

**Quality Assurance Project Plan
for the
Paleochannel Water Quality Monitoring Study
Water Resource Inventory Area (WRIA) 54**

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TABLE OF CONTENTS

	<u>Page No.</u>
BACKGROUND.....	1
INTRODUCTION.....	1
WEST PLAINS GEOLOGIC SETTING	1
WEST PLAINS HYDROGEOLOGIC SETTING	2
General	2
Unconfined Surficial Aquifer	3
Wanapum Basalt Formation Aquifer.....	3
Grande Ronde Formation Aquifer.....	3
Basement Rock Aquifer	4
EXISTING INFORMATION	4
General	4
Existing Wells	4
Airway Heights Paleochannel	4
Airport Paleochannel	6
Deep Creek Paleochannel.....	7
EXISTING WATER QUALITY DATA.....	7
PROJECT DESCRIPTION.....	8
INTRODUCTION.....	8
GOALS AND OBJECTIVES	8
Necessary Information.....	8
Subsurface Exploration Program.....	8
Baseline Groundwater Quality Monitoring	9
Long-Term Groundwater Monitoring.....	9
Hydrogeologic Analysis	9
Geophysical Investigation.....	10
Source Water Quality Monitoring.....	10
ORGANIZATION AND SCHEDULE.....	10
QUALITY OBJECTIVES.....	11
SAMPLING PROCESS DESIGN (EXPERIMENTAL DESIGN)	14
SUBSURFACE EXPLORATION PROGRAM	14
Monitoring Well Drilling and Installation.....	14
Installation of Monitoring Equipment.....	14
Existing Wells	15
BASELINE GROUNDWATER QUALITY MONITORING	16
LONG-TERM GROUNDWATER MONITORING	17
HYDROGEOLOGIC ANALYSES	18
GEOPHYSICAL INVESTIGATION.....	18
SOURCE WATER QUALITY MONITORING	19
SAMPLING PROCEDURES	19
GROUNDWATER SAMPLING, MONITORING WELLS	21
GROUNDWATER SAMPLING, EXISTING GROUNDWATER SUPPLY WELLS	21

TABLE OF CONTENTS (CONT.)

	<u>Page No.</u>
SOURCE WATER SAMPLING	22
MEASUREMENT PROCEDURES	23
FIELD MEASUREMENTS	23
Groundwater Elevations	23
Hydraulic Conductivity	23
Groundwater Quality	23
LABORATORY MEASUREMENTS	24
QUALITY CONTROL	24
FIELD	24
Field Quality Control Evaluation	25
LABORATORY	25
Laboratory Data Quality Control Evaluation	26
DATA MANAGEMENT PROCEDURES	26
FIELD DATA	26
LABORATORY DATA	27
DATA STORAGE	27
OBTAINING EXISTING DATA	27
AUDITS AND REPORTS	28
DATA VERIFICATION AND VALIDATION	29
FIELD MEASUREMENT EVALUATION	29
FIELD QUALITY CONTROL EVALUATION	29
LABORATORY DATA VALIDATION	29
DATA QUALITY (USABILITY) ASSESSMENT	30
REFERENCES	31
ACRONYMS	34

List of Tables

Table 1A. Group A and B Paleochannel Wells	
Table 1B. Private Paleochannel Wells	
Table 2. Paleochannel Aquifer Hydraulic Properties	
Table 3. Paleochannel Aquifer Water Balances	
Table 4. Project Activities and Targeted Completion Timeframe	10
Table 5a. Field Measurement Quality Objectives	11
Table 5b. Groundwater Laboratory Measurement Quality Objectives1	12
Table 5c. Surface Water Laboratory Measurement Quality Objectives1	12
Table 6. Recommended Existing Wells	15
Table 7. Sample Containers, Preservation and Holding Times	19
Table 8. Measurement Methods (Field)	24
Table 9. Measurement Methods (Laboratory)	24
Table 10. QC Samples, Types and Frequency	26

TABLE OF CONTENTS (CONT.)

Page No.

List of Figures

- Figure 1. West Plains Vicinity Map
- Figure 2. Paleochannel Boundaries and Surficial Geology
- Figure 3. Paleochannel Boundaries and Well Locations
- Figure 4. WRIA 54 Future Land Use
- Figure 5. Experimental Design

APPENDICES

- Appendix A – Recommended Existing Groundwater Supply Well Logs

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BACKGROUND

INTRODUCTION

An evaluation of the potential for water quality impacts to paleochannel aquifers within the West Plains area of Spokane County, Washington is being addressed by the Water Resource Inventory Area (WRIA) 54 Planning Unit. The approximate boundaries of the West Plains area, as defined during the WRIA 54 Multi-Purpose Water Storage Study (Tetra Tech/KCM and GeoEngineers 2007b), are presented in the West Plains Vicinity Map, Figure 1.

Paleochannels within the West Plains area represent ancestral drainage-ways filled with sediment during Pleistocene-age (about 1.8 million to 10,000 years ago) glacial flooding events. Because paleochannel sediments have a significantly higher vertical permeability and storage capacity than the surrounding basalt rock, they are of interest for water supply projects, aquifer storage and recovery projects, and the disposal/infiltration of stormwater and/or reclaimed water. Studies to date have focused on:

- Mapping the extent of the paleochannels (SAIC 1992; Deobald and Buchanan 1995; Budinger & Associates 2001; CH2M Hill 2003; and GeoEngineers 2002, 2003, and 2007).
- Determining their infiltrative capacity, permeability, and other aquifer characteristics to evaluate groundwater flow conditions (GeoEngineers 2002, 2003, and 2007).
- Detailed study of aquifer geometry and properties within specific sites, such as the planned city of Airway Heights Water Reclamation Plant (GeoEngineers 2007).
- Groundwater quality and potential nitrate sources to city of Airway Heights Wells 1 and 4 (GeoEngineers 2003).

Few water quality studies have focused on the paleochannel aquifers. This presents a significant data gap in the water quality information for WRIA 54. This study is being undertaken to assess water quality in paleochannel aquifers and to comprehensively evaluate the potential impacts of the numerous stormwater, wastewater, and water supply projects already under consideration, planning, and/or construction. This Quality Assurance Project Plan (QAPP) has a number of investigative components ranging from field subsurface exploration to office-based hydrogeologic analyses. It is intended to be modular; each component could be independently conducted as funding sources are identified.

WEST PLAINS GEOLOGIC SETTING

The surficial geology of the West Plains area has been described in various publications including: Griggs (1966), Joseph (1990), and Stoffel et al. (1991). Aspects of the subsurface geology of the area have been documented in Deobald and Buchanan (1995), Drost and Whiteman (1986), Luzier and Burt (1974), and Whiteman et al. (1994).

Basement rocks in the vicinity of the site generally consist of metasedimentary rocks of the Precambrian Belt Supergroup (age greater than about 570 million years [Ma]). These rocks were intruded by granitic plutonic rocks during the Mesozoic (245 to 65 Ma) and Tertiary (65 to 1.5 Ma) (Stoffel et al. 1991).

Basement rocks are stratigraphically overlain by basalt flows associated with the Columbia River Basalt Group (CRBG). The CRBG was deposited during an extended period of Miocene (23 to 5 Ma) volcanism that extruded a series of very fluid lava flows. The lava flowed from north-northwest trending fissures as much as 90 miles long which were located primarily in northeastern Oregon and southeast Washington

(Hooper 1982). The resulting basalt deposits are hundreds to thousands of feet thick and extend throughout the Columbia Plateau. The CRBG has been subdivided into five formations that include, from oldest to youngest, the Imnaha Basalt, Picture Gorge Basalt, Grande Ronde Basalt, Wanapum Basalt, and Saddle Mountains Basalt. Two of these formations, the Grande Ronde and Wanapum, have been identified within the West Plains area (Drost and Whiteman 1986).

The Grande Ronde Basalt is the most voluminous of the CRBG formations, comprising 85 to 88 percent of the total volume of the CRBG (Whiteman et al. 1994). The Grande Ronde Basalt Formation underlies the entire West Plains area except where the elevation of pre-Miocene basement rocks were higher than the top of the formation; generally this occurred at step toes. The Grande Ronde has been observed at up to 514 feet in thickness in area wells. The top of the Grande Ronde Basalt is often marked by (1) a weathered zone frequently described in water well reports as a water-bearing, fractured or vesicular zone with minor clay and/or (2) a sedimentary interbed (Latah Formation) that separates it from the overlying Wanapum Basalt Formation (Deobald and Buchanan 1995).

The Wanapum Basalt is the second-most voluminous of the CRBG formations, comprising about 6 percent of the total volume of the CRBG (Whiteman et al. 1994). It stratigraphically overlies the Grande Ronde Basalt. It occurs throughout the Airway Heights area except where it pinches out at step toes or has been removed by erosion within drainages. Surface exposures are abundant (Stoffel et al. 1991). The Wanapum Basalt has been observed at up to 292 feet in thickness in area wells.

The CRBG is overlain by Pleistocene-age glaciofluvial (flood) deposits that consist of unsorted mixtures of silt, sand, gravel, cobbles and boulders. Recent geologic mapping by the Washington State Department of Natural Resources (Derkey and Hamilton 2008) suggests that, in some areas, glaciofluvial deposits contain large clasts of fine-grained sedimentary rock (presumably from the Latah Formation). Flood deposits are frequently interbedded with glaciolacustrine sediments that were deposited in a low-energy depositional environment (such as a lake); these deposits typically consist of clay, silt, or silty fine sand. Quaternary (less than about 1.5 Ma) loess (wind-blown clay, silt and fine sand) frequently overlie the glaciofluvial and glaciolacustrine deposits, and, in some areas, directly overlie the CRBG.

The top of the CRBG surface is incised and undulatory, creating a relatively complex distribution in overlying sediment thickness. Studies performed by Science Applications International Corporation (SAIC) (1992), Deobald and Buchanan (1995), Budinger and Associates (2001), and GeoEngineers (2002) defined a minimum of three eroded depressions in the basalt within the West Plains area. These depressions are up to 400 feet in depth and interpreted to represent past drainage features, or paleochannels, that were filled by permeable flood deposits during the Quaternary. The three identified paleochannels are herein termed the Airport, Airway Heights, and Deep Creek Paleochannels and are approximately located as shown in Paleochannel Boundaries and Surficial Geology, Figure 2.

WEST PLAINS HYDROGEOLOGIC SETTING

General

The Airway Heights area generally is underlain by a minimum of four aquifers. These aquifers occur within the (1) unconsolidated surficial deposits, (2) Wanapum Basalt Formation, (3) Grande Ronde Basalt Formation, and (4) basement rocks. The Wanapum Basalt and Grande Ronde Basalt Formations generally are the most suitable for extracting groundwater of sufficient quantity for municipal supply and distribution systems. However, the unconfined aquifer, within paleochannels, can yield significant supply and quantities of groundwater.

