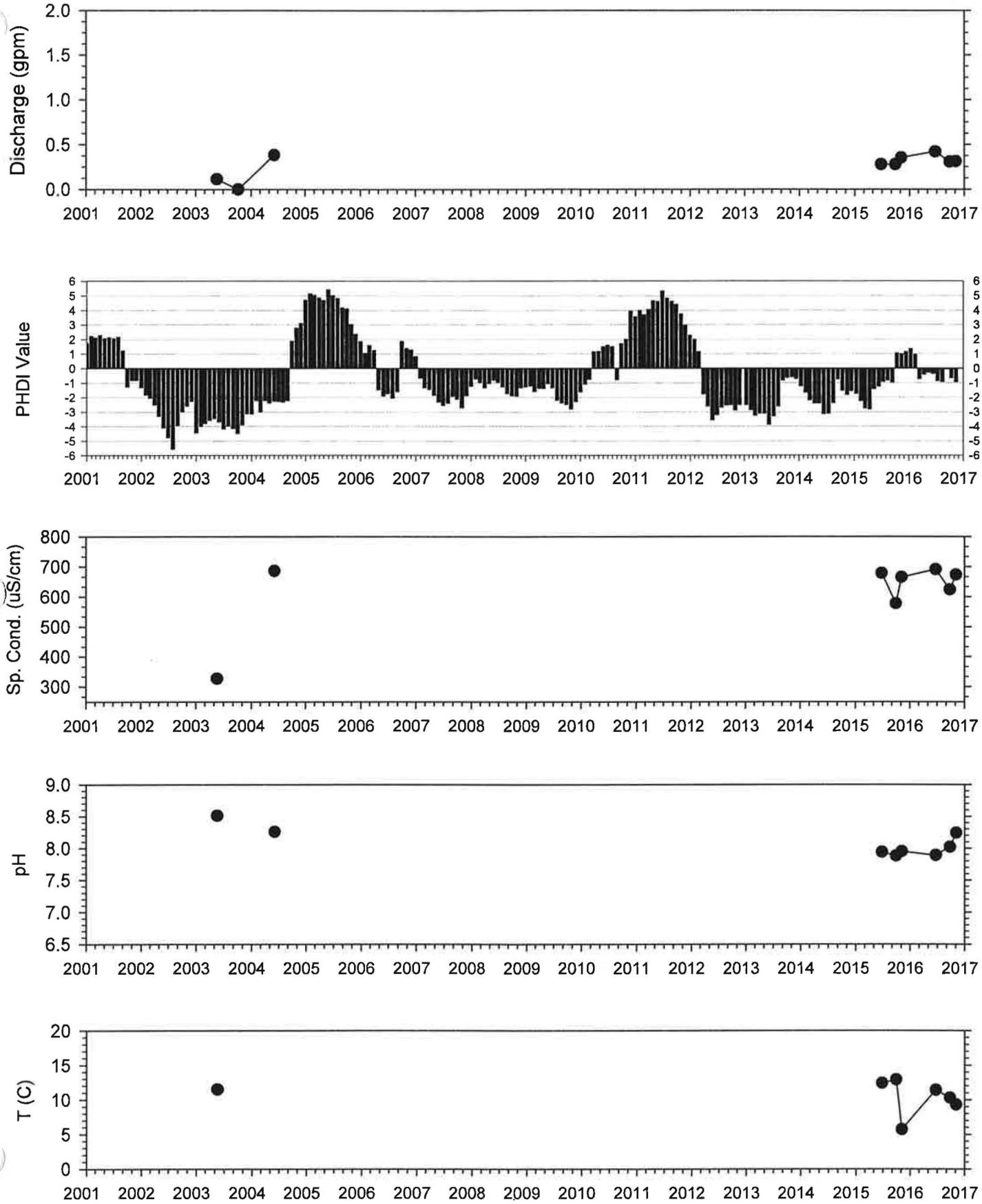
Spring M-SP100



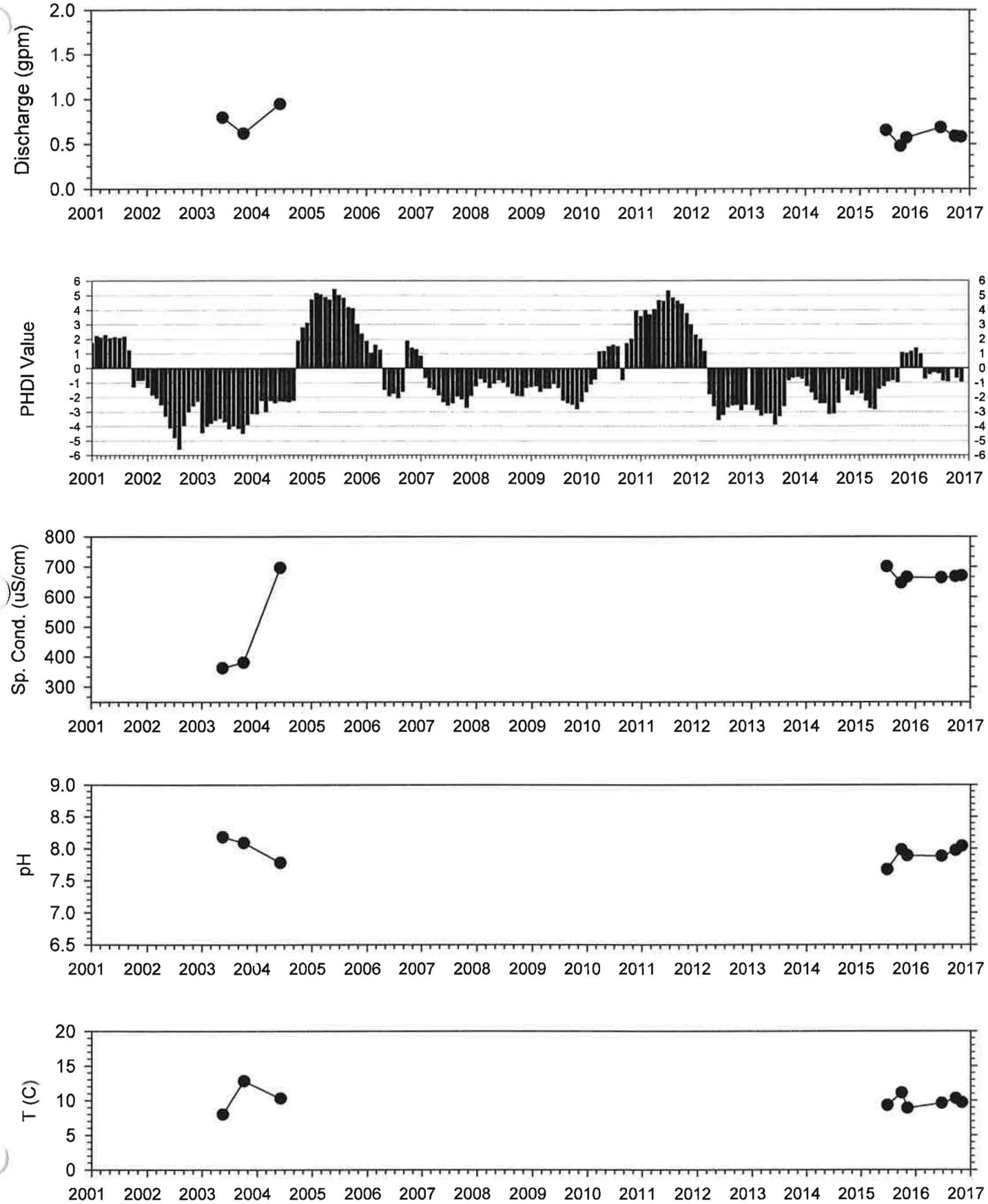
Spring M-SP103



Spring M-SP104



Spring M-SP105



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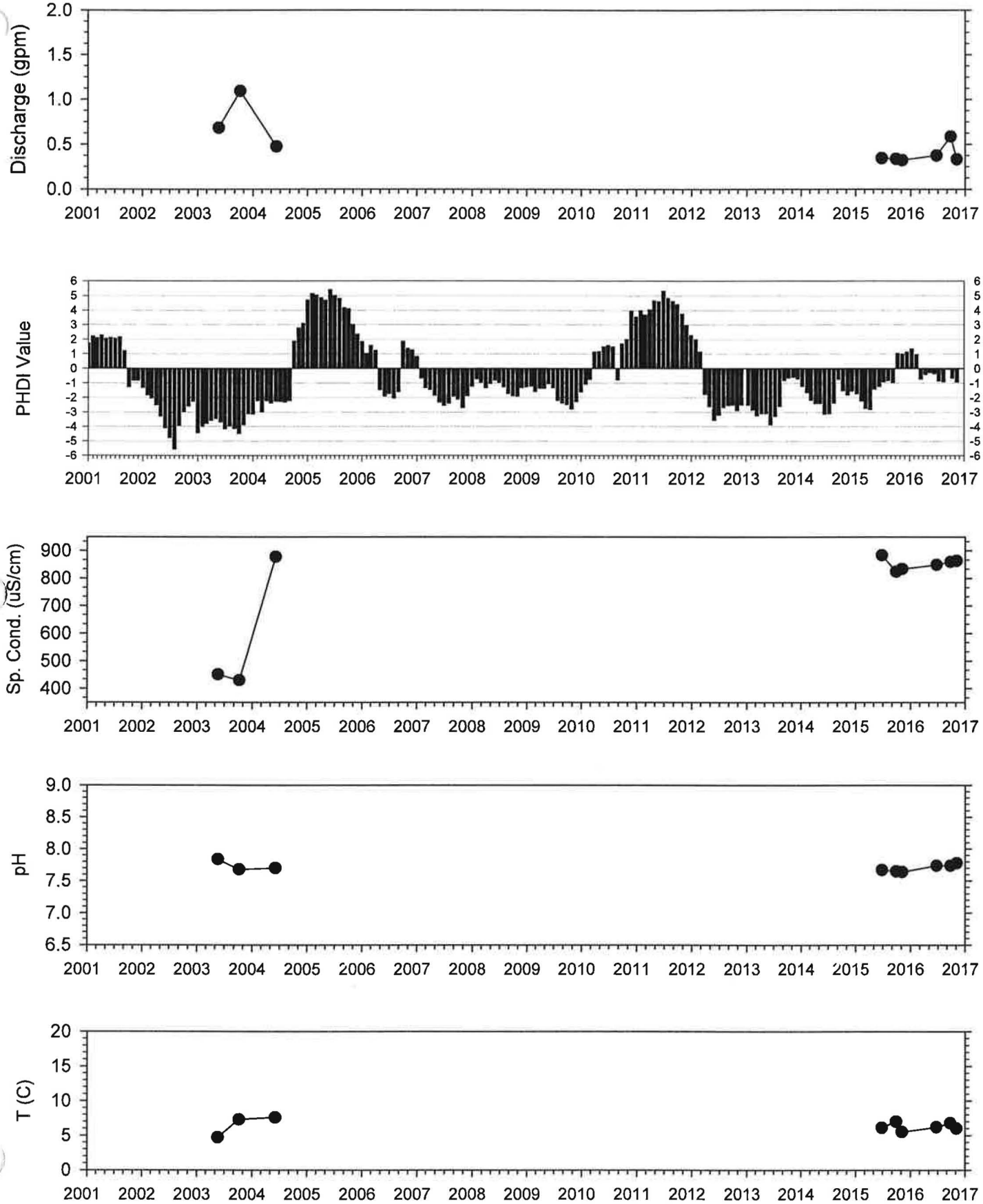
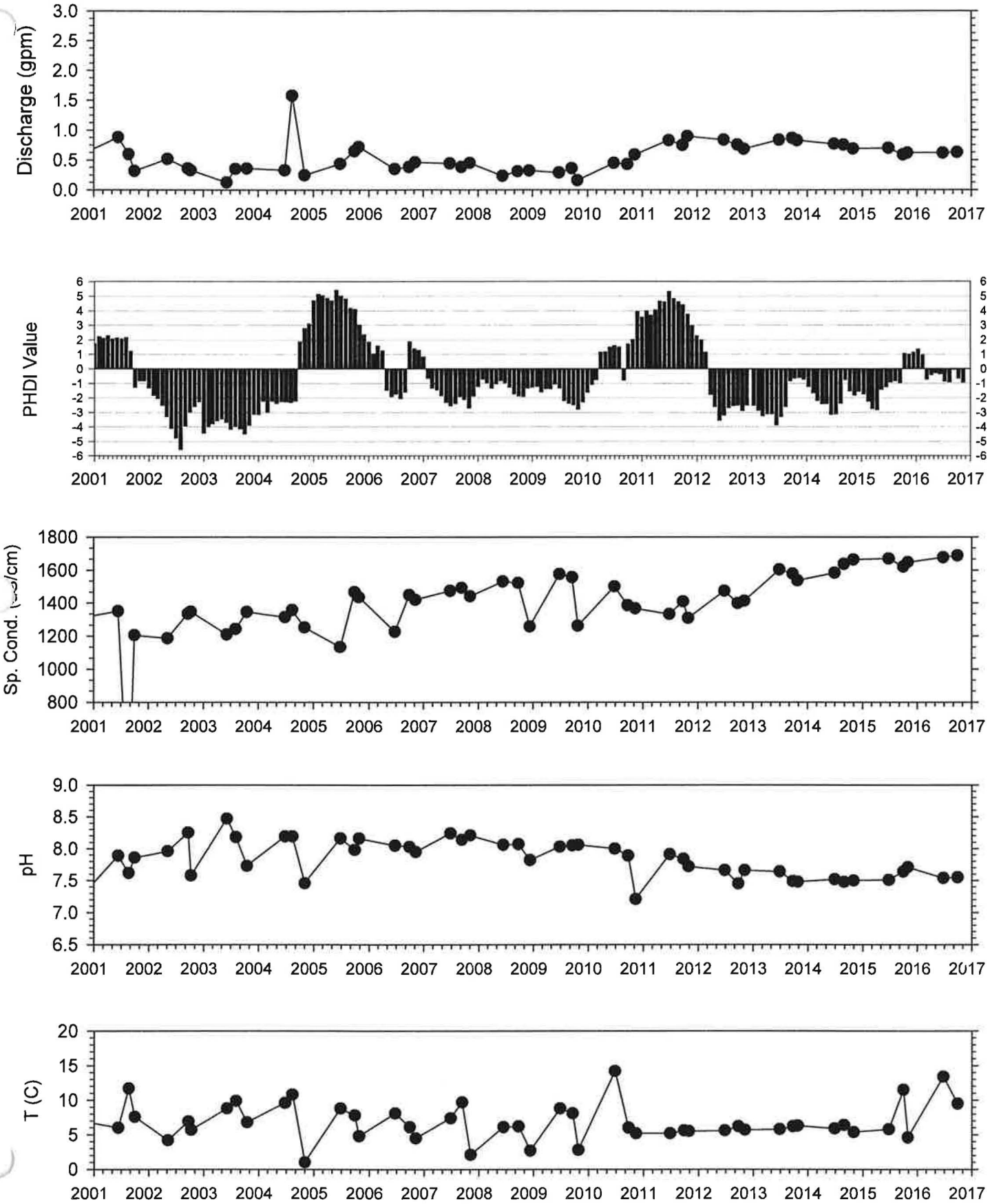
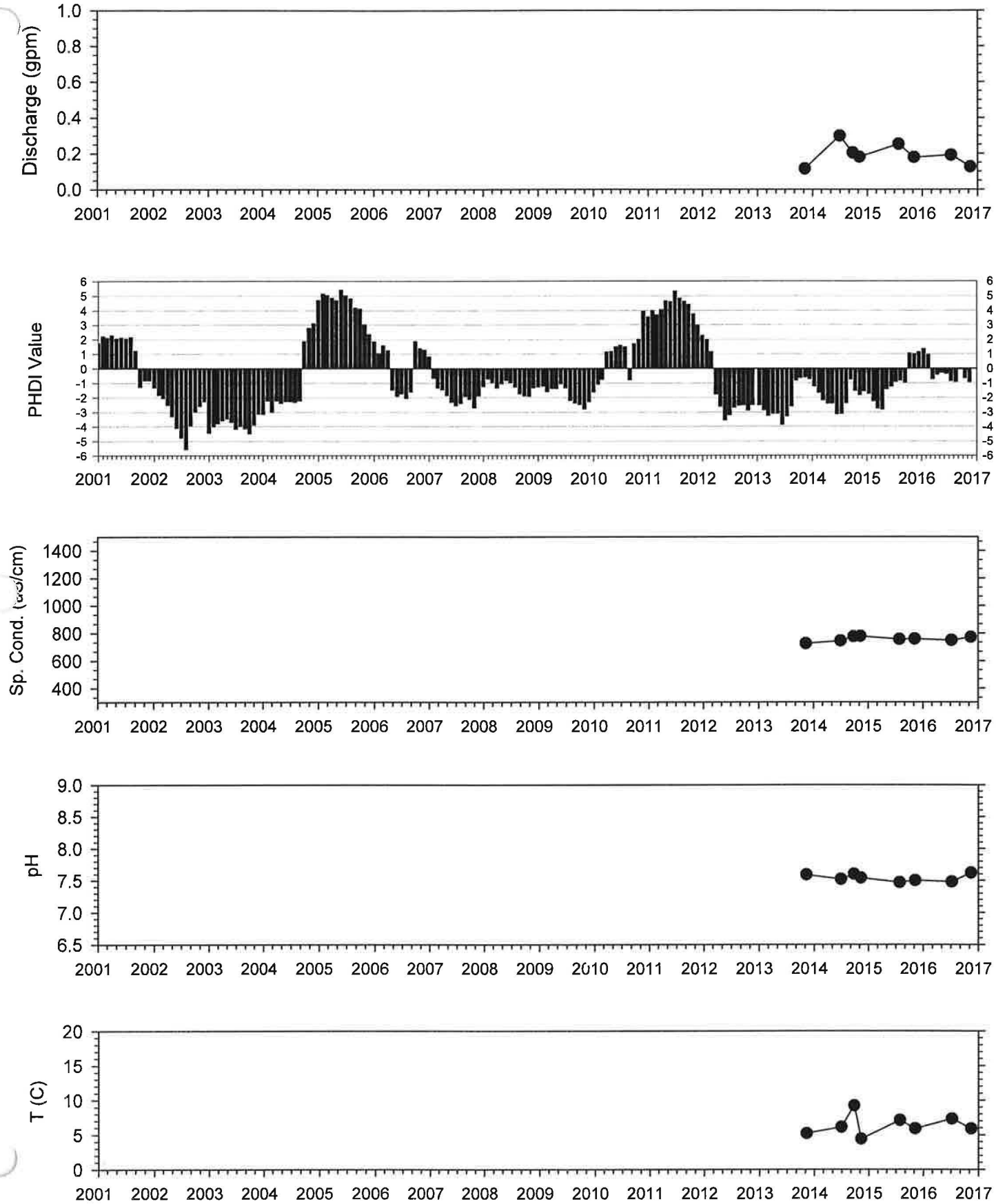


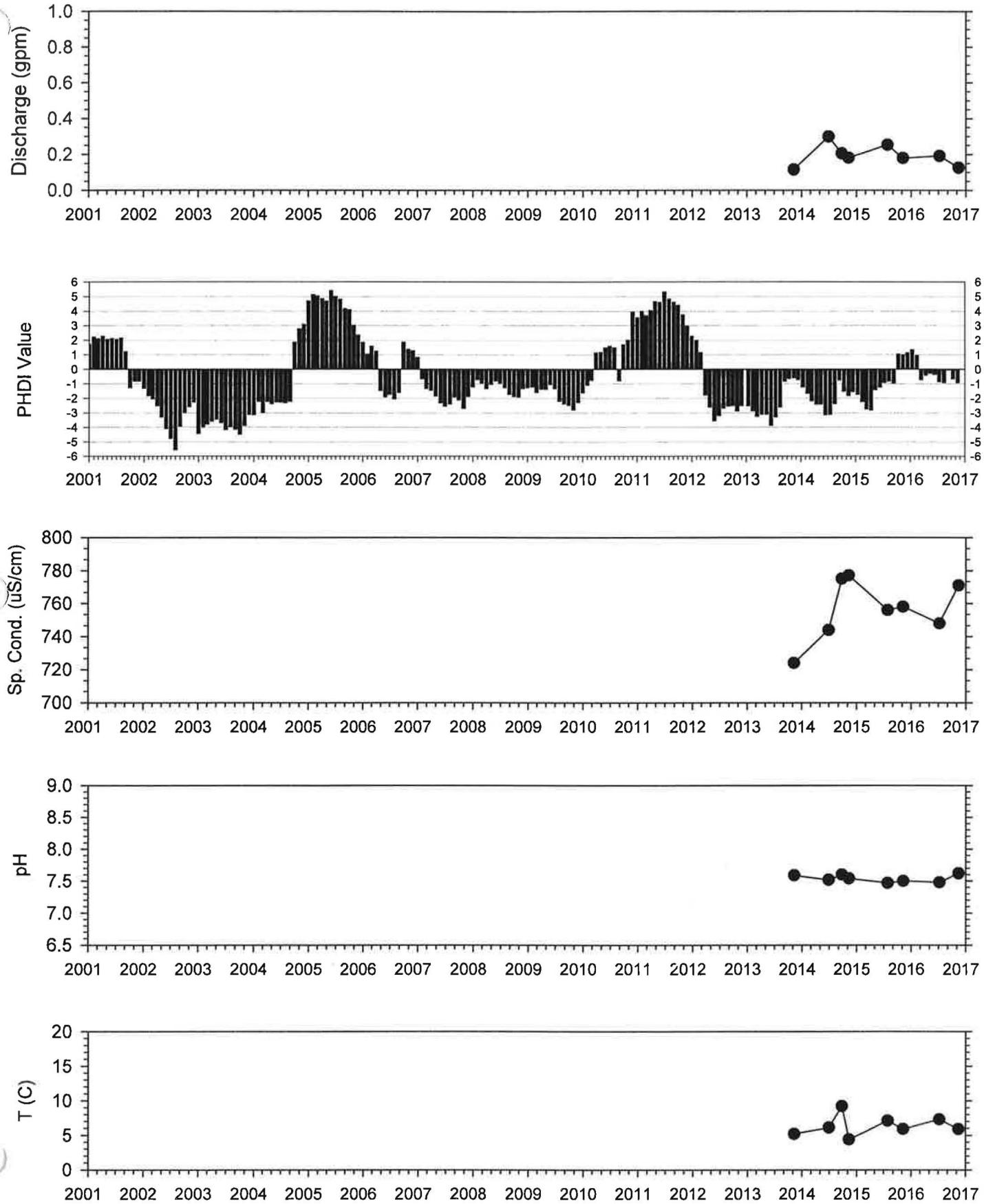
Spring GW-13


Discharge (gpm)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
PHDI Value
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
Sp. Cond. (µs/cm)
1800
1600
1400
1200
1000
800
pH
9.0
8.5
8.0
7.5
7.0
6.5
T (C)
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

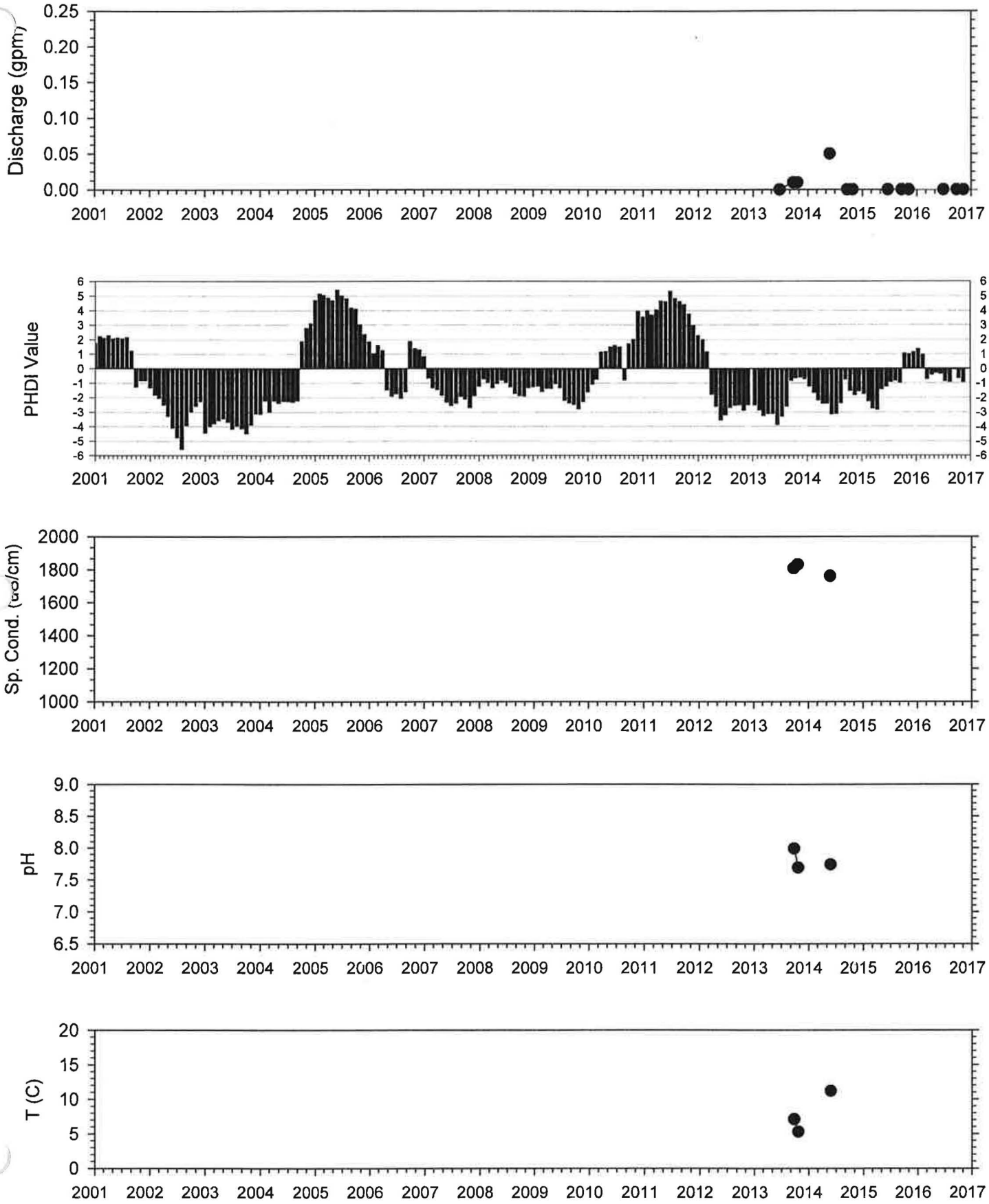
Spring Sufco 006A



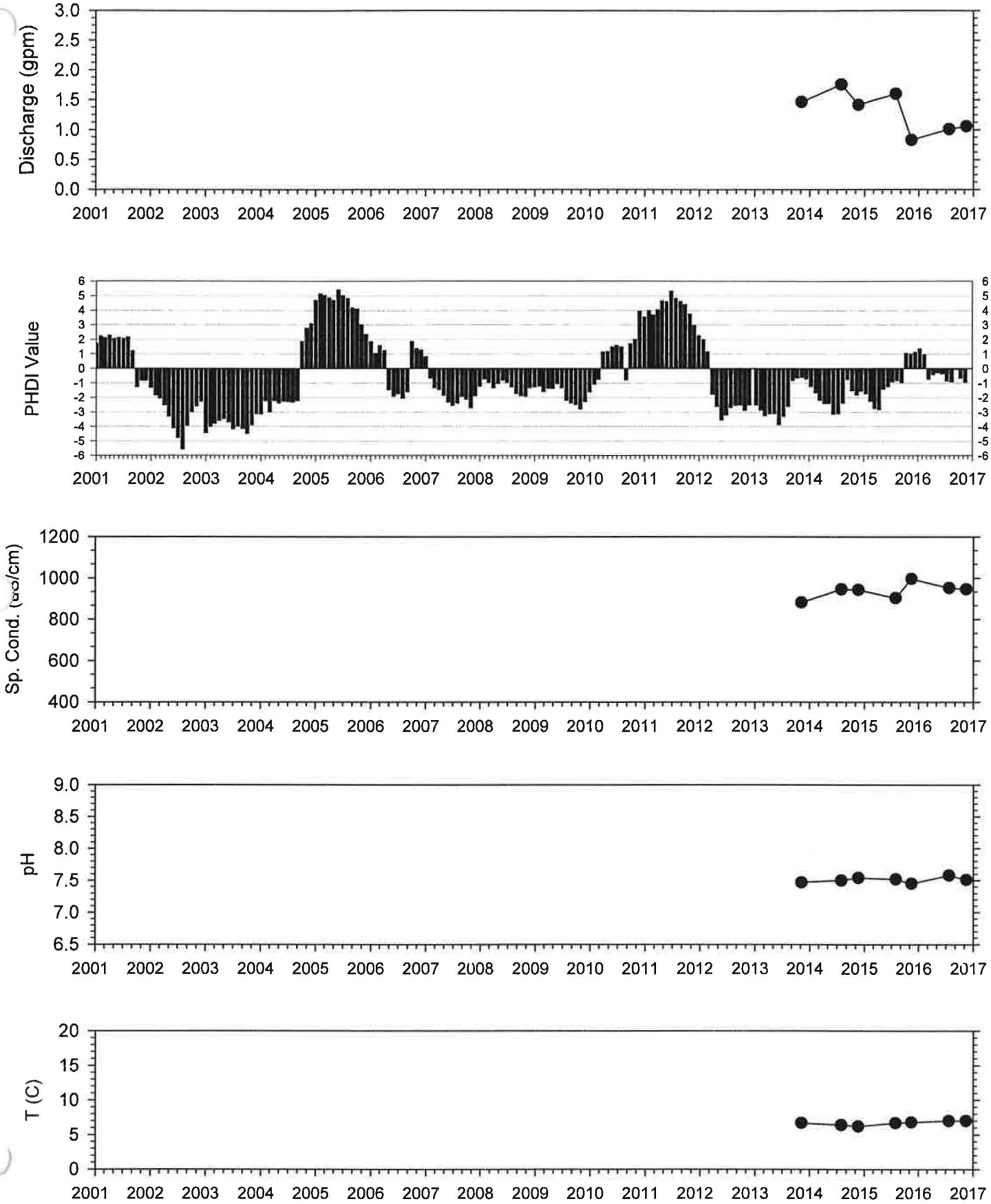
Spring 94-110



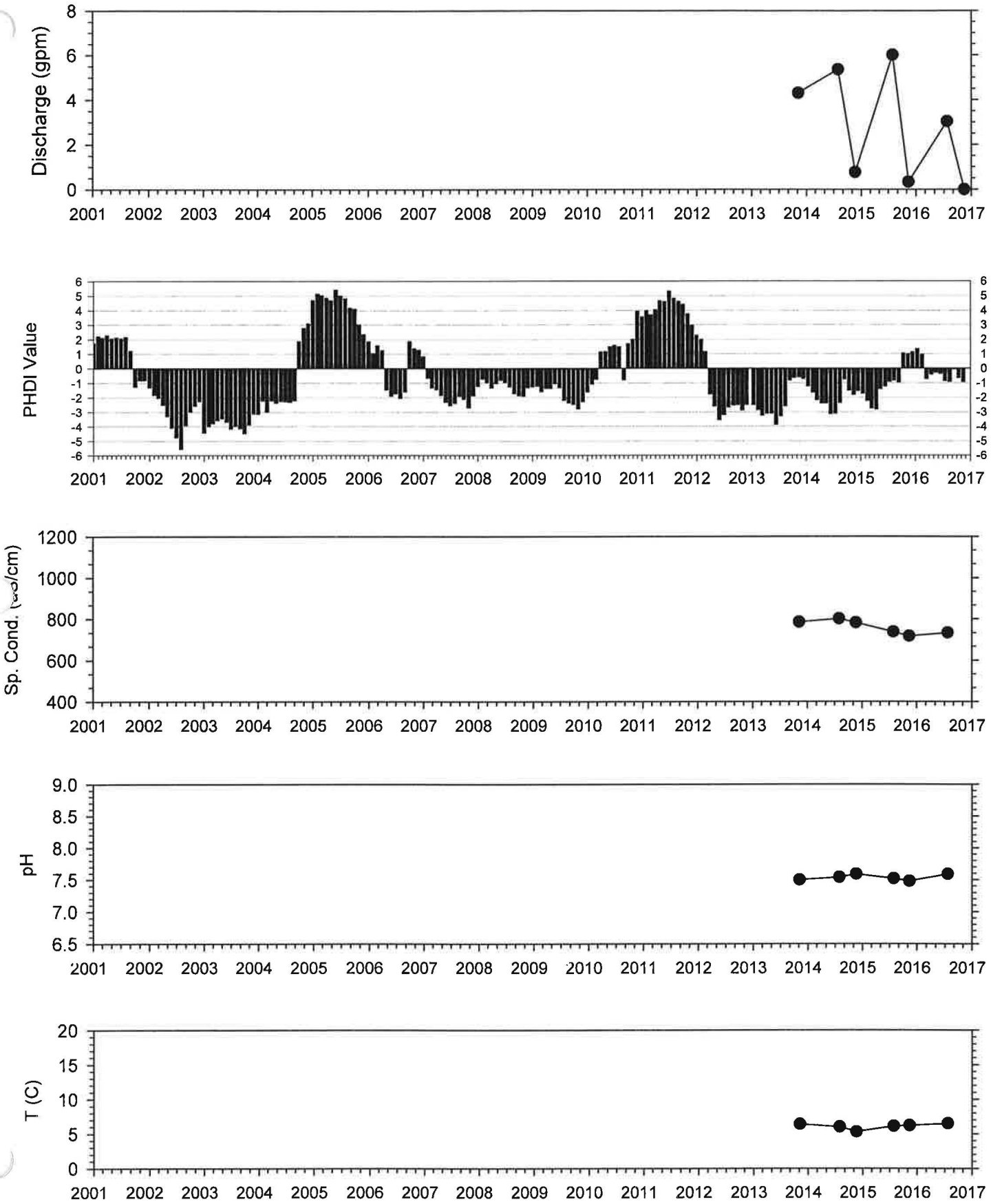
Spring 94-113



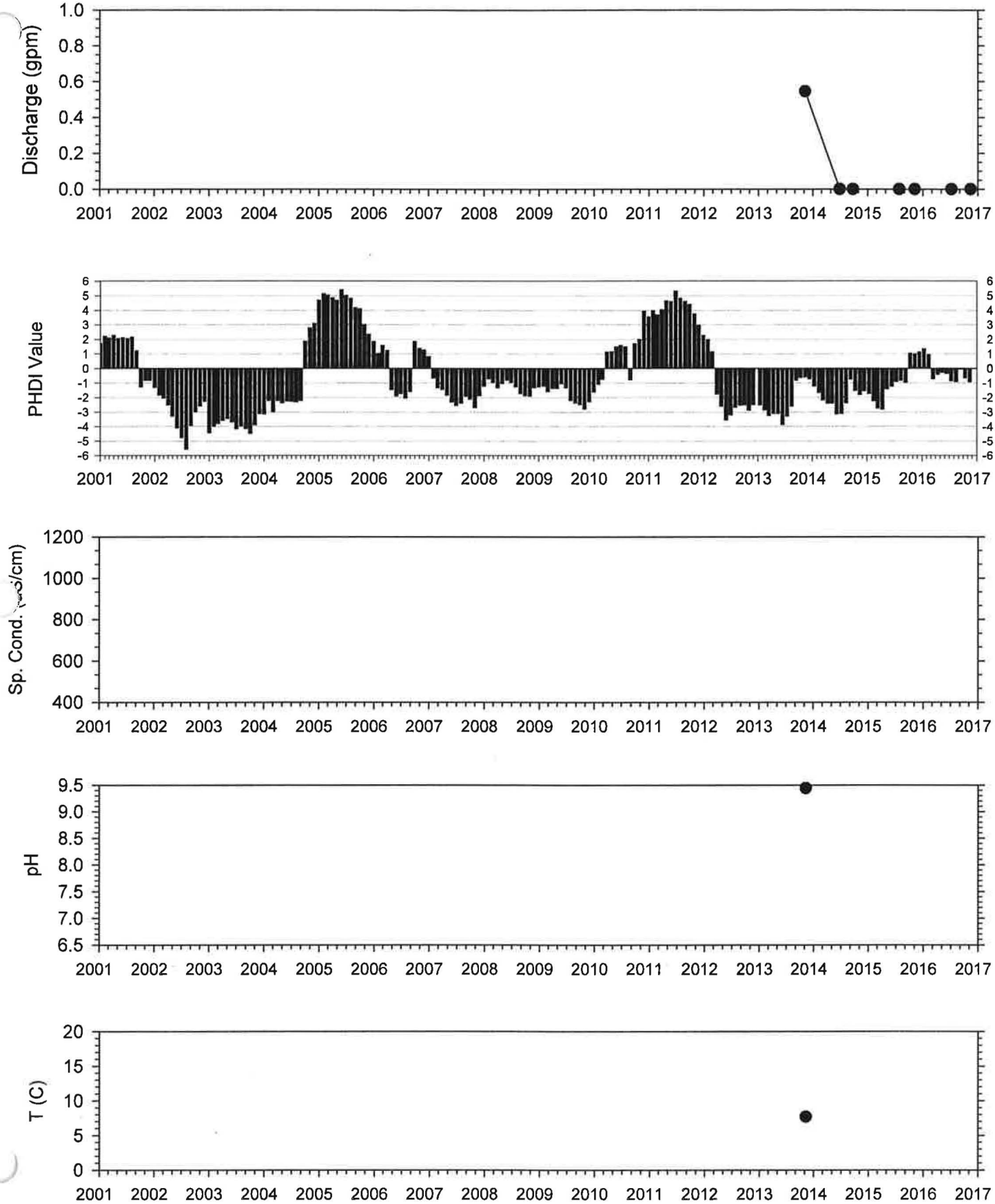
Spring A


Discharge (gpm)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
PHDI Value
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
Sp. Cond. (µs/cm)
1200
1000
800
600
400
pH
9.0
8.5
8.0
7.5
7.0
6.5
T (C)
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

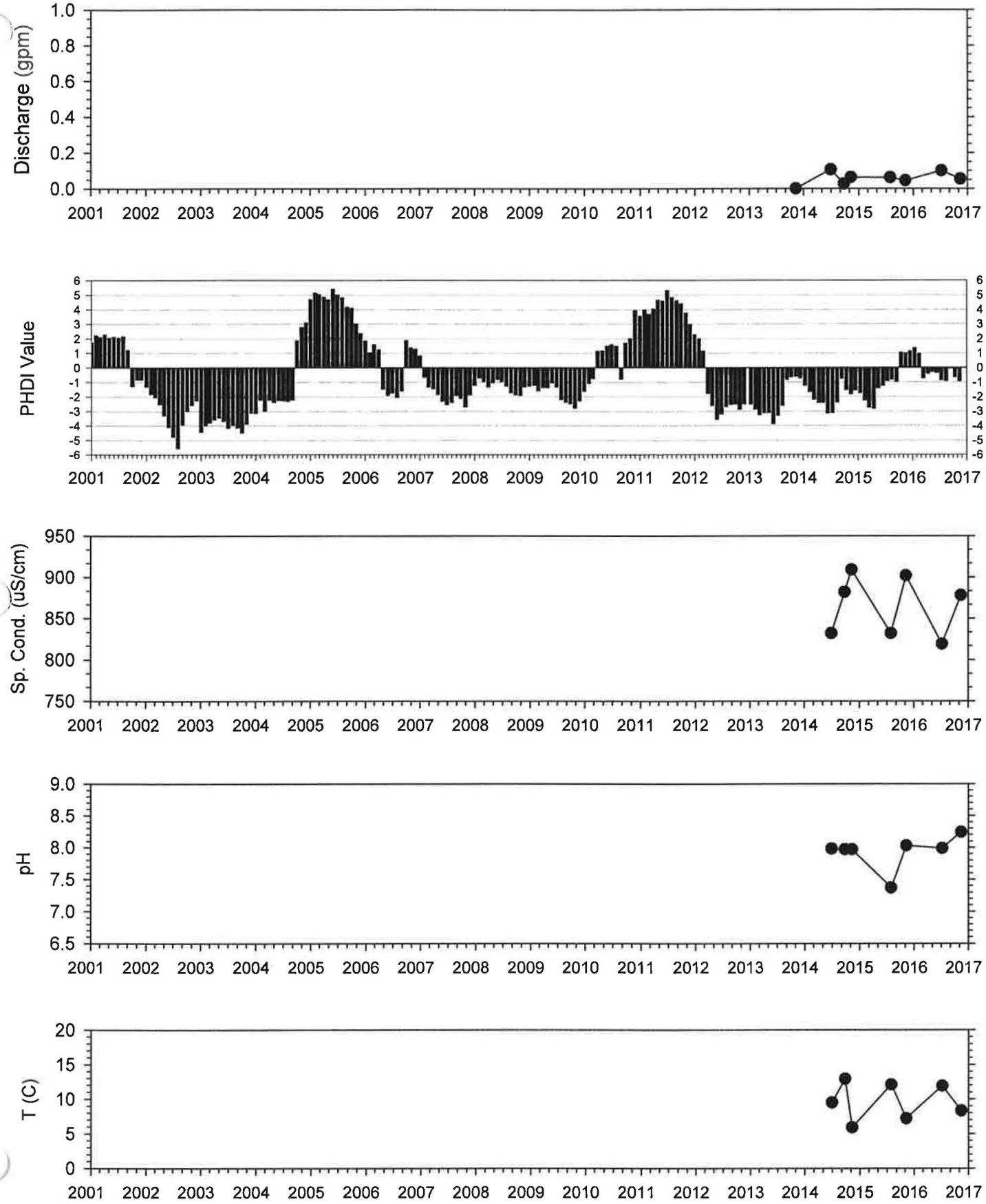
Spring B


Discharge (gpm)
PHDI Value
Sp. Cond. (µs/cm)
pH
T (C)
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

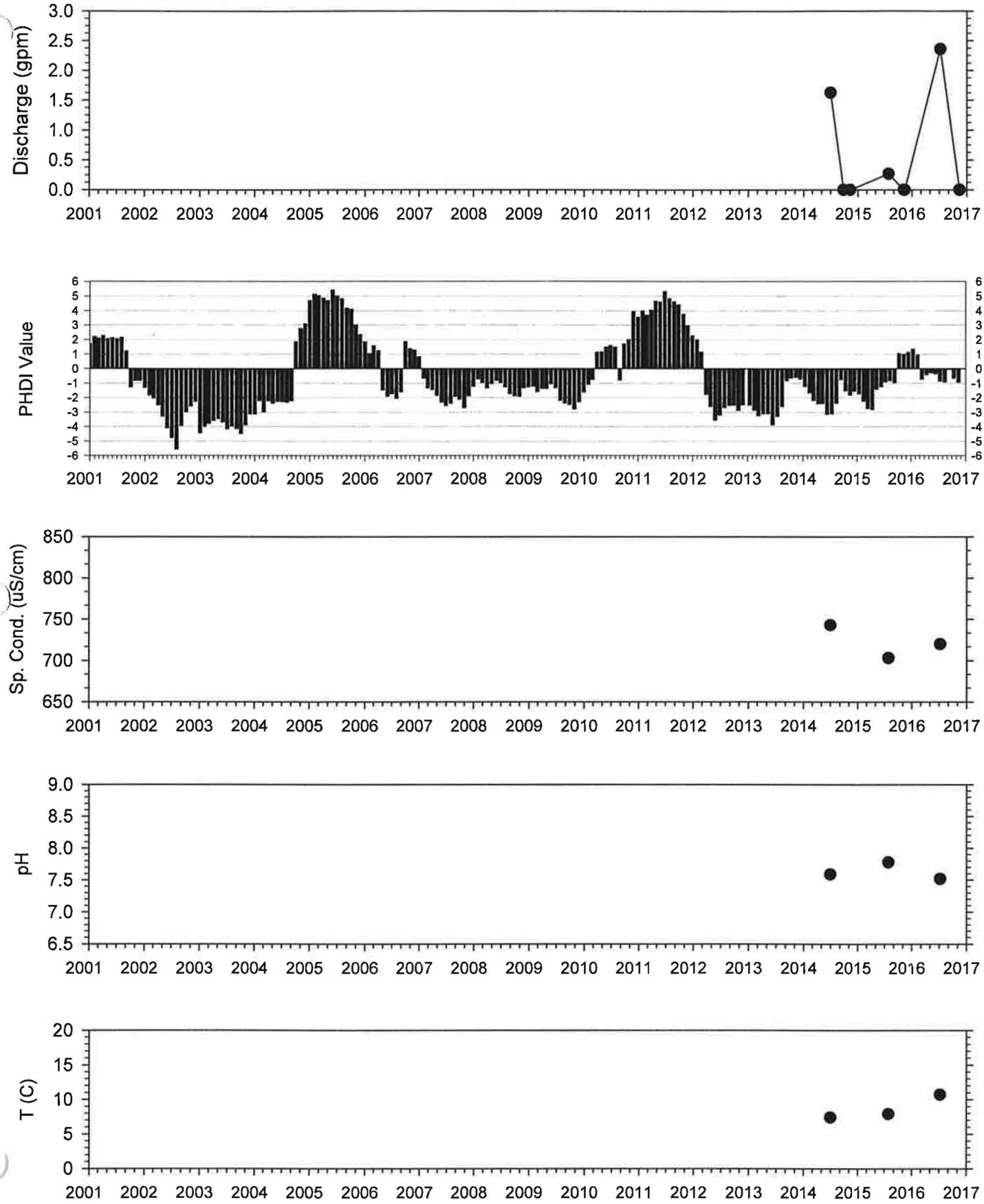
Spring D


Discharge (gpm)
1.0
0.8
0.6
0.4
0.2
0.0
PHDI Value
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
Sp. Cond. (µS/cm)
1200
1000
800
600
400
pH
9.5
9.0
8.5
8.0
7.5
7.0
6.5
T (C)
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

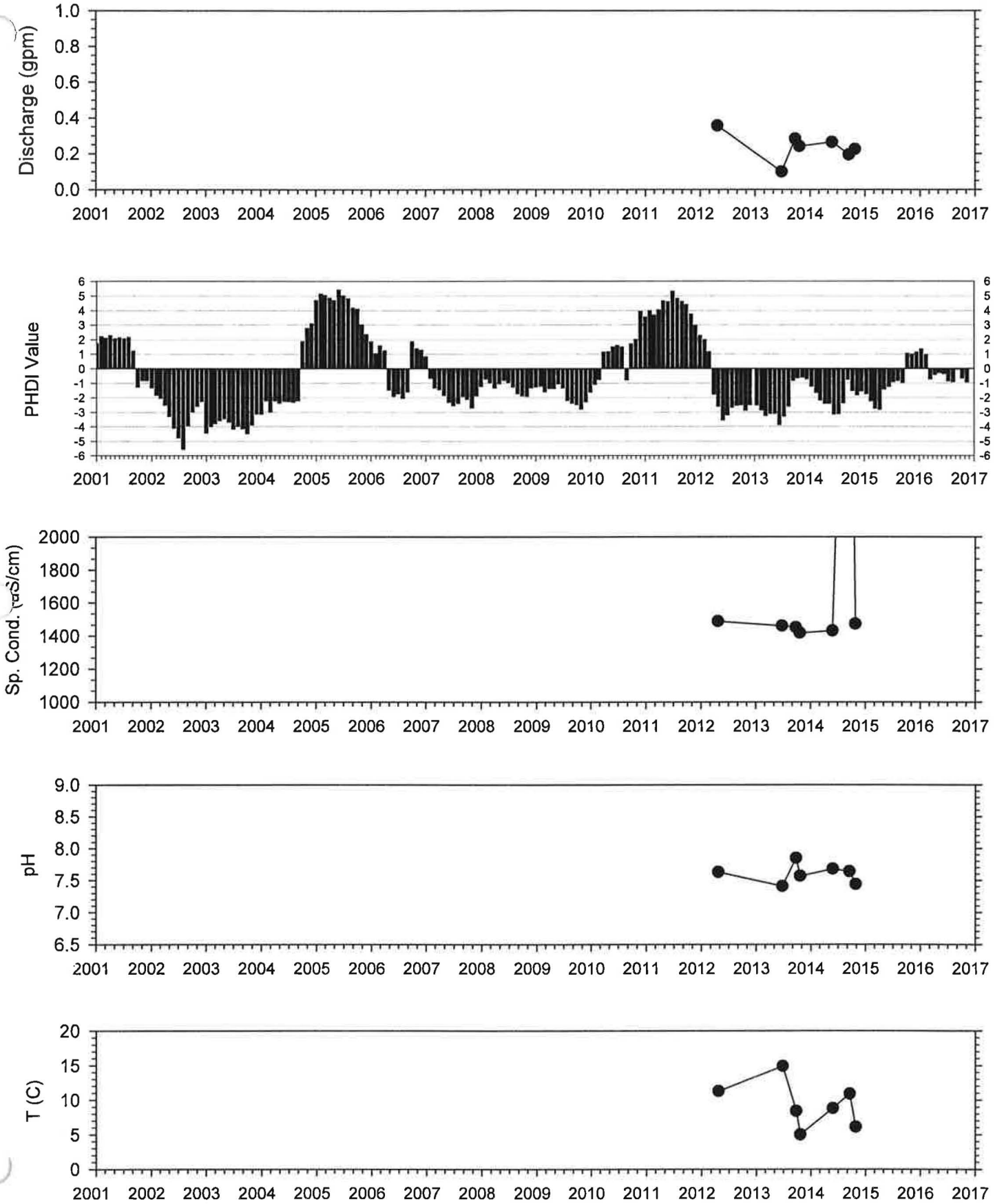
Spring A2S-1


Discharge (gpm)
1.0
0.8
0.6
0.4
0.2
0.0
PHDI Value
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
Sp. Cond. (uS/cm)
950
900
850
800
750
pH
9.0
8.5
8.0
7.5
7.0
6.5
T (C)
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

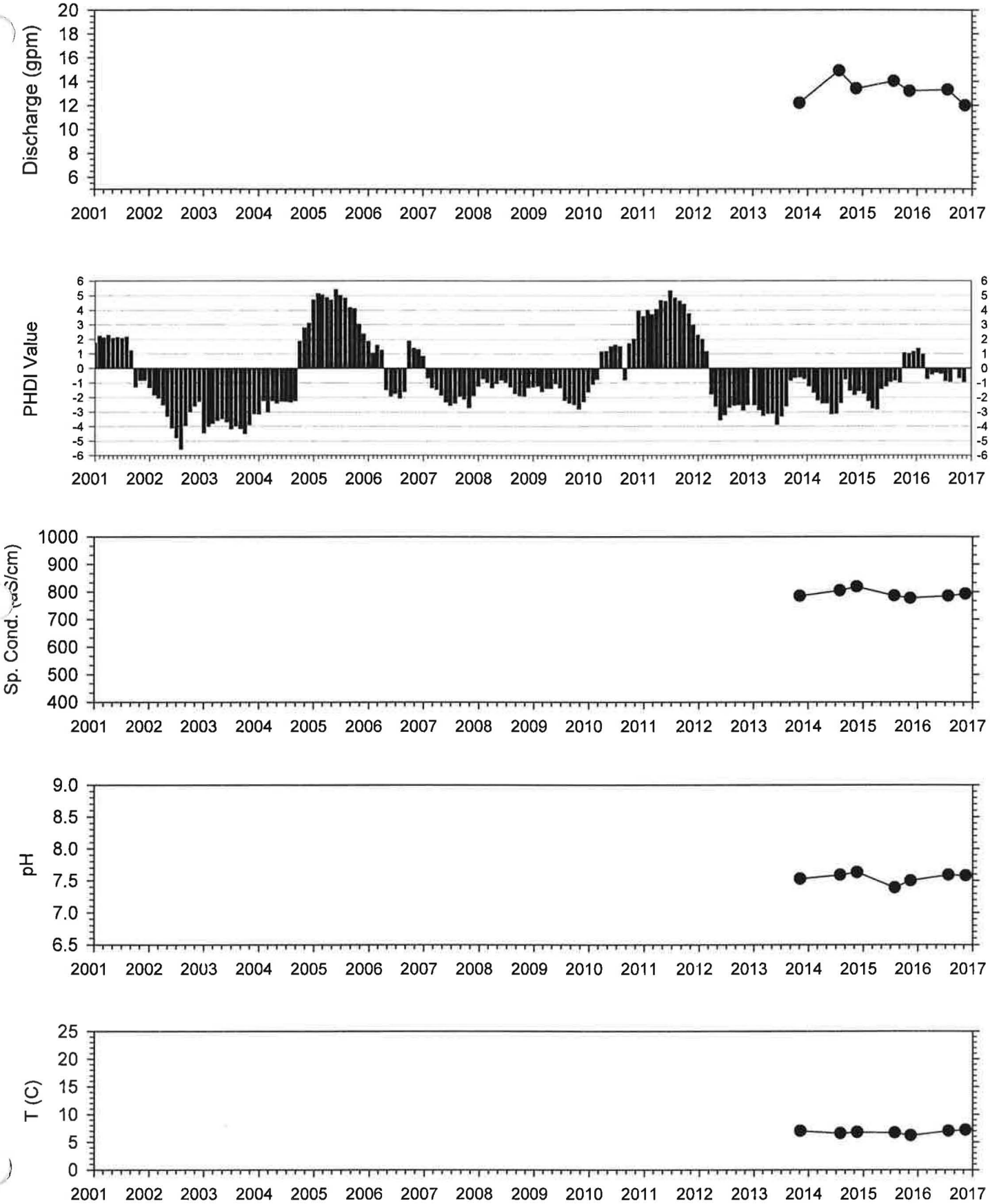
Divide Spring



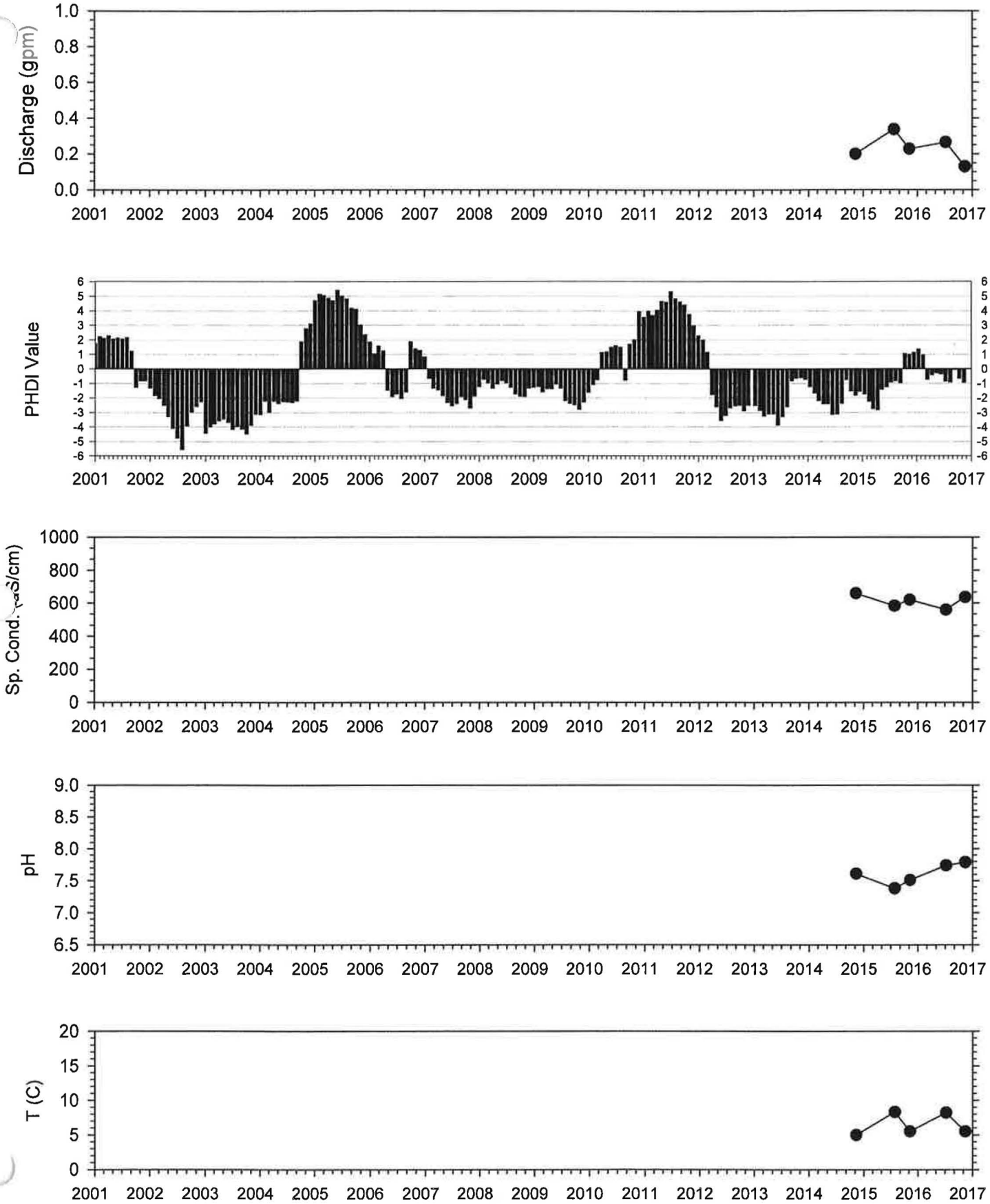
Hansen Seep


Discharge (gpm)
1.0
0.8
0.6
0.4
0.2
0.0
PHDI Value
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
Sp. Cond. (µS/cm)
2000
1800
1600
1400
1200
1000
pH
9.0
8.5
8.0
7.5
7.0
6.5
T (C)
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

Spring Skutumpah Spring



Spring Spg 99



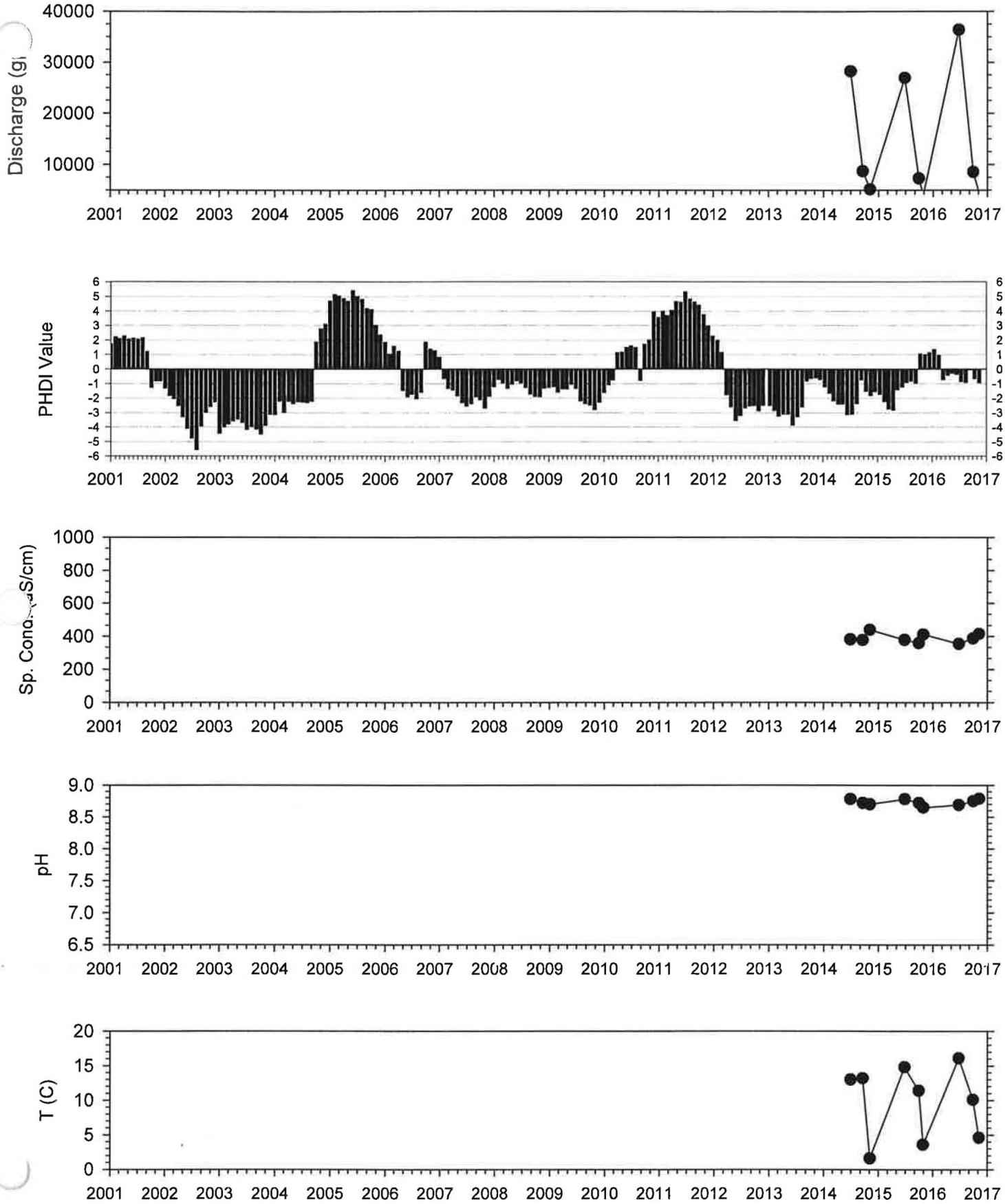
Attachment B

Discharge hydrographs for selected streams

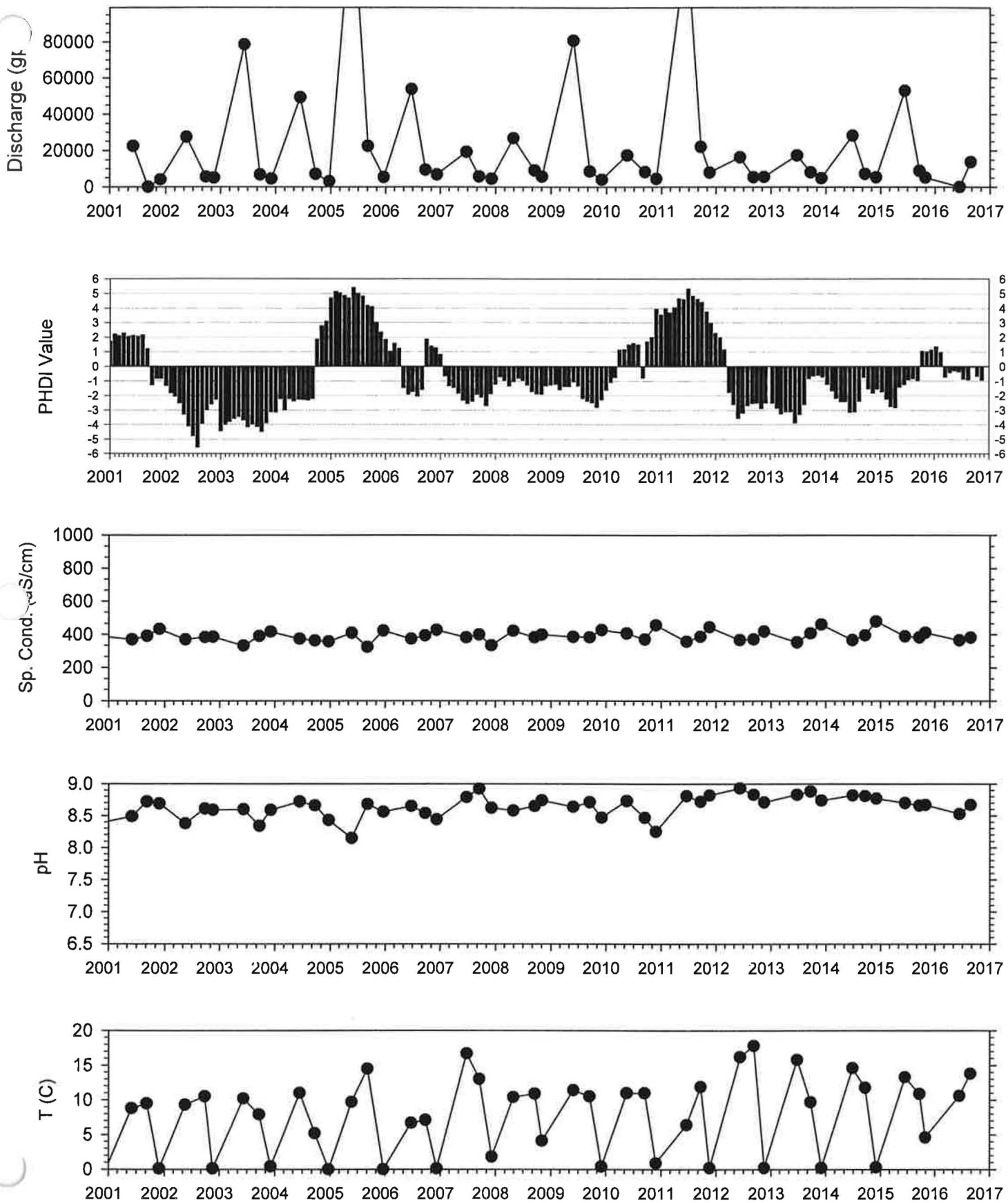
Plots of temperature, pH, specific conductance,

and Palmer Hydrologic Drought Index.

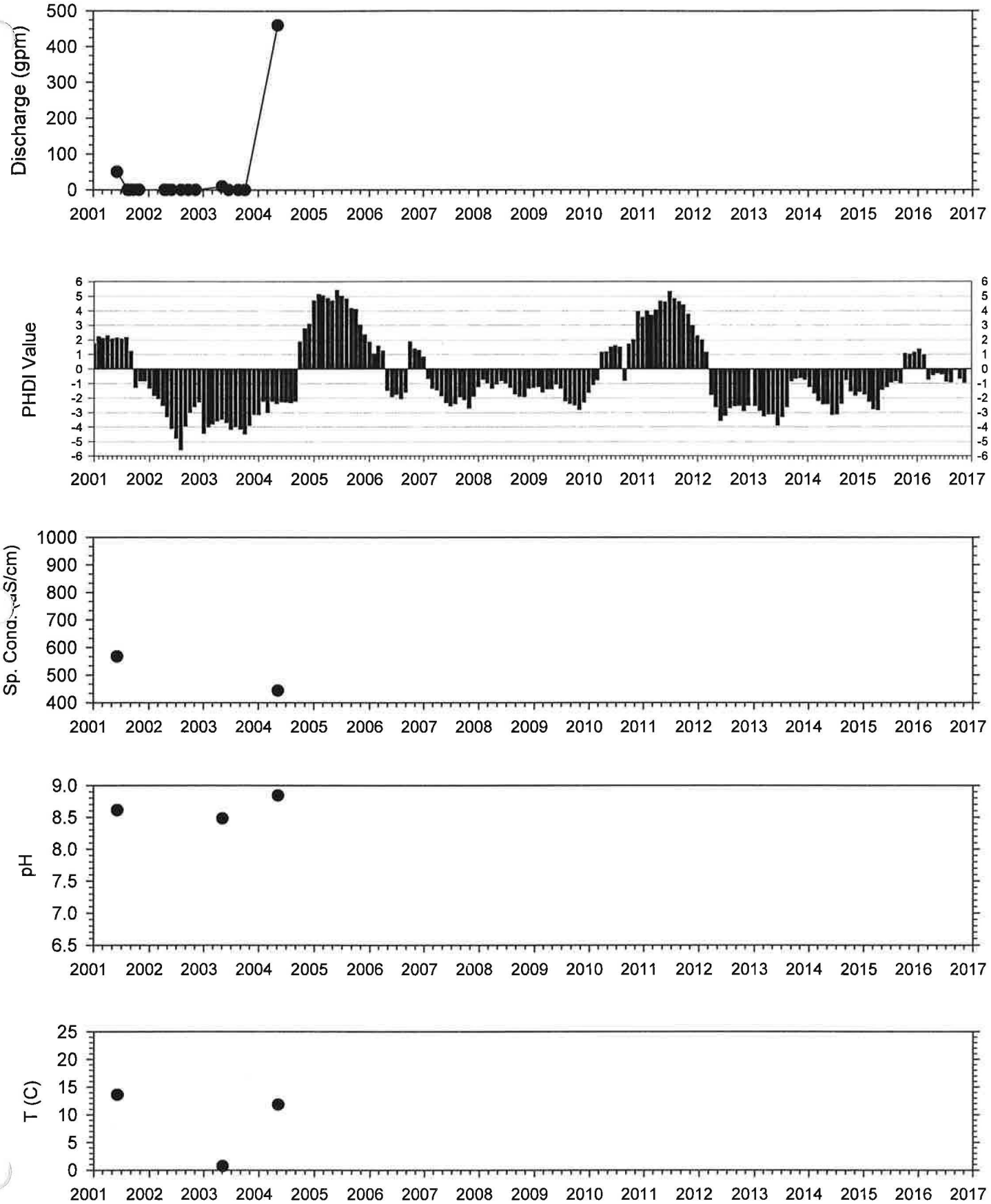
Stream U-Mud


Discharge (gl
40000
30000
20000
10000
PHDI Value
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
Sp. Cond. (µS/cm)
1000
800
600
400
200
0
pH
9.0
8.5
8.0
7.5
7.0
6.5
T (C)
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

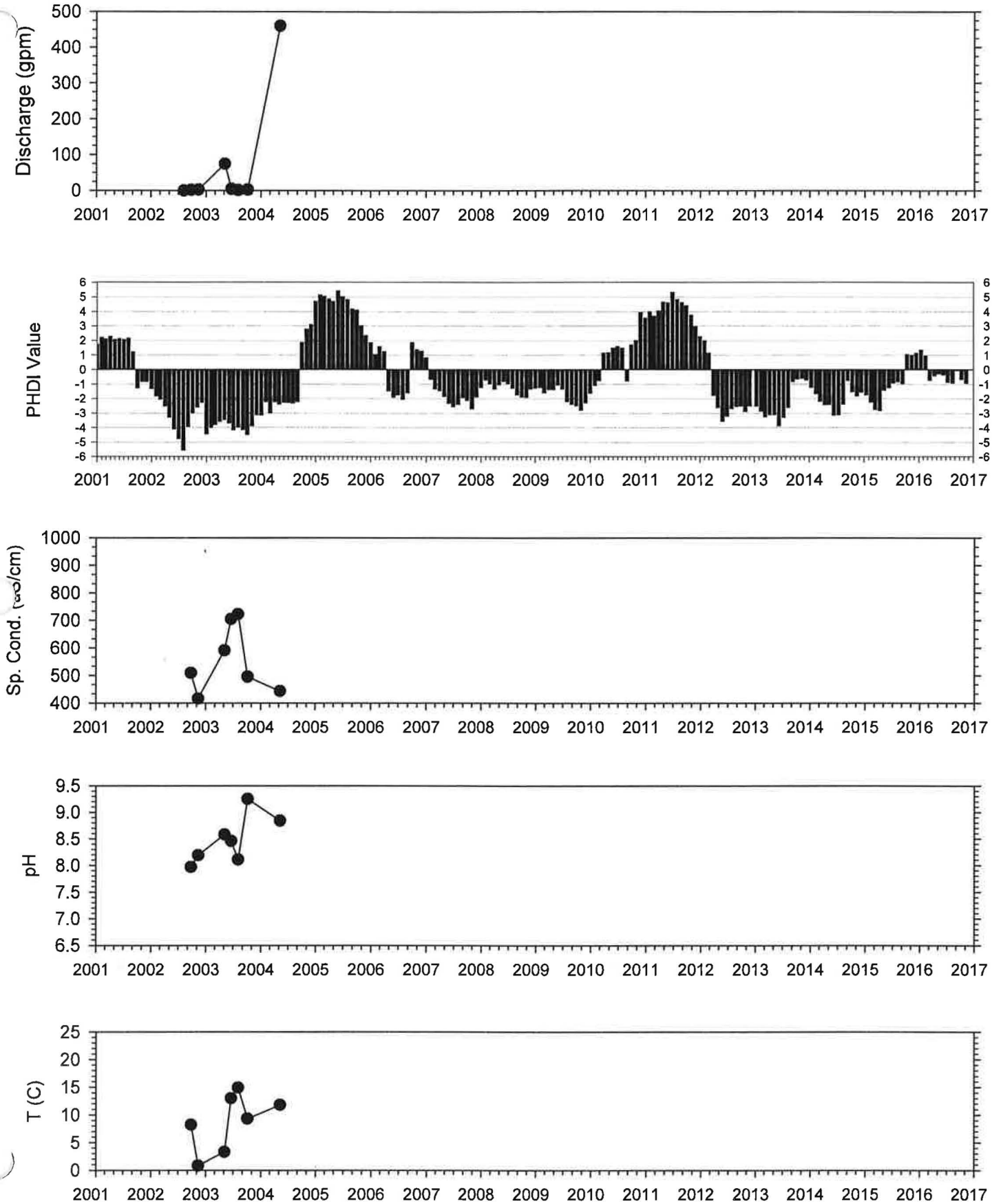
Stream Pines 405



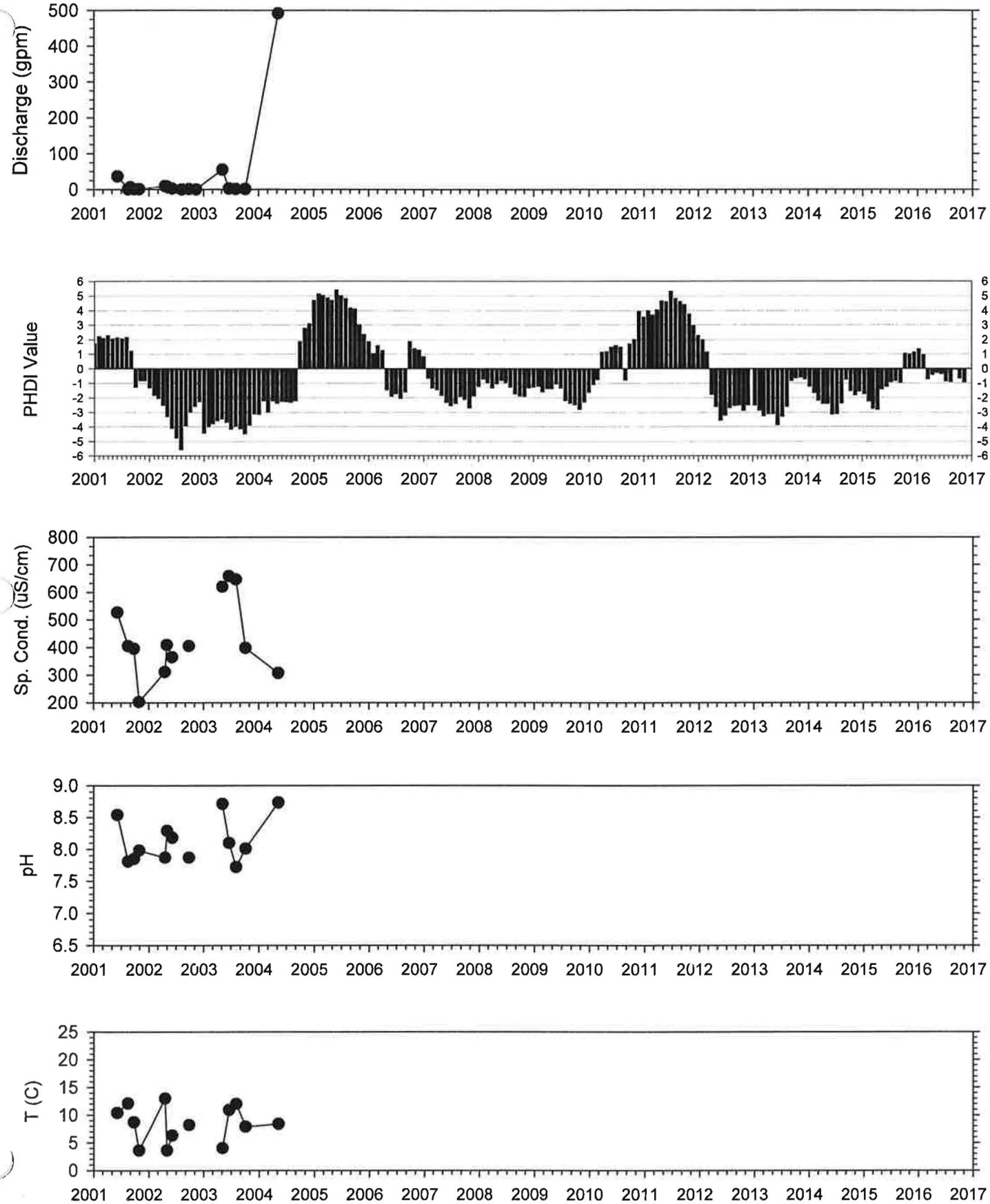
Spring M-STR01



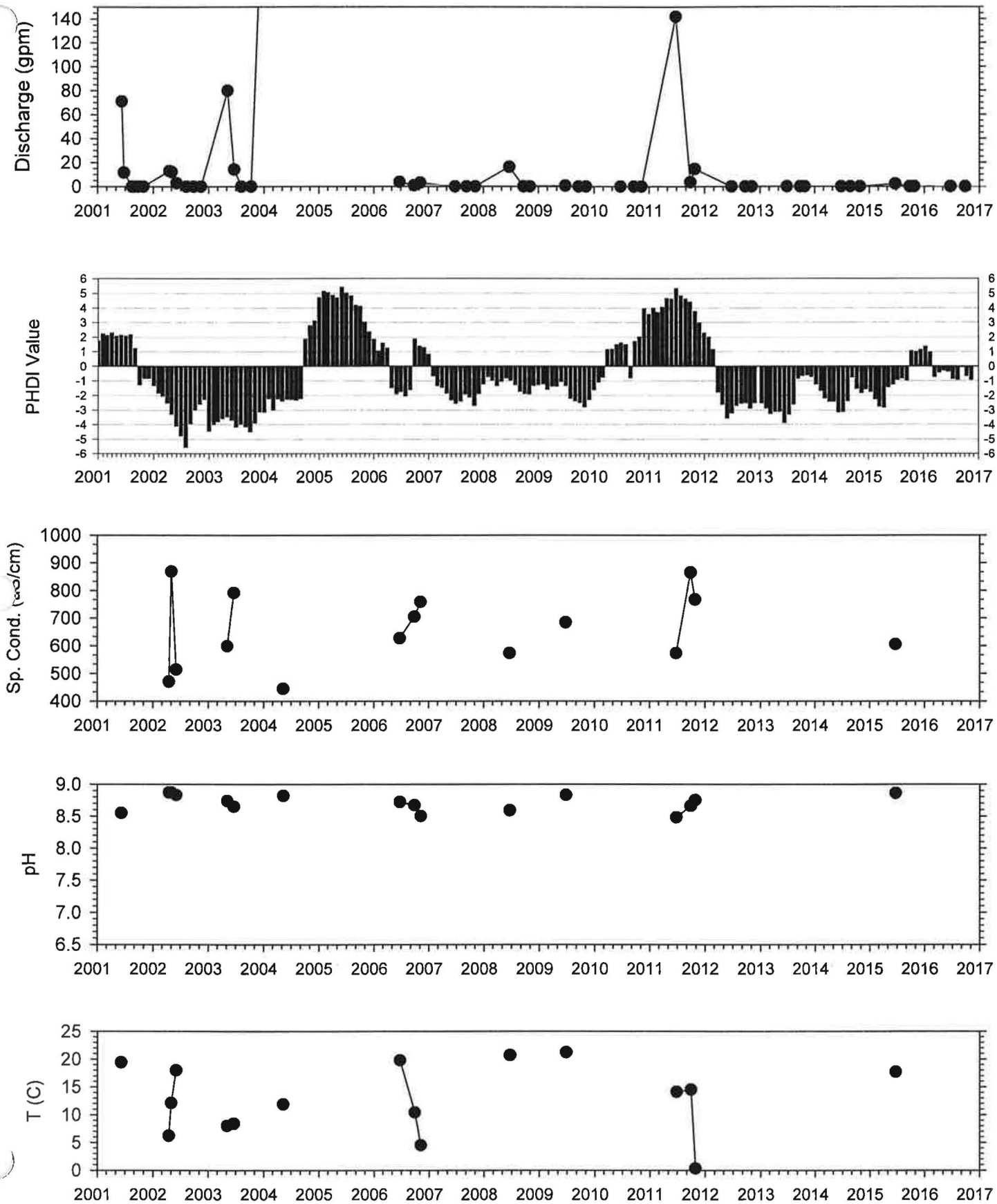
Spring M-STR02



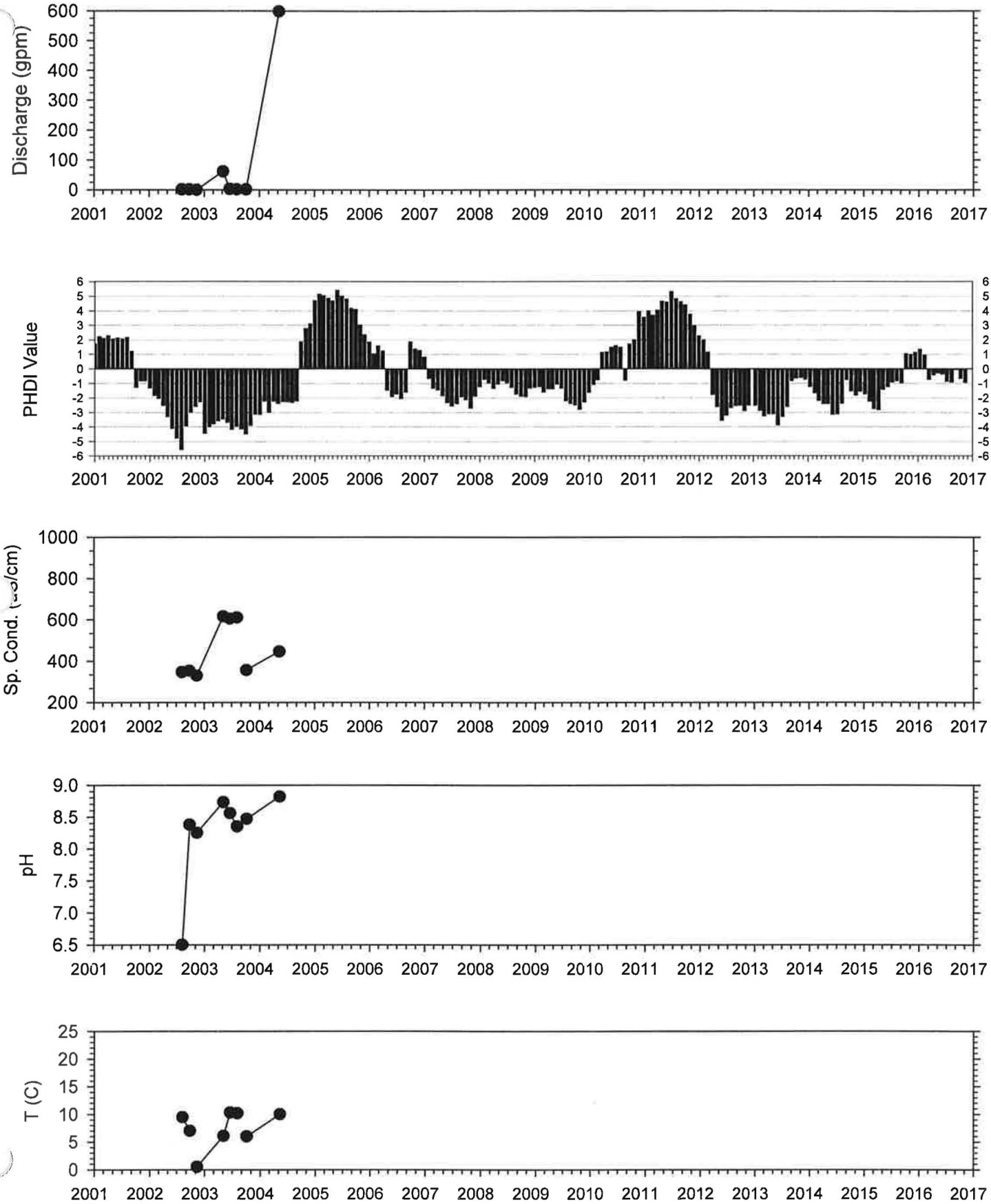
Spring M-STR03



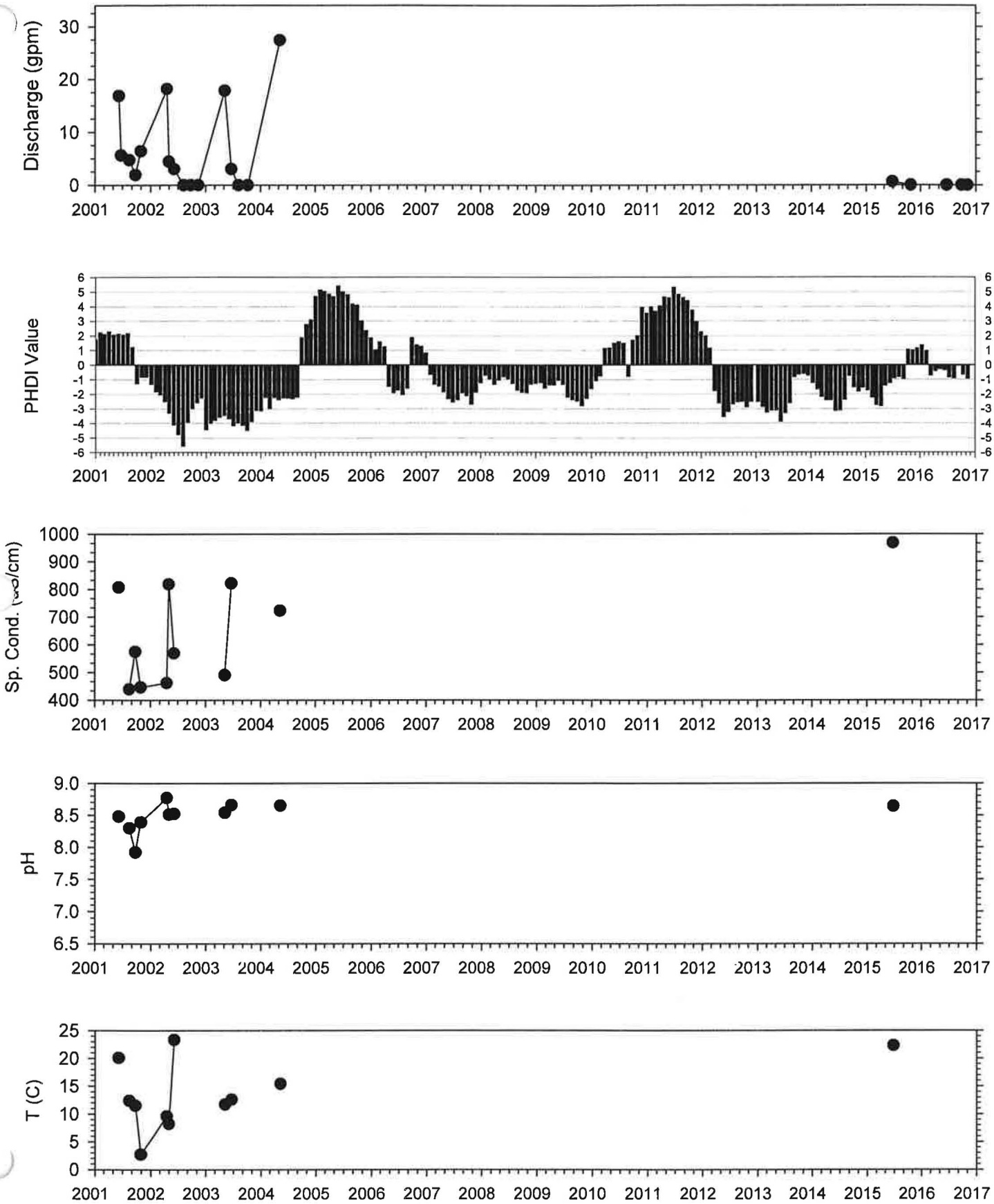
Stream M-STR04



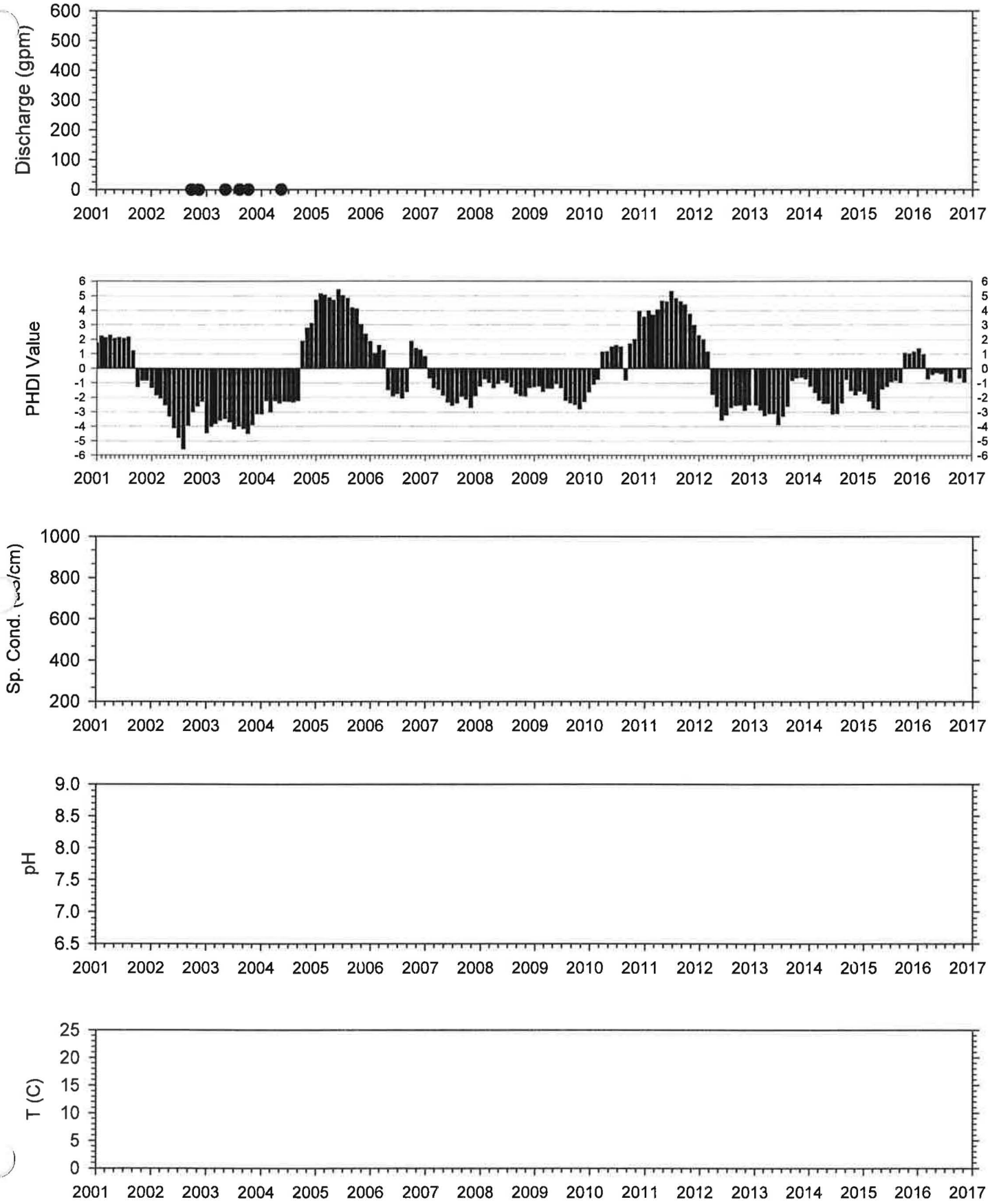
Spring M-STR05



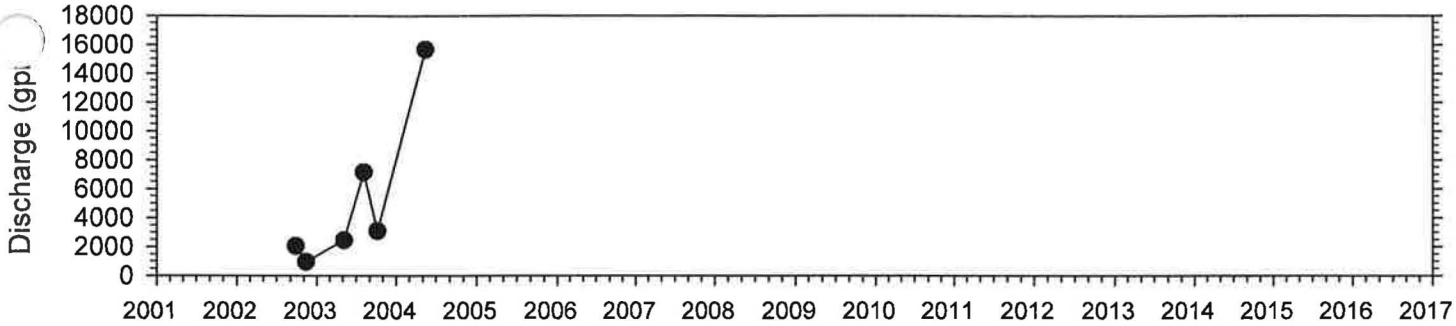
Stream M-STR06

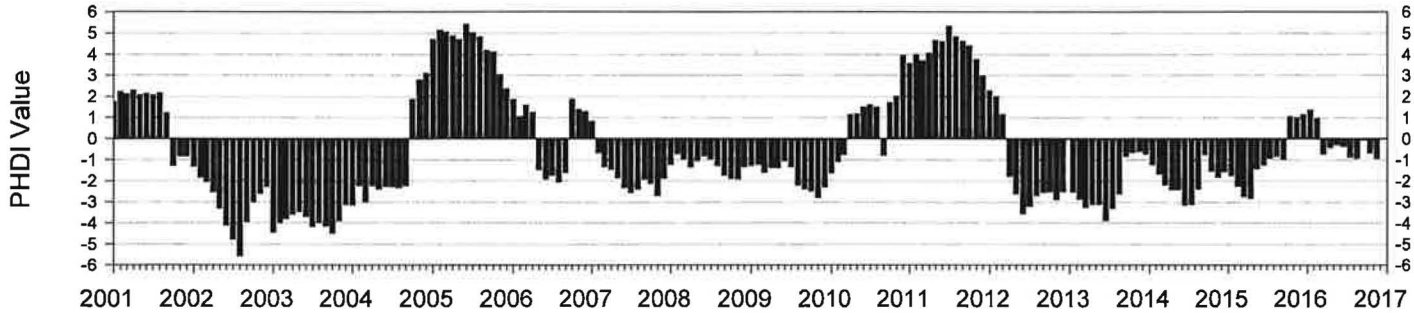


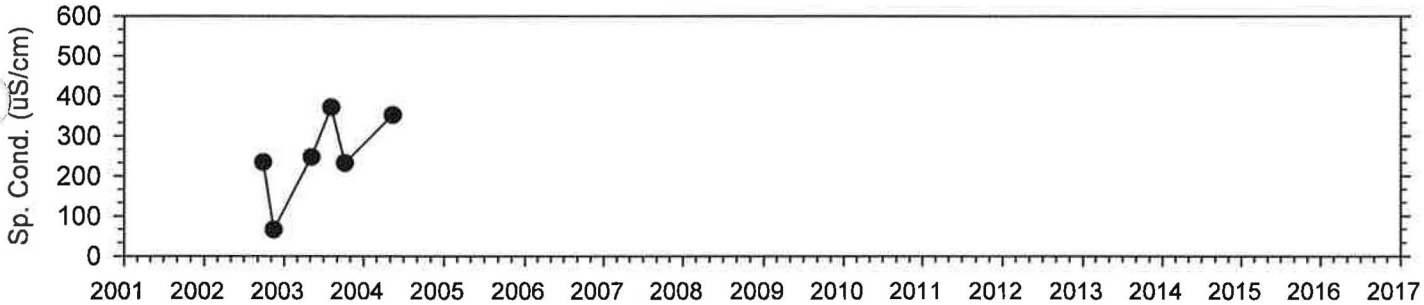
Spring M-STR07

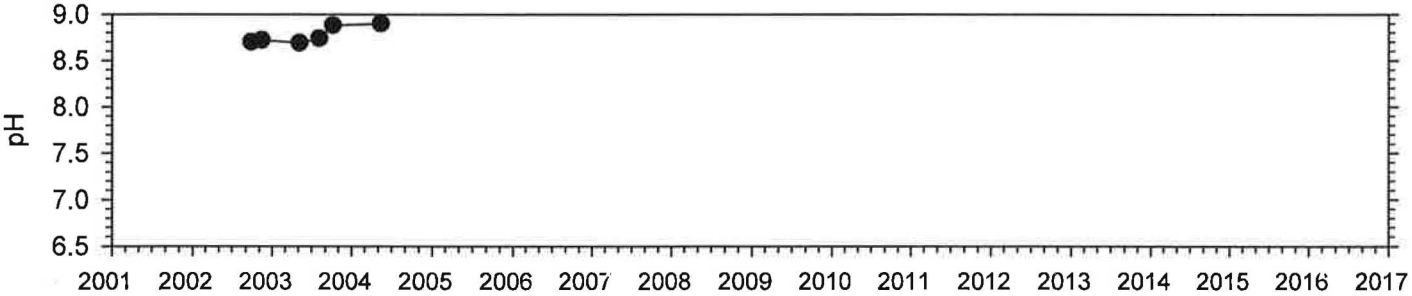


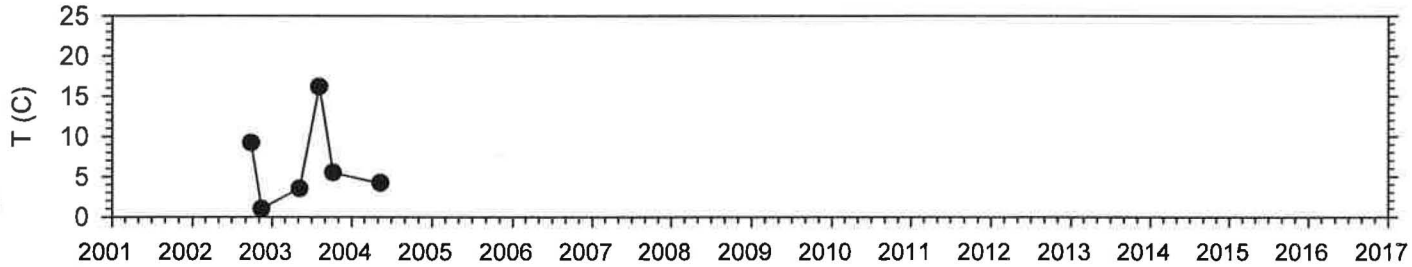
Stream M-STR08



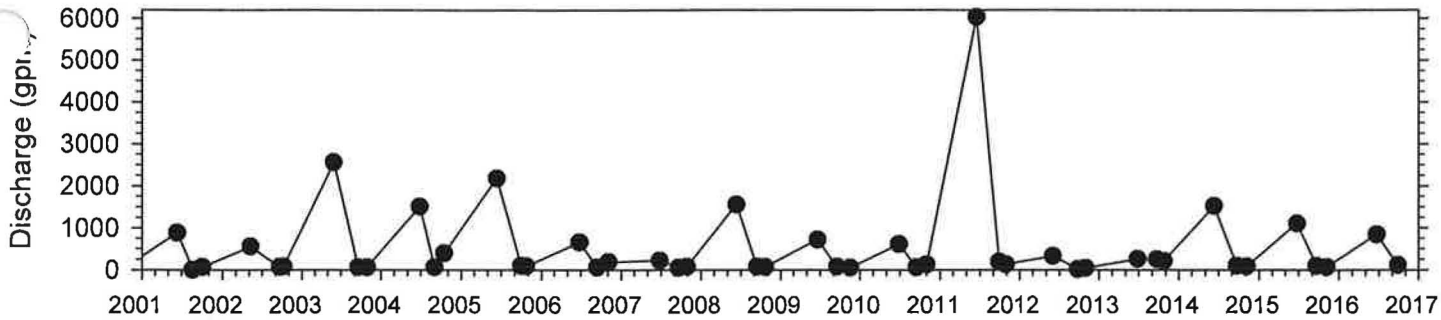


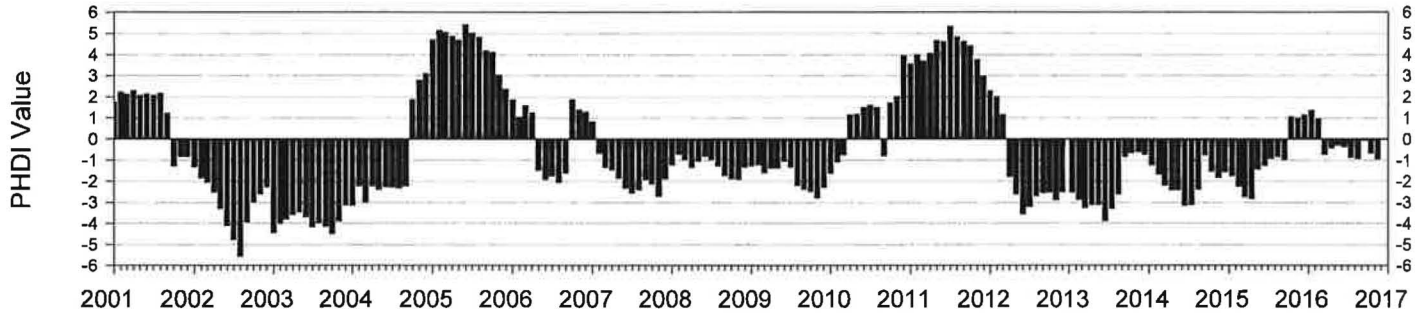


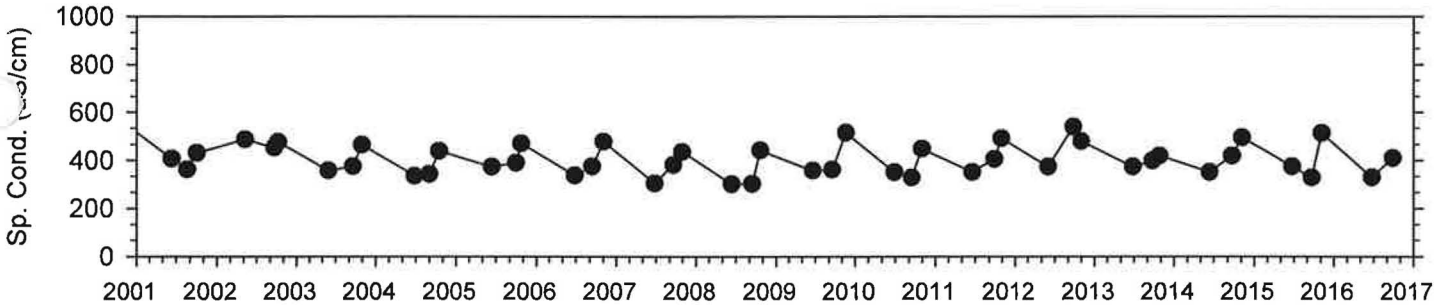


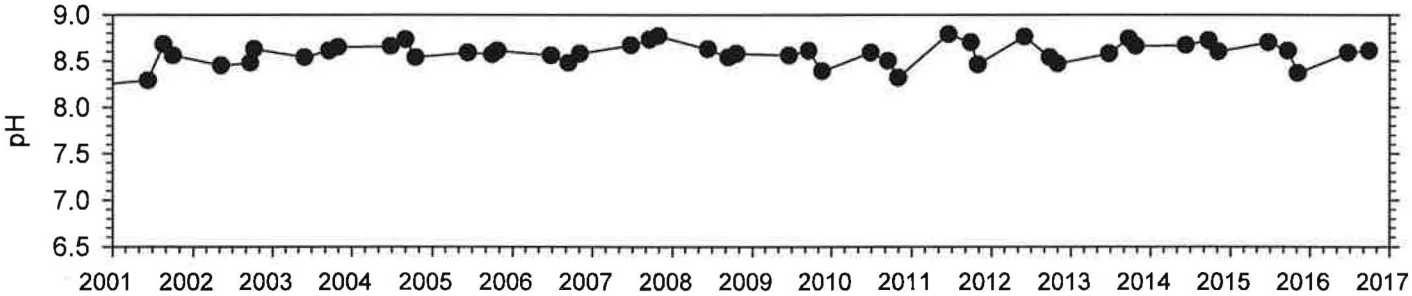


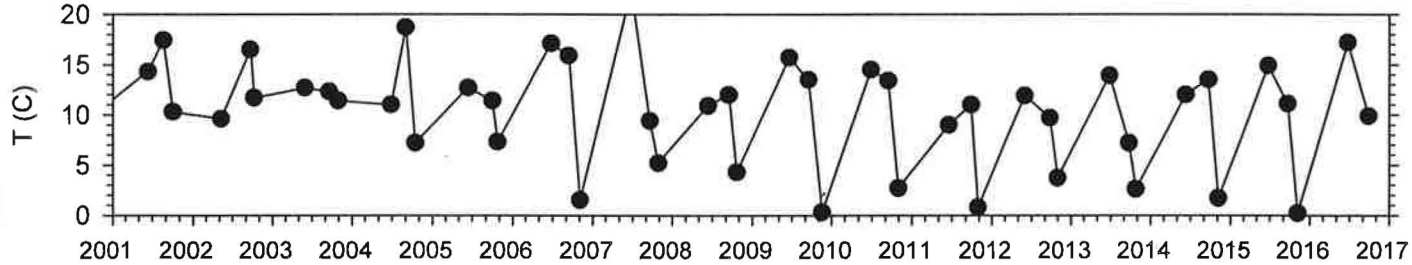
Stream Sufco 007



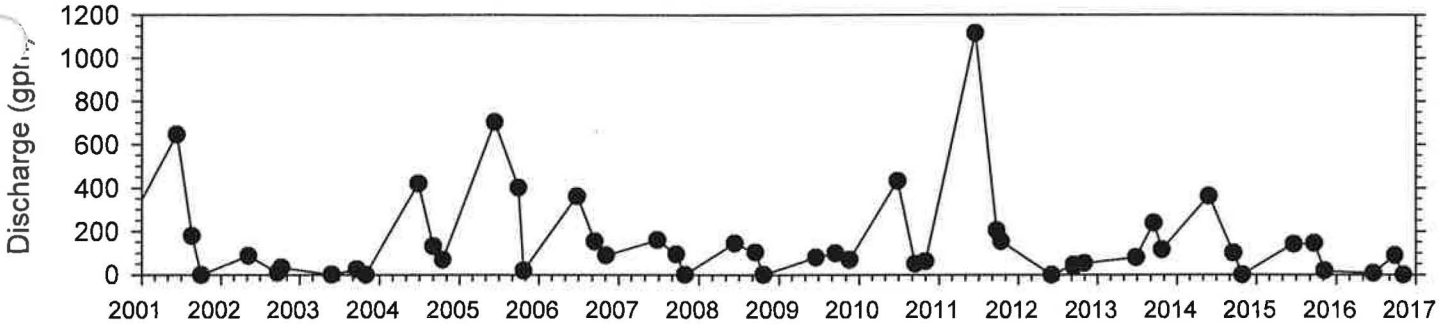


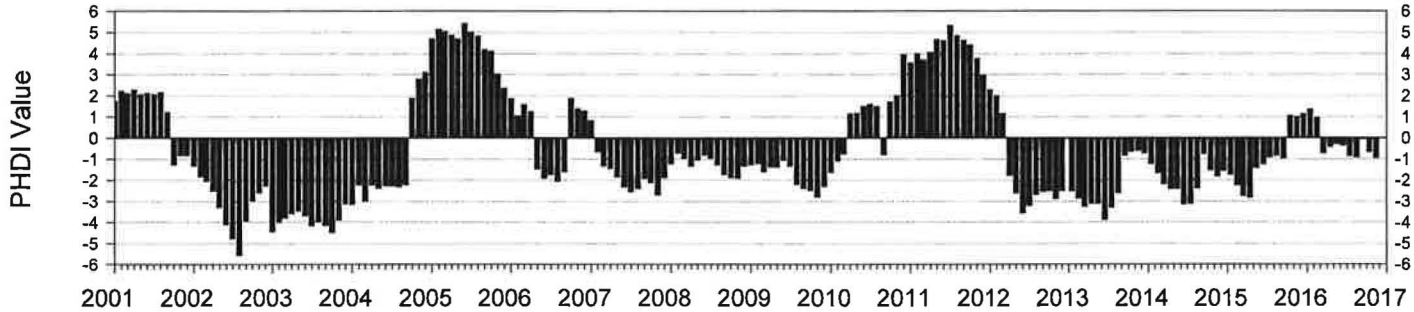


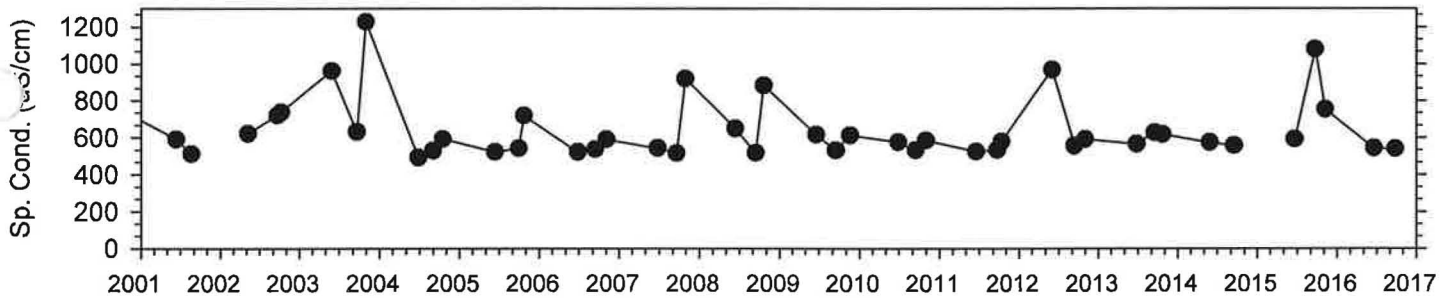


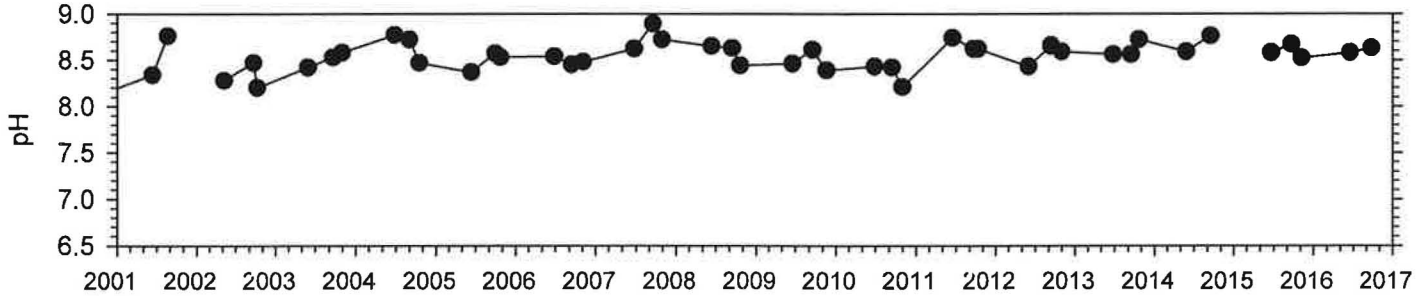


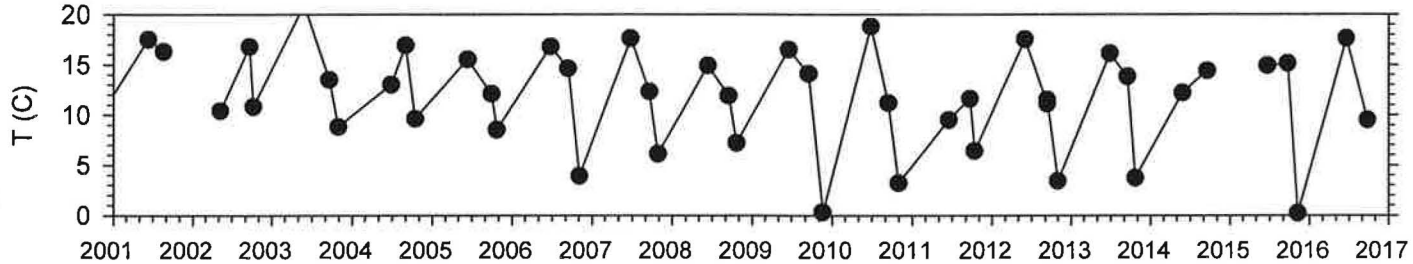
Stream Sufco 006



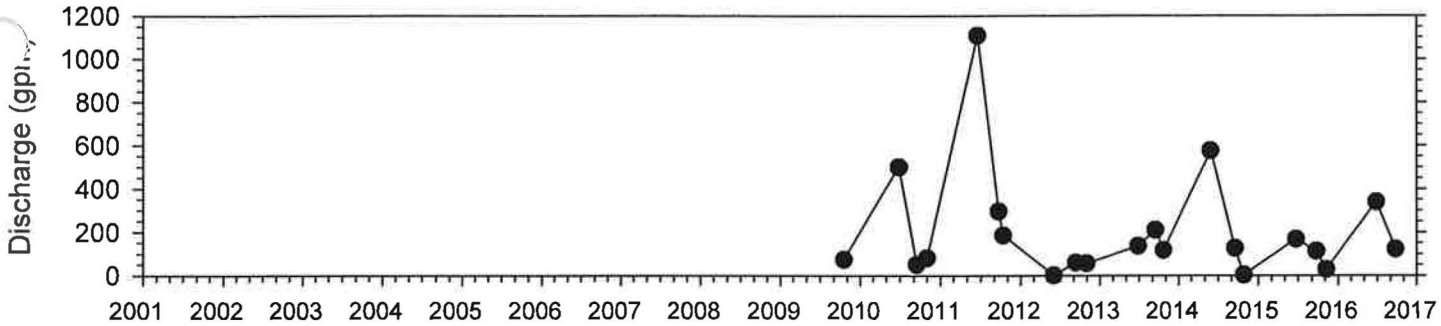


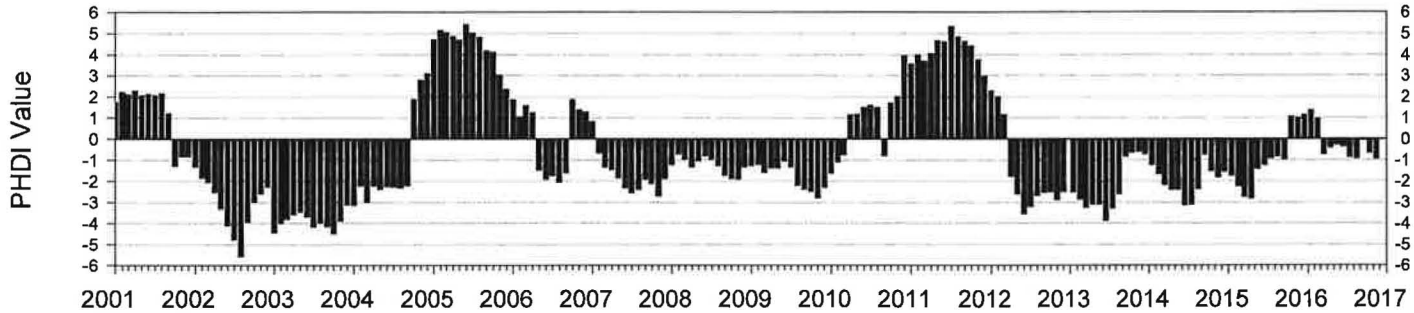


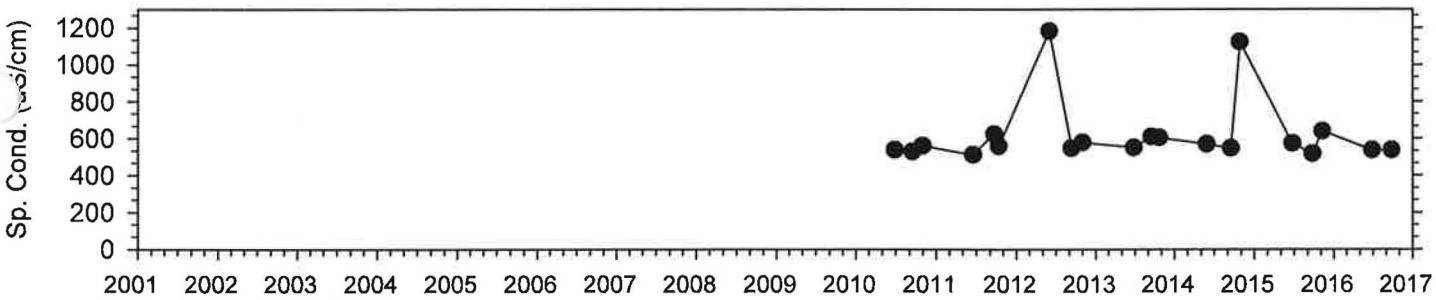


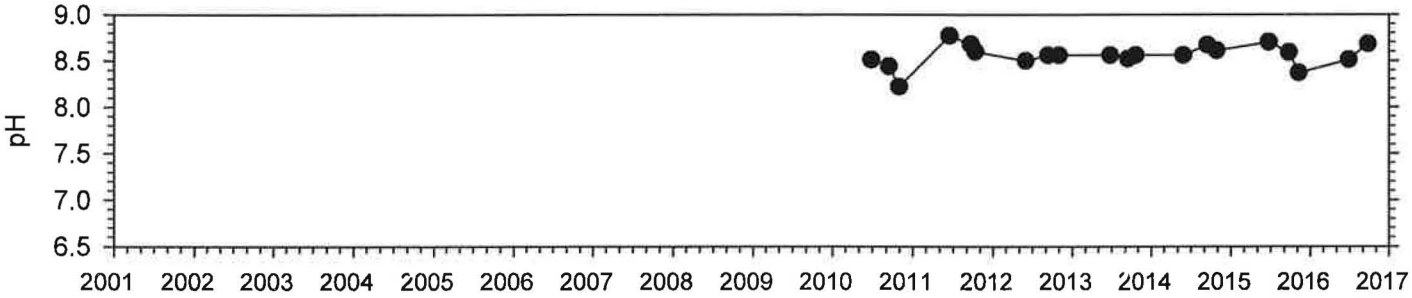


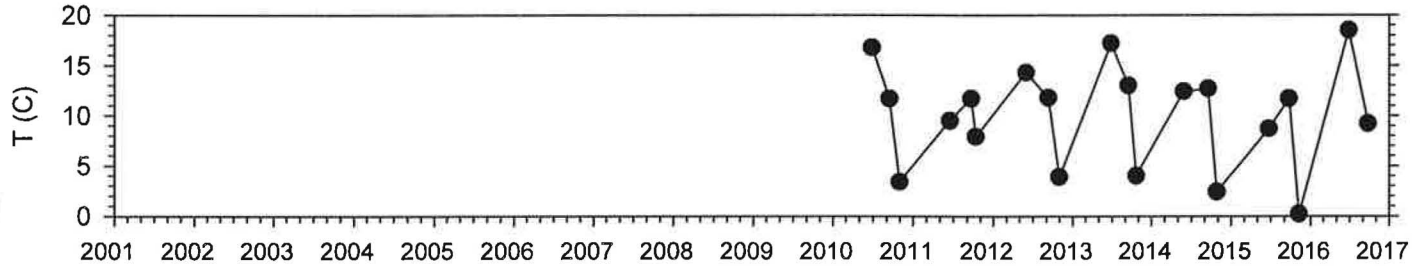
Stream Sufco 006A



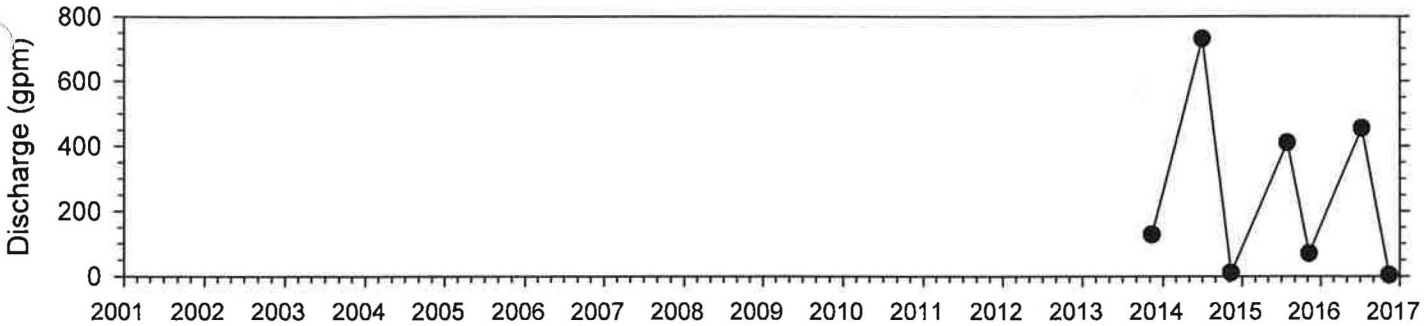


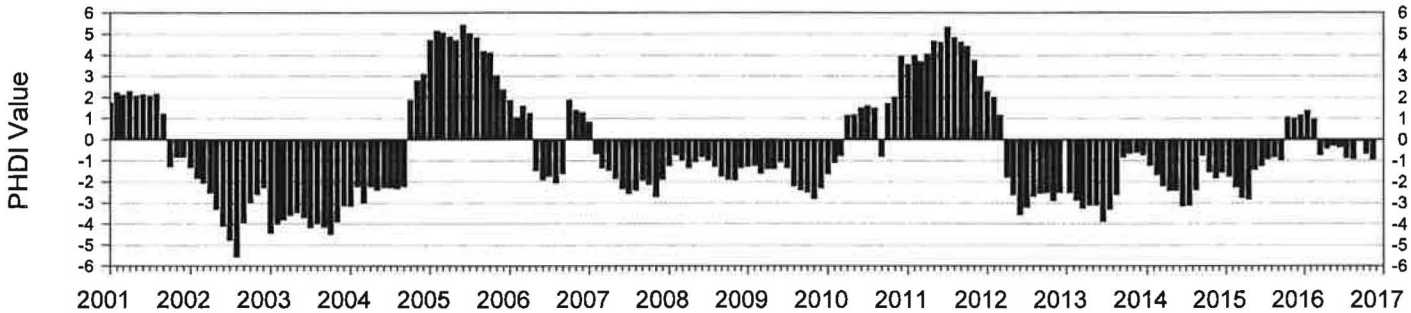


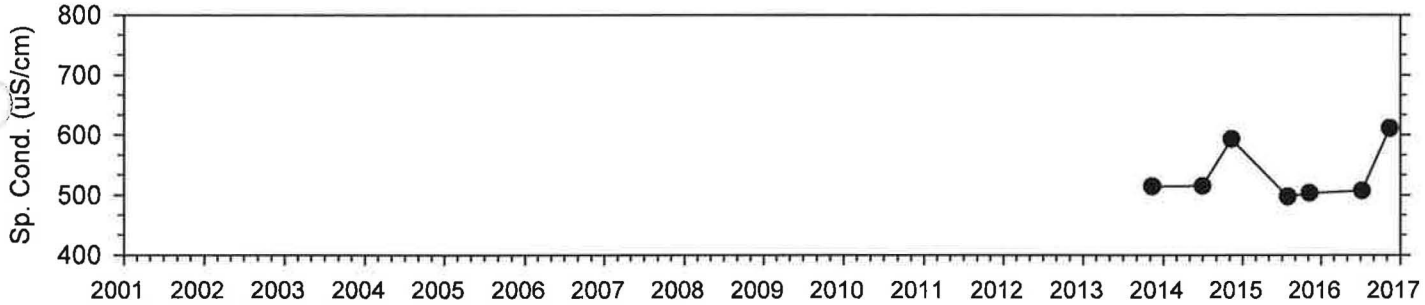


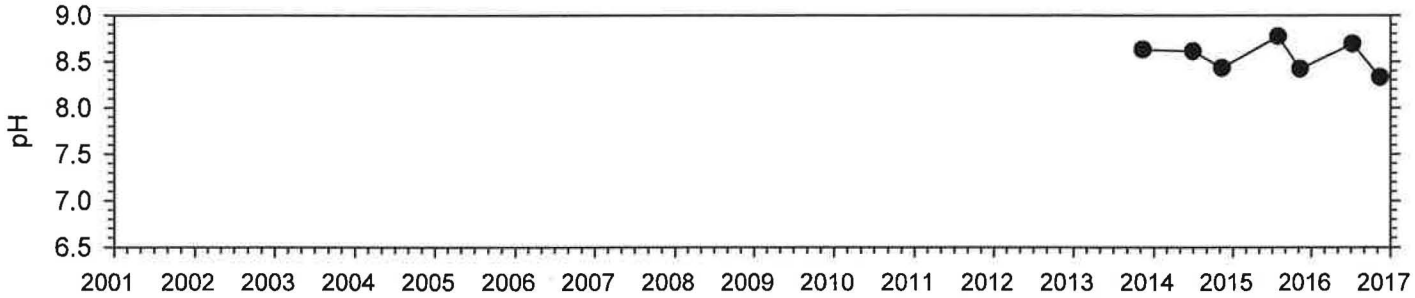


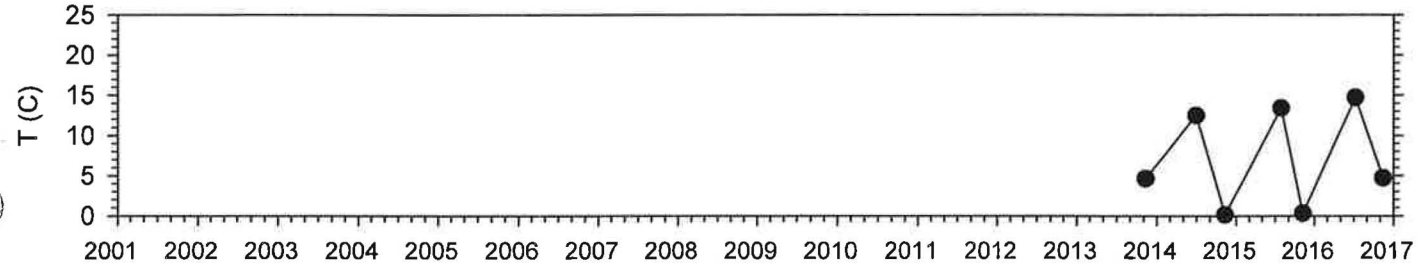
Stream South Fork Quitch. Upper



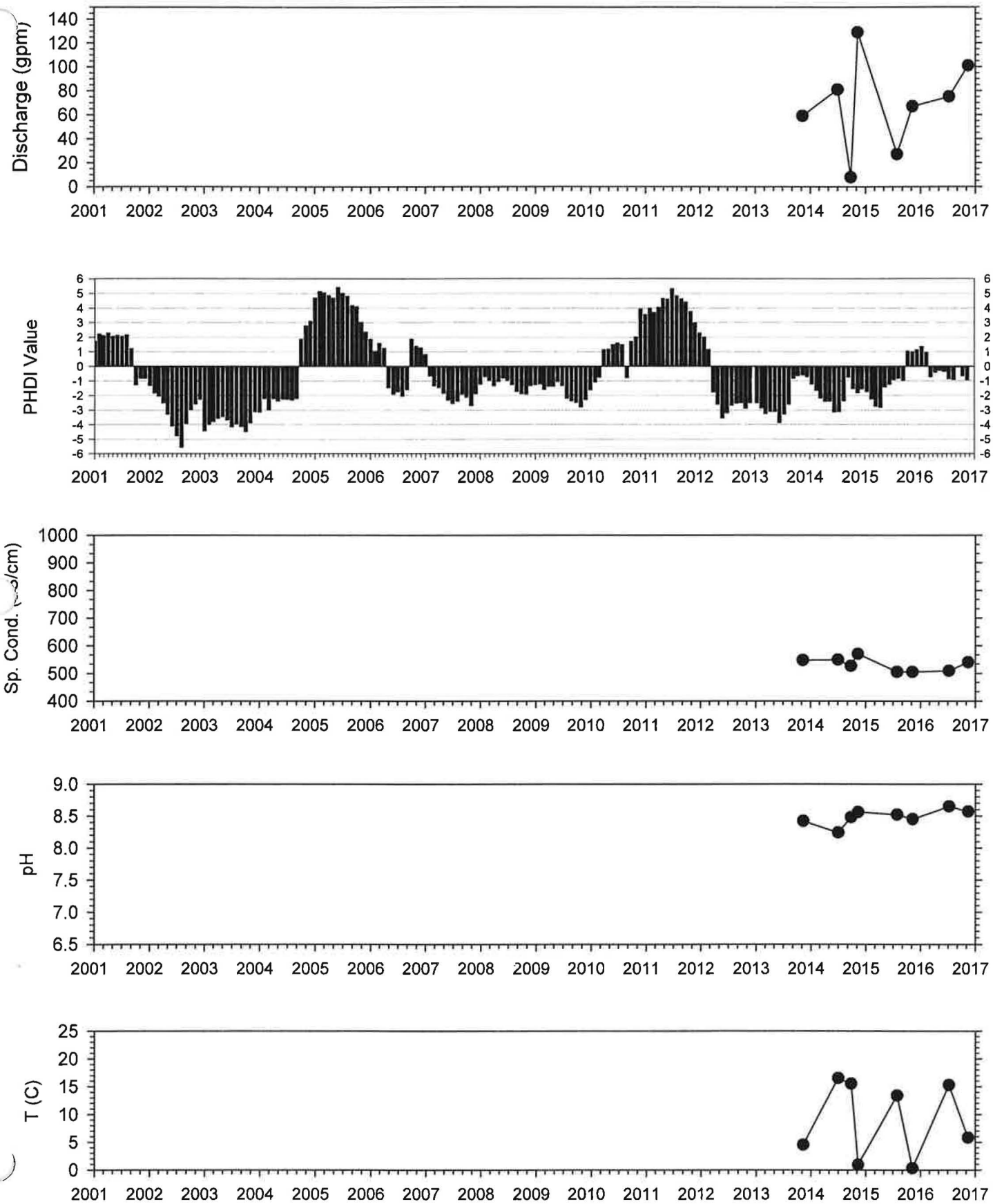








Stream Skutumpah Creek Upper

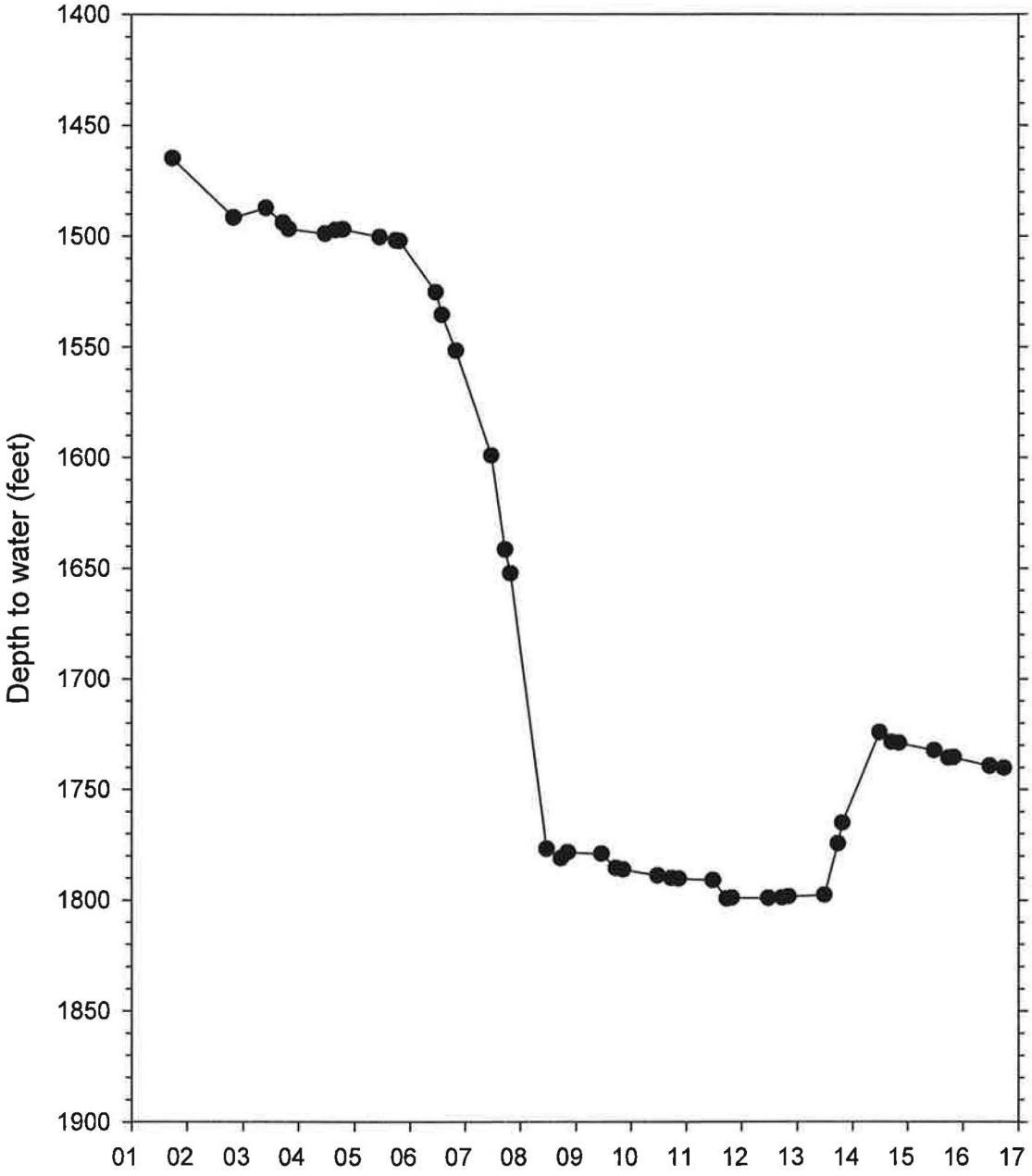


Attachment C

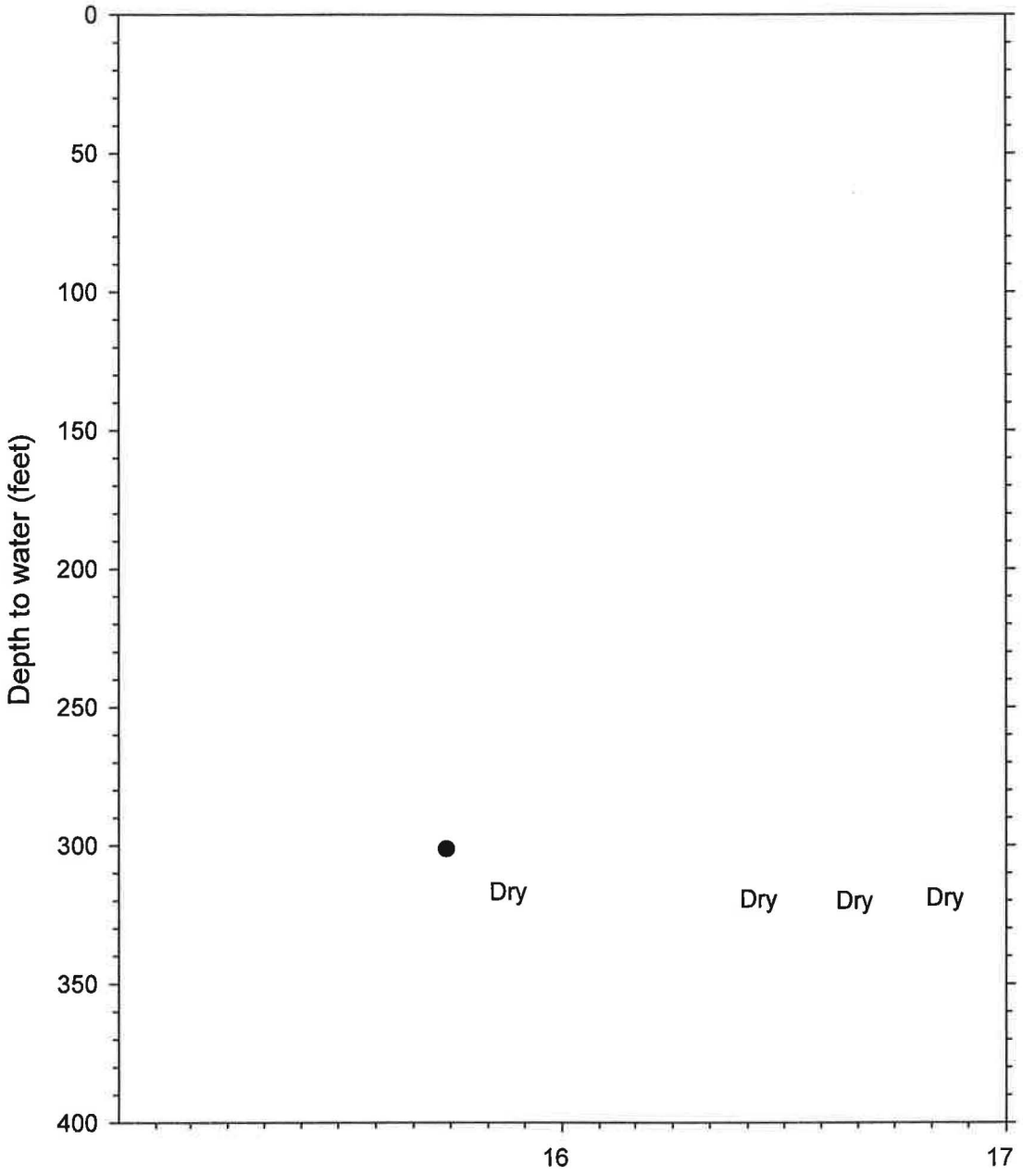
Water-Level hydrographs for

selected monitoring wells

Blackhawk Formation
Monitoring well 01-8-1



Castlegate Sandstone
Monitoring well MW 15-5-2



NOTES:

1. HISTORIC STREAM, SPRING AND WELL MONITORING SITES ARE OLD BASELINE MONITORING SITES OR SITES THAT HAVE BEEN DISCONTINUED OR MINED THROUGH THAT ARE NOT CURRENTLY BEING MONITORED.

EXPLANATION

	SUFCO MINE EXTERIOR LEASE BOUNDARY		UPDES MONITORING POINT
	SUFCO MINE INTERIOR LEASE BOUNDARY		STREAM MONITORING
100000 MC	MINE COORDINATES	(7600)	ELEVATION OF SITE
2020000 SPC	STATE PLANE COORDINATES		MONITORING WELL SITE
			PERENNIAL FLOWS
			SPRING MONITORING

PROFESSIONAL ENGINEER No. 9073261 JACOB D. SMITH STATE OF UTAH

I CERTIFY THE ITEMS SHOWN ON THIS DRAWING ARE ACCURATE TO THE BEST OF MY KNOWLEDGE

1000 0 1000

REVISIONS				
NO.	DATE	REQ. BY	DWG. BY	REMARKS

Canyon Fuel Company, LLC
SUFCO Mine
597 South SR 24 – Salina, UT 84654
(435) 286-4880 Phone
(435) 286-4499 Fax

OPERATIONAL HYDROLOGIC MONITORING STATIONS

PEN TBL:	SCALE:	DATE:	DRAWN BY:	ENGINEER:	CHECKED BY:	SHEET NO.
_1Sndrd-SUFDIP1.ctb	1" = 1,000'	4/26/2017	BTN	J.D.B.	V.M.	PLATE 7-10
SHT SET: #### / PROJECT NUMBER: ####	FILE NAME: H:\DRAWINGS\MRP\PLATES\PLATE 7-10.dwg					

Bluebeam: 4/26/2017 7:59 AM