WORK PLAN FOR CONDUCTING AN ENGINEERING EVALUATION/COST ANALYSIS

NORTH POTATO CREEK WATERSHED

DUCKTOWN, TENNESSEE

In Response to
Administrative Order on Consent
For Non-Time Critical Removal Action
U.S. EPA Region IV
CERCLA Docket No. 01-11-C

Prepared for

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1.0 INTRODUCTION

This Work Plan was prepared in response to a United States Environmental Protection Agency (EPA) Administrative Order on Consent (AOC) dated January 11, 2001. The AOC establishes a Non-Time Critical Removal Action under EPA Region IV CERCLA Docket Number 01-11-C for the North Potato Creek Watershed. Barge, Waggoner, Sumner and Cannon, Inc. (BWSC), Shepherd Miller, Inc. and the EDGE Group have been retained by Glenn Springs Holdings, Inc. (GSH), a subsidiary of OXY USA, Inc., to conduct an Engineering Evaluation/Cost Analysis (EE/CA) required under Section VI.2 of the AOC.

The EE/CA will be conducted in the vicinity of the South Mine Pit to provide the necessary data to determine temporary response action alternatives to reduce the contaminant loading from North Potato Creek to the Ocoee River. This Work Plan presents background information, summary of existing data and defines the scope and objectives of the activities to be performed. The methodology and approach used to establish the project objectives and scope of work are consistent with the EPA National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300; EPA "Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA" dated August 1993, and Section 121 of the Superfund Amendments and Reauthorization Act (SARA) of 1986.

The South Mine Pit area is the subject of a State of Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order in addition to the EPA AOC. The Commissioner's Order dated January 4, 2001, places the administration of the Order under the Voluntary Cleanup Oversight and Assistance Program (VOAP). The Order requires some interim actions in the North Potato Creek Watershed but focuses on long-term actions and studies. Certain tasks that will be completed under the EPA AOC will be utilized and integrated into the required VOAP actions.

2.0 SITE BACKGROUND AND PHYSICAL SETTING

2.1 Background

The North Potato Creek Watershed is located in the southeastern corner of Polk County, Tennessee in an area referred to as the Copper Basin. The Copper Basin was the site of extensive copper mining and processing operations that date back to the 1850s. Open roasting of ore in the 1890s resulted in emissions of sulfur dioxide, which adversely impacted vegetation in and around the Basin. This impact, combined with clear cutting of forests for fuel, made a unique, barren landscape.

Over the last 150 years, numerous companies and individuals have been involved in various mining, refining and manufacturing operations within the Copper Basin. No longer able to produce copper at a profit due to depressed prices, mining operations ceased in 1987. Since 1987, the mining, refining and manufacturing facilities within the Lower North Potato Creek Watershed have been abandoned and most have been dismantled.

Over the years, the various mining companies utilized both underground and surface mining methods. There were three underground mines, the Tennessee, Cherokee and Westervelt Mines, and two surface mines, the North and South Mine Pits, developed in the area just north of the Ocoee River. The shafts for the Tennessee and Cherokee Mines are located northeast of the South Mine Pit. The Westervelt Mine was located within the aerial extent of the South Mine Pit and no surface expression of the mine remains.

The North Mine Pit was developed in the early 1970s and, at this time, North Potato Creek was diverted from its original location to the west of the surface mining activities. The South Mine Pit was developed in the late 1970s and was mined through the mid-80s. The surface mining may have intercepted the underground works associated with the Westervelt, Tennessee and Cherokee Mines. During the mining operations for the South Mine Pit, the North Mine Pit was filled with the waste rock and overburden from the South Mine Pit. Other waste rock from the open pit mining was placed to the north and west of the pit locations.

De-watering operations were conducted within the Tennessee, Cherokee, Boyd and Central Mines during the surface mining of the South Mine Pit. Subsurface mining associated with the Tennessee Mine was being conducted beneath the South Mine Pit at that time. De-watering ceased in 1987 when mining operations halted, and by 1992 the South Mine Pit was approximately 25 percent filled with water. In 1992, the EPA ordered North Potato Creek to be diverted into the South Mine Pit so that the pit would act as an in-stream sediment trap. As a result, North Potato Creek flows into and out of the South Mine Pit and ultimately discharges into the Ocoee River.

2.2 Site Description

2.2.1 Geographic Location

The South Mine Pit is located in the North Potato Creek Watershed approximately one mile above the confluence of North Potato Creek with the Ocoee River. The geographic coordinates are N35°00’25” Latitude and W84°23’55” Longitude. The Work Plan focuses on the South Mine Pit area, approximately 220 acres, including the former diversion channel and drainage area, as shown in Figure 3.1.

2.2.2 Current Site Conditions

Presently, the South Mine Pit contains water to an approximate elevation of 1,450 feet National Geodetic Vertical Datum (NGVD). The Pit has a maximum depth of approximately 200 feet and a surface area of approximately 20 acres. North Potato Creek enters the South Mine Pit at the northeastern edge of the Pit and exits at the southwestern edge. Diversion ditches were constructed around the Pit during mining operations to reduce surface water flow into the Pit. The diversion ditches were breached in 1992 to redirect the surface water into the South Mine Pit, as shown in Figure 3.1.

A cyclone fence, with barbed wire at the top, is in place around the perimeter of the South Mine Pit, except where North Potato Creek enters and exits the Pit and a section where it apparently

was removed by vandals. The fence was installed, at the request of EPA, in the early 1990s to prevent access. The area, which is privately owned and not under the control of GSH, is currently not being utilized for residential or recreational purposes. Access agreements have been obtained to gain access to the area to conduct investigations and data collection.

2.2.3 General Topography

The Copper Basin is located within the Blue Ridge Physiographic Region. The Basin is an extremely incised, plateau-like feature of approximately 100 square miles rimmed entirely by mountain ridges. The elevations within the Basin generally range from 1,500 to 1,800 feet NGVD. The topography of the immediate site vicinity has been significantly altered by mining activities.

2.3 Previous Investigations and Remedial Activities

Investigations concerning water quality and flow have been previously conducted within the EE/CA study boundary by various entities. These investigations have been conducted on behalf of GSH and, along with a brief summary of results, are described below.

- Surface-water quality samples and flow measurements were collected monthly near the inlet and outlet of the South Mine Pit from September 1997 through August 1999 by Bratton Farms and Conestoga-Rovers & Associates (CRA). Comparison of the North Potato Creek inflow and outflow of the South Mine Pit show that, from the inflow to the outflow, acidity, conductivity and sulfate generally increase in concentration and constituents such as aluminum, iron and suspended solids generally decrease in concentration.

- A stratified sampling event was conducted by CRA at four locations within the South Mine Pit in November 1998, at depths of 50, 100, 150, and 200 feet below the water surface. Results showed water quality in the South Mine Pit below 50 feet had much higher values of total dissolved solids (i.e. aluminum, iron, and sulfate) as compared to the North Potato Creek inflow and outflow.

- Chris Ransome & Associates prepared a hydrographic study of the South Mine Pit in October 1998. The study was conducted to determine the amount of sediment accumulation. Only a very small part of the pit's storage capacity has been filled with sediment.

Additional information was included in the Focused Data Collection Program/ Supplemental Focused Data Collection Program (FDCP/SFDCP) Report prepared by CRA and submitted to TDEC and EPA in September 1998. Flow measurements and water quality samples were collected from the old NPDES gauging station (identified as Station No. 3) along North Potato Creek, approximately 800 feet downstream of the South Mine Pit. CRA conducted this investigation during the period from September 1993 to August 1997.

With the exception of re-routing the North Potato Creek into the South Mine Pit in 1992 at the request of the EPA, GSH has no knowledge of prior remedial actions or removal actions

performed within the Study Area to reduce the contaminant loading to the Lower North Potato Creek.

3.0 WORK PLAN RATIONALE

3.1 Objective

The activities outlined in this Work Plan will employ sound scientific and engineering practices and will be substantially consistent with the AOC entered into by the EPA, OXY USA, Inc. and GSH. The objective of the EE/CA is to provide the necessary data to evaluate temporary response action alternatives to reduce the contaminant loading from North Potato Creek to the Ocoee River. Information gathered as a result of this Work Plan will be utilized, when possible, to aid in the determination of long-term solutions; however, this Work Plan addresses specifically the interim remedial action.

3.2 Data Quality Objectives

The following summarizes the data quality objectives (DQOs) for conducting the EE/CA for the removal action for the North Potato Creek Watershed. This summary is generally in accordance with the EPA guidance, *Data Quality Objectives Process for Hazardous Waste Site Investigations*, EPA QA/G-4HW, EPA/600/R-00/007, January 2000.

1. State the Problem – The problem is to provide the data necessary to evaluate temporary response action alternatives to reduce contaminant discharge from North Potato Creek into the Ocoee River. The temporary response action alternatives are to be evaluated while long-term work and study is proceeding upstream of the South Mine Pit in the North Potato Creek watershed under a Commissioner's Order issued by the Tennessee Department of Conservation (TDEC).

2. Identify the Decision – Is the data adequate to select an appropriate temporary response action alternative?

3. Identify Factors for the Decision – The flow and water chemistry of the inputs to the South Mine Pit, as well as the geochemical and limnological behavior of the pit must be known to determine appropriate and feasible remedial action alternatives. The factors influencing the South Mine Pit have been identified as the following:

    - Stratification of the South Mine Pit
    - Flow from North Potato Creek into and out of the South Mine Pit
    - Run-on from the area surrounding the South Mine Pit
    - Precipitation, evaporation, wind direction, and wind velocity
    - Chemical Reactions within the South Mine Pit
    - Ground Water
    - Flow from the underground mine works

Flow and chemical data, collected in accordance with this Work Plan, will be utilized to develop a hydrologic and chemical mass balance of the South Mine Pit. Precise flow measurements are critical in determing the hydrologic and chemical mass balance of the Pit. To accomplish the necessary level of precision, sharp crested weirs to measure the base flow of North Potato Creek will be installed near the entrance and outlet of the Pit. [Note: the construction of the weirs is included in *Work Plan for Weir Construction and Surface-Water Flow Measurement, South Mine Pit* (BWSC, 2001).]

4. Define the Study Boundaries – The Site Boundary delineated in the approved Scope of Work includes the South Mine Pit and contributing watershed (Figure 3.1). A temporal limit is placed on data collection activities in order to accommodate the schedule included in the AOC. Data collected later than March of 2002 will not be included in the report, but will be evaluated to assure that the data is consistent with previous sampling events. This imposed deadline of March 2002 is required in order to complete additional tasks to meet the July of 2002 deadline for completing the EE/CA imposed by the AOC. However, data collection activities as described in this Work Plan will continue during the entire AOC period. Data collected after March 2002 will be reviewed only to determine if significant changes that may affect the conclusions have occurred. If significant deviations in the data appear after March 2002, an extension will be requested in order to allow for the additional data to be incorporated into the decision making process.

5. Develop a Decision Rule – Water quality samples will be collected twice a month from selected locations from North Potato Creek within the Study Area. The analytical suite for the initial two sampling events will include:

   - Acidity
   - Alkalinity
   - Chloride
   - Dissolved inorganic carbon (DIC)
   - Hardness
   - Nitrate
   - Phosphate (PO4)
   - Sulfate (SO4)
   - Total suspended solids (TSS)
   - TAL Metals
   - TCL volatile organic compounds (VOCs)
   - TCL semi-volatile organic compounds (SVOCs)
   - Polychlorinated biphenols (PCBs)

   Following the collection and analysis of the initial two sampling events, constituents of interest will be identified based on detected constituent concentrations and potential environmental impacts of the constituents. After the identification of the constituents of interest, the analytical suite for the twice a month sampling events will reflect the constituents of interest. The minimum analytical suite will include acidity, alkalinity,

aluminum, calcium, copper, chloride, DIC, hardness, iron, magnesium, manganese, nitrate, phosphate, potassium, sodium, sulfate, TSS, and zinc. Continuous pH, temperature, and conductivity measurements will be made at SW-8 and SW-9 which will collect data during storm flow events, including potential "first flushes". Additionally, during the low-flow season (October/November 2001) and during the high-flow season (March/April 2002) the full suite of constituents will be analyzed.

6. Specify Limits on Decision Errors – Initially, a pre-determined number of sample locations and sampling frequency, as described in this Work Plan, will be implemented. The analytical results will be reviewed for variability after each sampling event to determine if modifications in the sampling scheme are appropriate in order to obtain the data necessary to make the decision. Detection limits for each constituent are discussed in the QAPP. If changes are deemed necessary by the GSH team, GSH will request approval for modifications of the plan by the EPA and TDEC.

   Analytical methods utilized for sampling events will be selected based on knowledge of the current conditions, if available, and the precision needed to accomplish the mass balance and modeling efforts. The lower detection limits required by the Tennessee Water Quality criteria will be used, where technically possible, for the first expanded sampling event. Flow measurements will be obtained via site-specific designed weirs and instrumentation.

7. Optimize the Design for Obtaining Data – The selected analytical suite for this investigation has been selected to evaluate the overall chemistry of the water within the South Mine Pit. The selected constituents are expected to be detected at relatively high concentrations compared to the method detection limits.

   Conversely, the determination of the hydrologic mass balance within the South Mine Pit is dependent on accurate flow monitoring of North Potato Creek as it enters and exits the South Mine Pit. In comparison to storm flow conditions, variations in base flow are more indicative of other sources of inflow or outflow to the South Mine Pit; therefore, more accurate base-flow measurements will be collected compared to storm-flow measurements.

3.3 Work Plan Approach

The scope of work in this Work Plan complies with the EPA Administrative Order on Consent for Removal Action at the North Potato Creek Watershed. The approved Scope of Work for the EE/CA has established a preliminary Site Boundary for this Work Plan as shown in Figure 3.1.

An objective of the EE/CA, is to collect data to develop a hydrologic and chemical mass balance of the South Mine Pit system. Flow and chemistry characteristics of North Potato Creek from its inflow into the South Mine Pit to the mouth of the Ocoee will be included in this evaluation. The hydrologic and chemical data will then be entered into a Dynamic Systems Model (DSM) of the South Mine Pit System and contributions from inputs and outputs of the system will be evaluated. The hydrologic and chemical data collected in the South Mine Pit will also be used to evaluate the chemical stratification in the South Mine Pit and hydrodynamic limnologic modeling will be conducted using CEQUAL-W2 to evaluate the potential for and depth of

thermal pit-turnover. Once conditions in North Potato Creek and the South Mine Pit system are understood, potential treatment alternatives for the system will be evaluated.

This Work Plan presents the EE/CA process as a phased approach. Phase I includes the data collection, development of the dynamic system and limnologic models. Results from Phase I will then be used in Phase II to evaluate treatment alternatives. A meeting of interested parties is suggested after the completion of Phase I. The meeting will allow all parties to understand what data has been collected, review the results and to have input on the path forward. The observations and conclusions drawn from this meeting and subsequent Work Plan will also be incorporated into the overall project, leading to the restoration of the watershed. The phases, both of which are planned to be completed within the overall EECA schedule established by the AOC, are discussed in more detail in Section 4.0. They are designed to conform to the requirements of the AOC, the Sampling and Analysis Plan and the Site Health and Safety Plan.

4.0 WORK PLAN

4.1 Responsible Party/Task Leader

The scope of work outlined in the Work Plan will be conducted by BWSC, the Edge Group, Inc, and Shepherd Miller, Inc. under the direction of GSH. The key personnel and their specific responsibilities on the task team are shown below. Table 4.1 presents the addresses and phone numbers of the key personnel.

Key Team Member	Responsibility
Franklin Miller	GSH Project Coordinator
Frank Russell	GSH On-Scene Coordinator
James Downing	BWSC Project Manager
Ken Faulk	BWSC Task Order Manager
Chuck Higgins	EDGE Group Senior Engineer/Task Leader
John Chermak	Shepherd Miller Senior Scientist
Andrew Murr	BWSC Project Engineer
Carrie Little	BWSC Project Engineer
Tom McComb	BWSC Field Coordinator

Within BWSC, the Project Manager has overall responsibility for performance of the project, the Task Order Manager is responsible for client communication and the day-to-day direction of the project, and the Field Coordinator will coordinate and direct the execution of the field activities. The Task Leader will provide technical direction for execution of the Work Plan. Mr. Tim Ward of BWSC will serve as Project Health and Safety Officer. Mr. Paul Lynes will serve as BWSC's Quality Assurance Officer for this project.

4.2 Project Planning

4.2.1 Compilation of Existing Data

As part of the initial effort, GSH will compile existing information (e.g., topographic maps, aerial photographs), data collected by various regulatory agencies, mapping and data available at

the Ducktown Basin Museum and data that may be available from Intertrade Holdings, Inc. (Intertrade) for the site. Additionally, interviews with past mining personnel that have knowledge of the South Mine Pit and its interconnections with the underground workings will also be conducted. GSH will make this information available to EPA and TDEC.

The EPA and the TDEC have significant amounts of information relating to the site. GSH will coordinate with both agencies to exchange information, including maps, data, Sampling and Analysis Plans (SAPs), Work Plans and reports. Mine maps of works within the Site Boundary, (Figure 3.1) will be examined to compile a description of the extent of works and their interconnections with the South Mine Pit.

GSH will provide the necessary documents to EPA for the Administrative Record. EPA will prepare the Administrative Record. GSH will also provide copies of all additional information to TDEC.

4.2.2 Obtain Site Access and Construction Authorization

GSH neither owns nor controls any of the property within the site boundary. The activities contemplated by the Work Plan include access to the site to collect samples and make observations, as well as to construct both temporary and semi-permanent structures.

Access agreements have already been obtained from Emil Watson and the Fourth Fractional Township, Section 16 (the two parties that control the site.)

4.3 Phase I - Site Characterization

4.3.1 Determine Source, Nature and Extent of Contamination

Phase I of the Work Plan is organized into three sections: data collection, dynamic system modeling (DSM), and limnological modeling. Phase II consists of the treatability alternative analysis and streamlined risk evaluation.

4.3.1.1 Data Collection

The purpose of this study is to collect and interpret data that are necessary to develop an understanding of the hydrologic and chemical mass balance of the South Mine Pit system as well as to evaluate changes, if any, in the flow and/or water quality of the reach of North Potato Creek below the South Mine Pit. Using these data, North Potato Creek's water quality impacts upon the Ocoee River will be evaluated. The data necessary for this evaluation include:

- Flow and water quality monitoring in North Potato Creek at three primary monitoring stations; at the inlet to the South Mine Pit, at the outlet from the South Mine Pit and at the mouth of North Potato Creek [Sample locations SW-8, SW-9, and NPC1 (Figure 4.1)].

- Water quality of the South Mine Pit [Sample locations SMP1, SMP2, SMP3 and SMP4 (Figure 4.1)].

- Flow and water-quality monitoring of two secondary contributors of surface runoff into the South Mine Pit originating from sub-basins within the Site Boundary located on the east and west sides of the pit [Sample locations SMP-R01 and SMP-R02 (Figure 4.1)].

- South Mine Pit water elevations [Locations of staff gauges SMP-SG1 though SMP-SG3 (Figure 4.2)].

- Site-specific weather data including precipitation, evaporation and wind measurements.

- Potential pit-wall effects

- Mine and ground-water quality data and elevation data in the vicinity of the South Mine Pit

4.3.1.1.1 North Potato Creek and South Mine Pit Sampling

North Potato Creek

Typically, two types of water quality monitoring will be conducted at three primary stations in North Potato Creek: (1) periodic water-quality sample collection; and (2) continuous temperature, pH, and conductivity measurements.

Periodic Water-Quality Monitoring

Water-quality samples will be collected twice a month from SW-8, SW-9, and NPC1. The water-quality samples will be analyzed for the field parameters of pH, conductivity, Eh, temperature, ferrous iron, and dissolved oxygen (DO). The analytical suite for the initial two sampling events will include:

- Acidity
- Alkalinity
- Chloride
- Dissolved inorganic carbon (DIC)
- Hardness
- Nitrate
- Phosphate (PO4)
- Sulfate (SO4)
- Total suspended solids (TSS)
- TAL Metals (filtered and unfiltered)
- TCL volatile organic compounds (VOCs)

- TCL semi-volatile organic compounds (SVOCs)
- Polychlorinated biphenols (PCBs)

Following the collection and analysis of the initial two sampling events, the constituents of interest will be identified based on detected constituent concentrations and potential environmental impacts of the constituents. After the identification of the constituents of interest, the analytical suite for the twice a month sampling events will reflect the constituents of interest. The minimum analytical suite will include acidity, alkalinity, aluminum, calcium, copper, chloride, DIC, hardness, iron, magnesium, manganese, nitrate, phosphate, potassium, sodium, sulfate, TSS, and zinc. Continuous pH, temperature, and conductivity measurements will be made at SW-8 and SW-9 which will collect data during storm flow events, including potential "first flushes". Additionally, during the low-flow season (October/November 2001) and during the high-flow season (March/April 2002) the full suite of constituents will be analyzed.

"First Flush" storm-water quality characteristics will be evaluated from the set of data collected during the routine sampling events (assuming at least two of the routine events can be scheduled during storm events). The storm-water inflow data evaluated will include data from SW-8, SMP-RO1 and SMP-RO2.

As data is developed and the understanding of the dynamics of the system is improved, the number of sampling locations and/or the extent of the analytical suite may be added to, or dropped from the list of analyses. Revisions to the analytical suite will be reviewed and approved by the EPA and the TDEC prior to implementation.

Continuous Monitoring

The principal flow of water into the South Mine Pit is surface-water discharge from North Potato Creek at the upstream limit of the site boundary. This location, SW-8, is one of the three primary monitoring locations to be monitored and sampled. See Figure 4.1 for sample locations. Using constant flow measurement devices at the weir and continuous measurements of temperature, pH, and conductivity, a continuous record of flow and these indicator parameters will be obtained. The installation and operation of the weirs and monitoring equipment is presented in a separate work plan.
The principal flow of water from the South Mine Pit to the lowest reach of North Potato Creek is at location SW-9**,** which will be designed to measure similar parameters as discussed above for SW-8. Information from this location will be used both in the hydrologic and chemical mass balance evaluation as well as in the evaluation of site conditions in the lowest reaches of North Potato Creek from the pit downstream to its mouth.

The third location, NPC1, to be monitored in North Potato Creek, is near the confluence with the Ocoee River and surface-water sampling will be conducted at the same frequency as stations SW-8 and SW-9. The chemical data collected at NPC1 will be compared to the chemical results at SW-9 and changes in water quality, if any will be evaluated for the North Potato Creek between the discharge from the South Mine Pit and discharge into the Ocoee River. The comparison between stations will show if there are other sources of contamination and corresponding degradation in water quality in lower North Potato Creek below the South Mine

Pit. If water quality is found to degrade below the South Mine Pit then the source of contamination will be investigated, quantified and identified. Depending on the constituent, likely sources can be inferred and will be identified (potential contributors could be sediment in the creek, mine workings, surface water runoff, etc.). Also, a corresponding evaluation of flow measurement options at NPC1 will then be conducted.

Direct measurement of flow at NPC1 will be conducted on a schedule compatible with the storm-water flow monitoring being proposed under a separate work plan. Following the field survey of the cross section of the stream channel and the installation of a stream gauge, the collection of the direct flow measurements will include:

- Measurement of water depth in the stream channel using the stream gauge
- Measurement of the estimated flow velocity using a Marsh-McBirney Flo-Mate

The sampling effort will be coordinated with the operation of the London Mill Water Treatment Plant (LMWTP) to identify the operations of the London Mill Water Treatment Plant during the sampling activities.

South Mine Pit Sampling

Twice monthly a Hydrolab will be used to measure conductivity, dissolved oxygen, temperature, pH, and Eh at various locations and depths within the South Mine Pit. The primary sample locations, SMP1 through SMP4, are shown on Figure 4.1. For a minimum of three expanded events, the initial time, once during October/November 2001 and once during March/ April of 2002; a total of 12 locations will be monitored using the Hydrolab. The 12 locations will consist of the four primary locations plus an additional two locations on the perpendicular transect for each location near the NW and SE walls of the Pit. Hydrolab monitoring will continue through March of 2002 at which time the monitoring schedule will be modified by agreement with EPA and TDEC.

At times other than the expanded sampling events described above, a minimum of three locations will be monitored using the Hydrolab (likely ; SMP1, SMP4 and SMP2 or SMP3). If the data indicates dynamic behavior in the pit, the number of sampling locations to be monitored and/or the monitoring frequency will be increased.

Field measurements will be collected at 2-meter intervals down to a depth of approximately 20 meters. Thereafter, from 20 meters to the bottom of the pit, measurements will be made every 5 meters. The interface(s) between the high and low conductivity water (chemocline) and higher and lower temperature water (thermocline) will be monitored more extensively (i.e., 1 meter increments). The sampling frequency with depth will be adjusted based on variability of measurements; i.e. sampling may be less frequent if parameters are found to vary less than 5 %. The operating procedures for the Hydrolab are presented in the Field Sampling and Analysis Plan (Appendix A)

Based upon the parameter profiles obtained by the Hydrolab, water-quality samples will be collected at various depths (4 or 6 depths per sampling location) and at a minimum of 3 sampling locations. Specific depths and sampling locations will be determined based on evaluating the results of the initial physical/chemical Hydrolab measurements and the locations of the chemocline and thermocline. The intent is to collect samples above and below each water layer. This intensity of water quality sampling will be performed a total of four times; twice during the initial two sampling events, once during October/November 2001 and once during March/April of 2002. Ferrous iron will be measured at one sampling location at multiple depths (approximately 4 or 6 depths).

During routine twice monthly monitoring events, water quality sampling will include 4 or 6 samples from one location and two samples (one near the surface and one at depth) from the other two sampling locations. Ferrous iron concentrations will be measured in the field at the sampling location with the 4 or 6 depth samples.

The Hydrolab results will also be used to evaluate the mixing of North Potato Creek with the South Mine Pit at its the influent and effluent and across its surface. At locations SMP1 and SMP4, particular attention will be paid to the upper 15 meters of depth. Hydrolab measurements will be made in the presumed mixing zone, as close to the Pit inlet and outlet as practical.

GSH has identified four locations within the South Mine Pit where boreholes or underground mine works were intercepted by the open pit mining. The Hydrolab will be used to make measurements as close possible to these locations on three occasions; once during the initial two sampling events, once during October/November 2001 and once during March/ April of 2002.

Estimation of run-on quantity and quality into the pit from the diversion ditches will be conducted at two locations, SMP-R01 and SMP-R02, shown on Figure 4.1. Onsite observations of the pit rim have shown that surface water generally enters the pit in these two locations. If these two locations are observed to have measurable flow during the routine sampling events that will be performed twice a month, grab water-quality samples will be collected and flows will be estimated at these locations using the bucket and stopwatch method. The water samples will be analyzed as described above in the section Periodic Water-Quality Sampling.

4.3.1.1.2 <u>South Mine Pit Water Level Measurement Using Calibrated Benchmarks</u>

Precise elevation control will be established around the perimeter of the South Mine Pit by the installation of three staff gauges (SMP-SG1 through SMP-SG3) in the water near the pit rim. Using first order surveying instruments, the elevation of these staffs will be measured to an accuracy of ± 0.01 feet (Figure 4.2). All three will be tied to a common benchmark.

Concurrent measurements of water levels at these three staffs will be made periodically under varying conditions of wind speed and direction while other field activities are being conducted. Wind speed and direction will be monitored at a meteorological station located at the Copper Basin High School. The meteorological data will be correlated to staff gauge readings to assess the potential impact of wind action upon pit pond water levels.

The staff gauges will record water levels is 0.1 feet intervals. They will be read visually to +/- 0.05 feet. They will be installed to allow them to be read by an observer standing on the bank. Safety procedures concerning the drowning hazards are discussed in the Safety Plan and will be implemented.

4.3.1.1.3 Pit Wall-rock Analysis

Exposed pit wall-rock will be characterized by rock type and evaluated using Acid Base Accounting analysis (ABA) (Sobek et al., 1978) and Synthetic Precipitation Leaching Procedure (SPLP) for chloride, sulfate, and TAL metals. ABA analysis will determine the potential for the rocks in the pit walls to produce acidity based on the measured sulfur forms and neutralization potential and the SPLP will identify potential leaching of metals by surface runoff from the pit walls. The number of samples to be analyzed will depend on the variability of the rock type in the pit walls, and will include the major rock types found in the pit walls, but based on the oxidized nature of the exposed pit walls this will likely be a minor source of metals loading to the South Mine Pit. An estimate of the number of samples would be approximately five samples for ABA analysis and five samples for SPLP.

4.3.1.1.4 Site-Specific Weather Measurements

Site-specific pan evaporation rates will be determined using an evaporation pan installed at the London Mills Water Treatment Plant (LMWTP). This equipment will be monitored daily by the water treatment plant operators.

Daily rainfall measurement is occurring at the LMWTP and measurement began in 1998. An additional rain gauge and anemometer will be installed at the Copper Basin High School. This rain gauge will be measured on the same schedule already established for the LMWTP.

Wind speed and direction measurements will be obtained from the meteorological station to be installed at the Copper Basin High School..

4.3.1.1.5. Water Level Measurement and Water Quality Determination in Wells and Shafts around the South Mine Pit

During this South Mine Pit investigation, GSH will measure mine-water and ground-water levels in boreholes and/or shafts in the vicinity of the South Mine Pit and the reach of NPC between the pit and the Ocoee River. Preliminary site reconnaissance identified four to six locations where water levels may be available (Figure 4.2). To the North-east of the South Mine Pit are the Cherokee and Tennessee mine shafts and N14, to the South-West are S-16 (gravel hole), S-16 (vent), S-17 (waste pass), S-19 (vent raise), and S-21 (vent borehole). A drill hole has been tentatively identified west of the South Mine Pit; its location will be field verified during the sampling activities. These shafts, vents and bore-holes will be investigated and reopened, if possible, to allow sampling using a water level monitoring probe and water sampling equipment. The conductivity of the water column will be evaluated. If field measurements of conductivity are found to vary by greater than 10% between the top and bottom of the accessible water

column, two water samples will be collected from the different conductive zone of the water column. If a water sample can not be readily obtained, the feature will not be sampled.

A ground-water sample will be obtained from the well developed in a drill hole at the residence of Mr. Emil Watson. Mine-water samples will be collected from the selected vents, shafts, and/or drill holes during the initial sampling event and during the wet (March 2002) and dry season (October 2001). The water samples will be analyzed for the full suite of constituents as described above in the section Periodic Water-Quality Sampling. There is likely stratification in the mine workings and therefore water quality results will only be used for general characteristics and comparison purposes.

Sampling procedures for both the mine workings and the monitoring wells are discussed in Appendix A.

Water levels will be measured (± 0.1 feet) quarterly for one year. During the water-level measurement activities, field measurements of pH, dissolved oxygen, Eh, ferrous iron, conductivity and temperature will also be collected.

4.3.1.2 Sample Analysis

The water sampling and field measurements will be conducted in accordance with the procedures outlined in the Sampling and Analysis Plan (Appendix A). The water samples and the appropriate QA/QC samples will be analyzed for the parameters identified above using SW-846 analytical methods.

4.3.1.3 Data Management

The results of field parameter measurements will be recorded in a field log. The results of the analysis received from the laboratory will be validated and integrated into the GSH database. Field parameter measurements and other field measurements recorded in the field log will be entered into the comment field of the database. Information concerning maintenance or calibration conducted on the field measurement equipment will also be maintained in the field log and entered into the comment field in the database.

4.3.2 Conceptual Water and Chemical Mass Balance Model and Development of a Dynamic Systems Model (DSM) for the South Mine Pit

The 1998 laboratory and field data for the South Mine Pit collected by CRA will be compared to the field and laboratory data to be collected in this Work Plan to evaluate whether the water has reached steady state within the Pit. Additionally, the data collected in 1998 and the data to be collected in this Work Plan will be used to determine the hydrologic balance and chemical mass balance of the South Mine Pit System. The analysis tool to be used is dynamic system modeling (DSM). DSM is a well-documented, reliable approach that successfully retains the influence of hydrology and chemistry within a time-dependent structure (Lasaga, 1981; Garrels and Lerman, 1984; Berner and Canfield, 1989; Berner, 1994). Dynamic system modeling simulates

geochemical and hydrologic mass balance processes by representing volumes (e.g., total volume of water) or masses (e.g., total mass of a chemical species) as a series of linked cells. These volumes and masses accumulate or drain in response to changes in the relative rates of inflow and outflow to or from the cells. Cells are also connected by flows representative of physico-chemical processes (e.g., precipitation) responsible for transferring volume and/or mass from one cell to another or to a cell from an external source.

Dynamic systems modeling of water and chemical mass balances are conceptually straightforward. The volume of water and mass of chemicals present at any given location in the South Mine Pit are the balance between the rate of inflow and the rate of outflow, with secondary removal of mass by geochemical reactions. Dynamic systems modeling permits efficient handling of time-dependent, or non-steady-state, simulations of water and chemical mass balances for complicated water systems. Modeling is conducted on a per-unit time basis, and flow rates can vary over time.

Dynamic system modeling consists of assembling model "building blocks" that represent the basic components of the water routing system, including: (1) compartments in which volume or mass resides (e.g., the South Mine Pit), and (2) flows that deliver and remove volume or mass from the compartments. The model is built from the ground-up by selecting these icons from a menu-bar and linking them together, simultaneously creating a model and a graphical representation of the models flow logic. This allows the model developer to easily go from a conceptual diagram to a simulation model because the conceptual diagram ultimately becomes the model.

The dynamic system model will be generated using the commercial STELLA® computer program (High Performance Systems, 1996). In this model, all parameters are independently defined and are readily modified, as will be required during model development. STELLA® also offers an array of built-in functions allowing sensitivity analysis of modeling results. This program is ideally suited for the dynamic compartment-by-compartment analysis proposed for the South Mine Pit.

In this software, all parameters can be independently defined and readily modified during model development. The dynamic systems model will provide the concentration of constituents in the South Mine Pit at any given point in time.

The primary reservoir in the system where mass and/or volume can be removed, added, or stored is the South Mine Pit. However, this reservoir will be represented by a minimum of two cells based on observed stratification in the South Mine Pit. The initial mass of each constituent in these two cells and the rate of transfer between the cells are required by the model. Additional information required to adequately represent the reservoir includes the mass loading or mass loss rates which are:

- North Potato Creek inlet to the South Mine Pit
- North Potato Creek at the outlet from the South Mine Pit

- Surface run-on into the South Mine Pit
- Precipitation into the South Mine Pit
- Evaporation from the South Mine Pit water
- Runoff from the pit-walls of the South Mine Pit
- Ground-water inflow to or outflow from the South Mine Pit

Model sensitivity will be assessed using existing functions in the STELLA® program. Test runs will be conducted to identify the parameter, or parameters, producing the largest change in model results for the smallest difference in initial value. Best estimates of uncertainty in final model results will be provided.

After the water balance model is developed, construction of the mass balance will proceed. The mass balance model will be constructed using conservative constituents (i.e., chloride, magnesium, and sodium) and can, therefore, stand alone with no linkage to other geochemical processes. The mass balance behavior of TDS and other potentially non-conservative constituents (i.e., iron and sulfate) are dependent on other chemical components that may, in turn, be controlled by a variety of geochemical reactions (i.e., mineral precipitation and dissolution). Constituents will first be looked at to see if they behave conservatively in the mass balance and constituents will be identified that do not behave conservatively. Initial mechanisms for non-conservative behavior of an individual constituent will be evaluated and added to the model as needed.

The final product will include complete documentation of the DSM modeling effort including:

- A database of all information used to develop the model, with explanations of how data inputs were developed and used
- Full documentation of the model, calibration of the model, and results of model verification
- An interpretation of modeling results
- An electronic copy of the model

4.3.3 Limnologic Investigation of the South Mine Pit

Previous water quality sampling at depth in the South Mine Pit (CRA, 1998) has shown a lower density, lower conductivity layer above a higher density, high conductivity layer indicating stratification in the water column. The potential of the South Mine Pit to become well mixed is a major concern because this possible loss of stratification could potentially result in degradation of water quality in Lower North Potato Creek.

Pit lakes are generally classified into three categories, well mixed lakes, seasonally mixed lakes, and lakes that do not mix (meromictic) (Doyle and Runnells, 1997, and Wetzel, 1983). Analogous pit lakes and natural lakes in similar climatic environments will be used to compare their turnover behavior to conditions in the South Mine Pit. Factors affecting "stability" of a water column in a lake include; temperature gradients, climatic conditions, wind direction and intensity, water quality, depth of the water, and surface area and shape of the reservoir. The data necessary to evaluate long-term water column behavior in the South Mine Pit will be collected as discussed earlier in this Work Plan. The data collected in this Work Plan along with previously collected bathymetric data will be used in the development of a limnologic pit lake model using CEQUAL-W2 which will provide a time and depth-integrated picture of the mixing dynamics within the South Mine Pit.

CEQUAL-W2 was initially developed by Edinger and Buchak in 1975 and has been further refined by the Army Corps of Engineers since that time. CEQUAL-W2 was developed to understand physical and chemical relationships in water columns and mixtures of waters. CEQUAL-W2 has been applied to river systems, lakes, reservoirs, estuaries, and more recently to pit lakes. The model is a two-dimensional longitudinal/vertical, hydrodynamic and water quality model. It is best applied to relatively long and narrow water bodies that show water quality gradients.

Once the South Mine Pit model is developed and calibrated, what-if scenarios can be evaluated for the South Mine Pit. For example, changes in temperature, water quality, and density of the South Mine Pit system can be evaluated in terms of water column stability. Climitalogical inputs can also be experimentally modified assuming worst-case scenarios, such as the affects of a 100-year wind-storm on the stability of the water column in the South Mine Pit.

It is critical to understand the stability of the water column in the South Mine Pit because it will effect treatability alternative selection. If the model can confidently predict pit stability or pit turnover, Phase II will begin. If there is uncertainty in the Pit stability analysis an extension of the schedule will be requested to allow the collection of additional data through the Fall of 2002 (an approximate 6 month extension).

Upon completion of Phase I, preliminary data reports will be submitted to EPA and TDEC. Following the submittal of the preliminary data reports, a workshop involving participants from GSH, EPA and TDEC is planned to review data and discuss the conceptual model of the South Mine Pit dynamics. The workshop will utilize preliminary data from the limnology study. It is intended to keep the EECA on the schedule established by the AOC and the workshop will assist in identifying alternatives that can begin to be evaluated in Phase II while site characterization

continues (Phase I). Based upon the understandings reached at that meeting, the EE/CA will proceed into Phase II. Data collection, as described above, will continue in Phase II. Because of the requirement to complete the EE/CA by July 2002, it may not be possible to completely integrate the Phase II data obtained after March 2002, unless an extension of time to complete the EE/CA is authorized by EPA

Phase II is organized into two sections, Treatability Alternative Analysis and Streamlined Risk Evaluation (4.4.1 and 4.4.2). Prior to the Phase I workshop, a more detailed work plan for the Treatability Alternatives Analysis will be distributed to EPA and TDEC for review. The more detailed work plan will identify a more specific list of alternatives to be considered highlighting those that require treatability studies.

4.4 Phase II – Treatability Alternative Analysis and Streamlined Risk Analysis

The Phase II portion of the EE/CA includes the analysis of treatability alternatives and the implementation of a streamlined risk analysis.

4.4.1 Treatability Alternative Analysis

The EE/CA will assess the ability of the various alternatives to implement the treatment for the loading into the Ocoee River remedy. Section 4.6.1 includes a preliminary list of alternatives to be considered. For technologically based alternatives, particularly treatment schemes, treatability data is required to properly evaluate the alternative.

The time available to conduct treatability studies is limited. Consequently, studies on technologically impractical(undemonstrated for the contaminant concentrations or flow regime in NPC) or cost-prohibitive (greater than $30,000,000 i.e. 5 times the AOC established $6,000,000 GSH commitment for lime treatment) alternatives will not be conducted. Further, treatability studies are likely to be limited to bench-scale. Finally, to be considered in the Identification and Analysis of Alternatives, all treatability studies must be completed prior to May 2002. Therefore, in November 2001, after initial site characterization data is obtained and reviewed, the need for treatability studies will be evaluated and a plan of study(ies) will be developed. Thereafter, once sufficient data exists to confirm the appropriateness of an alternative by allowing a preliminary assessment of technological practicality and cost and to suggest the need for a treatability study, a plan of study will be developed. Irrespective of when the decision to conduct a treatability study is made, GSH will submit the plan to the EPA and to the TDEC for approval before implementation.

The plan of study will evaluate the data available and identify any requirements for additional data to plan the study or assess results. Bench-scale tests will be designed and described in the plan. After filling data gaps, bench-scale studies will be implemented, results obtained and a report documenting outcomes will be prepared.

An initial assessment of some of the alternatives listed in 4.6.1 suggests the likely need for treatability data for the following:

- Lime treatment of North Potato Creek water and South Mine Pit water
- Physical tests on sludge settling behavior in the South Mine Pit
- Evaluation of the chemical stability of the sludge in contact with South Mine Pit water

4.4.2 Streamlined Risk Evaluation

Once the sufficiency and reliability of site characterization data are established, the data will be compared to screening-level, risk-based standards to assess the nature of the threat to public health or the environment. This Streamlined Risk Evaluation (SRE) will focus on the specific problems identified by the AOC.

The SRE will evaluate the removal action and identify current and potential exposures to be evaluated. The risk evaluation will use data from the site to:

- Identify constituents of concern
- Provide an estimate of how and to what extent human health might be impacted by the constituents of concern identified from the analysis of water samples collected from the South Mine Pit Area
- Assess potential impacts on the biological integrity of North Potato Creek below the pit, i.e. from the pit discharge to the Ocoee River
- Provide an assessment of potential effects associated with constituents of concern.

For each treatment alternative evaluated as part of the EE/CA, the quality of the discharge from the treatment system will be predicted. The SRE will evaluate the risk to human-health and the environment if no removal action is taken at the site and the risk associated with each treatment alternative using the predicted quality of the discharge for the alternative.

4.5 Identification of Removal Action Objectives

4.5.1 Evaluate Preliminary Remediation Goals based on Applicable or Relevant and Appropriate Requirements (ARARs) and Background Conditions

The removal action selected will meet Applicable or Relevant and Appropriate Requirements (ARARs), to the extent practicable as provided in 40 CFR 300.415. It is anticipated that ARARs may be waived in certain instances as provided in 40 CFR 300.480(f)(1)(ii)(e) and 40 CFR 300.415(i). A list of potential ARARs as well as a general discussion of the selection of potential ARARs will be included in the EE/CA.

The EE/CA report will include a summary table of ARARs, both Federal and State, that are applicable to the site. The table will identify particular requirements to attain regulatory compliance or eliminate requirements not of concern for the site or a particular alternative.

Initially, the list of ARARs will be general, focusing on chemical and location specific requirements. As qualifying alternatives are evaluated in the EE/CA, action specific ARARs will be identified. Based upon site circumstances, the practicability of compliance with ARARs, cost impact and effect on alternative duration will be determined. Where waivers are required, the reasons for the waiver will be documented.

4.5.2 Evaluate Statutory Limits Objectives

Although evaluation of statutory limits is included in many EE/CAs, it is anticipated that statutory limits will not be addressed in this EE/CA. A statutory limit of $2,000,000 applies for Fund-financed actions. As described in the AOC, GSH has agreed to fund a capital cost up to $6,000,000 for one of the alternatives to be studied by this EE/CA, lime treatment at the South Mine Pit. Consequently, it is believed that the ultimate removal action selected will be GSH-financed and not Fund-financed and that the statutory limit will not apply. The estimated cost of each removal action studied will be provided.

4.5.3 Scope of Removal Action

The scope of the removal action will consider the physical limitations of the site, the nature and extent of contamination flowing from the mouth of North Potato Creek into the Ocoee River, and the condition of the water being collected and stored in the South Mine Pit. The scope will consider that water quality in North Potato Creek watershed is dynamic and will progressively improve over time. The recommended removal actions are not intended to ameliorate all environmental hazards present in the South Mine Pit or North Potato Creek, but will be designed to be compatible with site-wide remediation actions and goals and will be designed to address and alleviate contaminant discharge from North Potato Creek into the Ocoee River while long-term work and study is proceeding upstream in the North Potato Creek watershed.

4.6 Identification and Analysis of Removal Action Alternatives

4.6.1 Identify Treatment Technologies

The preliminary list of categories of alternatives to be considered is shown below.

Alternative I	No action
Alternative II	In-pit treatment options
Alternative III	Conventional lime water treatment plant
Alternative IV	Combined in-pit and conventional wastewater plant

Alternative V	Divert North Potato Creek around the pit and treat North Potato Creek and the South Mine Pit separately
Alternative VI	Water treatment using other technologies (NaOH, micro encapsulation, reverse osmosis)
Alternative VII	Other options, such as passive wetlands and pit backfill

Removal actions utilizing proven technologies are preferred over removal actions requiring relatively new technologies or treatability studies. Several of the alternatives presented above may require treatability studies to properly assess the appropriateness for the site. Given the short time available to complete the EE/CA, several activities such as data collection, field work and treatability studies may need to run concurrently.

4.6.2 Evaluation Criteria

Following EPA guidance, the analysis of alternatives will be based upon three broad criteria: effectiveness, implementability and cost. Each alternative will be evaluated independently against the criteria for both short- and long-term aspects. The major factors to be considered under the criteria are:

Effectiveness

The effectiveness of an alternative refers to its ability to meet the objective within the scope of the removal action. The evaluation will consider specific objectives discussed in terms of protectiveness of public health and the environment and the ability of the alternative to achieve the removal objectives.

Protectiveness considers how each alternative provides overall protection of public health and the environment. The discussion will draw on assessments conducted under other evaluation criteria, including long-term effectiveness and permanence, short-term effectiveness and compliance with ARARs. The following criteria will be considered and discussed:

- Protection of public health and community
- Protective of workers during implementation
- Protective of the environment
- Complies with ARARs

Ability to achieve removal objectives considers how each alternative will reduce, control, or eliminate risks at the site. This evaluation should identify any unacceptable short-term impacts. The following criteria will be considered and discussed:

- Level of treatment/containment expected, i.e. effectiveness of reducing the contaminant load into the Ocoee River

- No residual effect concerns
- Will maintain control until long-term solution is implemented

Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and assesses the availability of various services and materials required during implementation. The major implementability factors to be considered are technical feasibility, resource availability and administrative feasibility.

Technical feasibility assesses the ability of technology to implement alternative remedies. Each alternative will be evaluated against the reliability of the technology and its ability to achieve the removal action schedule. The following criteria will be considered and discussed:

- Construction and operational considerations
- Demonstrated performance/useful life
- Adaptable to environmental conditions
- Contributes to remedial performance
- Can be implemented in one to three years

The EE/CA will assess if equipment, personnel, services, materials and other resources necessary to implement an alternative will be available in time to maintain the removal schedule. The following criteria will be considered and discussed:

- Equipment
- Personnel and services
- Outside laboratory testing capacity
- Off-site treatment and disposal capacity
- Post-Removal Site Control (PRSC)

Administrative feasibility factors evaluate those activities needed to coordinate with other offices and agencies. Each alternative will be evaluated for the need for off-site permits, adherence to applicable non-environmental laws and concerns of other regulatory agencies. The following criteria will be considered and discussed:

- Permits Required
- Easements and rights-of-way required

- Impact on adjoining property
- Ability to impose institutional controls
- Likelihood of obtaining an exemption from statutory limits

Cost

Cost will be evaluated based upon capital cost, post removal site control costs and present worth costs. An estimate of the cost to implement each removal action alternative will be developed as part of the comparative analysis of alternatives performed. The cost estimating process will utilize guidelines established by the EPA. The major cost factors are:

- Direct capital cost
- Indirect capital cost
- Annual PRSC cost, including operating cost
- Present worth (any alternative lasting longer then 12 months)

Public Acceptance

Community and TDEC acceptance will be considered in determining the recommended alternative.

4.7 Comparative Analysis of Removal Action Alternatives

A comparative analysis will be conducted to evaluate the relative performance of each removal action alternative in relation to each of the evaluation criteria. This analysis will compare each alternative with the others to identify the relative advantages and disadvantages of each alternative and key trade-offs that would affect remedy selection.

The comparative analysis will be conducted in a semi-quantitative manner, allowing a clearly-identified, criteria-based selection of the optimum alternative. The evaluation will be conducted using available site data, professional judgement, and experience gained in the evaluation and remediation of similar problems at similar sites. Information gathered during the studies may significantly impact the alternative selection process.

4.8 Recommended Removal Action Alternative

The removal action that best satisfies the evaluation criteria based upon the comparative analysis will be the recommended removal action alternative. A detailed description of the recommended alternative will be provided in the EE/CA.

5.0 SCHEDULE

The scope of work will be initiated by GSH and its consultants upon approval of the Work Plan by the EPA. GSH anticipates a period of approximately nine months to complete Phase I Activities, and an additional period of about four months to complete the Phase II activities. However, depending on the results of the Phase I studies, an additional period of time may be required to adequately complete the activities in Phase II.Figure 5.1 presents the project schedule, including:

- Phase I
    - Work Plan Submittal and Approval
    - Determine Source, Nature and Extent of Contamination
    - Conceptual Water and Chemical Mass Balance Model and Development of a Dynamic Systems Model for the South Mine Pit
    - Limnologic Investigation of the South Mine Pit
    - Meeting – South Mine Pit Dynamics

- Phase II
    - Treatability Alternative Analysis
    - Streamlined Risk Analysis

- Evaluate Preliminary Remediation Goals Based on ARARs and Background
- Evaluate Statutory Limits Objectives
- Identification and Analysis of Removal Action Alternatives
- Comparative Analysis of Removal Action Alternatives
- Recommended Removal Action Alternative

6.0 PROGRESS REPORTS

Bi-monthly progress reports describing activities in the North Potato Creek Watershed will be submitted to the EPA project manager and to the TDEC. The bi-monthly progress reports will include updates on the execution of this Work Plan. Each progress report will itemize target and actual completion dates and will provide an explanation of significant deviations, if any, from the Work Plan. Subjects to be addressed in the progress reports include:

- Identification of task activity
- Status of work and current progress
- Percentage of completion and schedule status
- Difficulties encountered and potential problems
- Actions undertaken to rectify problems
- Activities planned for the next reporting period
- Personnel changes
- Additional issues to be resolved

The progress reports will identify any unusual problems that may occur or may be expected during the course of executing the Work Plan. If problems may be solved by implementing specific work scope changes, GSH/BWSC will formulate a Work Plan modification request. The Work Plan modification will include a clear description of the purpose, objective, methodology, quality controls, health and safety needs, technical oversight, document control, and reporting requirements. The Work Plan modifications will be submitted to the EPA and the TDEC for review and approval.

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