D15 Aquatic Instrument System (AIS) Site Characterization Report

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See configuration management system for approval history.

Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	04/16/2014	ECO-01810	Initial release
B	12/04/2015	ECO-03460	Updates to aquatic sensor locations

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1 DESCRIPTION

1.1 Purpose

Information collected and described here is used to inform the site design activities for the NEON project Aquatic Instrument System (AIS). This report includes information gathered by the Aquatic (AQU) and Environmental, Health, & Safety (EHS) teams. The purpose of this report is for the science team to outline what is desired at each site within a domain in order to obtain the best scientific data possible to help answer NEON's Grand Challenge Questions; therefore, this is not a design document, but a report that is an input to the design process.

This report takes precedence over other documents and reports that may repeat the information contained herein.

The Appendices include summary tables for the convenience of the multiple audiences of this report; some of the information in the tables is repeated from the body of this report while other information is exclusive to the summary tables.

1.2 Scope

AQU site characterization information presented in this document is for the D15 aquatic location: Red Butte Creek (core). Issues and concerns for each site that need further review are also addressed in this document according to our best knowledge. Unless otherwise noted, the information contained herein takes precedence over the same information repeated elsewhere; thereby, this document contains the official change-controlled information pertinent to these sites.

Disclaimer: All latitude and longitude coordinates are subject to the variation inherent in our GPS equipment and the conditions at the site. Some of the Aquatic sites are in narrow canyons with limited satellite coverage; resulting in coordinates that are not accurate to within 50 cm.

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

AD[01]	
AD[02]	
AD[03]	
AD[04]	

2.2 Reference Documents

RD[01]	NEON.NPR.000008	NEON Acronym List
RD[02]	NEON.NPR.000243	NEON Glossary of Terms
RD[03]	[Reference to photos]	
RD[04]	[Reference to map(s)]	

3 D15 AIS SITE CHARACTERIZATION REPORT

3.1 Red Butte Creek

The Red Butte Creek site is a second-order, wadeable stream, located just east of Salt Lake City, Utah near Fort Douglas. The stream reach is located upstream of the Red Butte Reservoir and a US geological Survey gaging station. The stream is confined within a steep canyon drainage basin in the southwestern Rocky Mountains. Typically, this region has long, cold winters and hot, dry summers. Hydrograph fluctuations are driven by spring snowmelt. During base flow conditions stream widths are typically <2 m and depth <0.5 m.

3.1.1 Aquatic Auxiliary and Aquatic Portal Locations for Construction

The initial estimated location for the Aquatic Auxiliary Portal is shown in Figure 1. The portal locations are placed closer to the met station and precipitation sensors. The conduit run from the portal to the met and precipitation FDPs is approximately 175 m, while the conduit run from the portal to the S1 location is approximately 950 m.

Figure 1 A Google-Earth-derived Image of Aquatic and Auxiliary Portal for D15

Table 1 Aquatic Auxiliary Portal Location

Aquatic Auxiliary Portal	Latitude	Longitude
Location	40.780896°	-111.804852°

The initial estimated location for the Aquatic Portal is:

Table 2 Aquatic Portal Location

Aquatic Portal	Latitude	Longitude
Location	40.780896°	-111.804845°

3.1.2 Sensor Locations for Construction

The GPS coordinates for S1, S2 the Met Station locations obtained by AQU, with input from EHS, are presented in Tables 3 and 4. Many aquatic sites are in narrow canyons or covered by dense canopy, which reduces satellite availability. In these situations, AQU will provide a description of the location and an approximate GPS location (e.g. not accurate to within <1 m). This description will suffice for the planning stages, but sites will likely need to be physically marked prior to construction.

These coordinates are to be used for the input to the AIS design:

Table 3 S1 and S2 Locations

Sensor	Latitude	Longitude
S1	40.784662	-111.795639
S2	40.783624	-111.798108

Table 4 Met Station Location

Sensor	Latitude	Longitude
Met Station	40.782270°	-111.805886°
Met FDP	40.782152°	-111.805832°
Primary Precipitation Gauge (**DFIR**)	40.782136°	-111.805954°
Wet Deposition Collector (NADP)	40.782163°	-111.806014°
Precipitation FDP	40.782150°	-111.805839°

This core site is no longer co-located with a terrestrial site and therefore is scoped to have precipitation sensors installed. Since this is a core AQU site and the site supports the primary precipitation requirements, a DFIR will be installed along with a wet deposition collector. The estimated locations for these sensors were given by AQU to D15 staff, which refined and verified the locations. This scouting effort included measurement of ground slope and vegetation heights and distances.

Figure 2 Kmz File of D15 Red Butte Creek Denoting Locations of S1, S2, AQU/AUX Portal locations, and Met Station and Precipitation Sensors.

Figure 3 Layout of Met Station, DFIR and Wet Deposition Collector with Associated Field Device Posts.

Figure 4 DFIR Location.

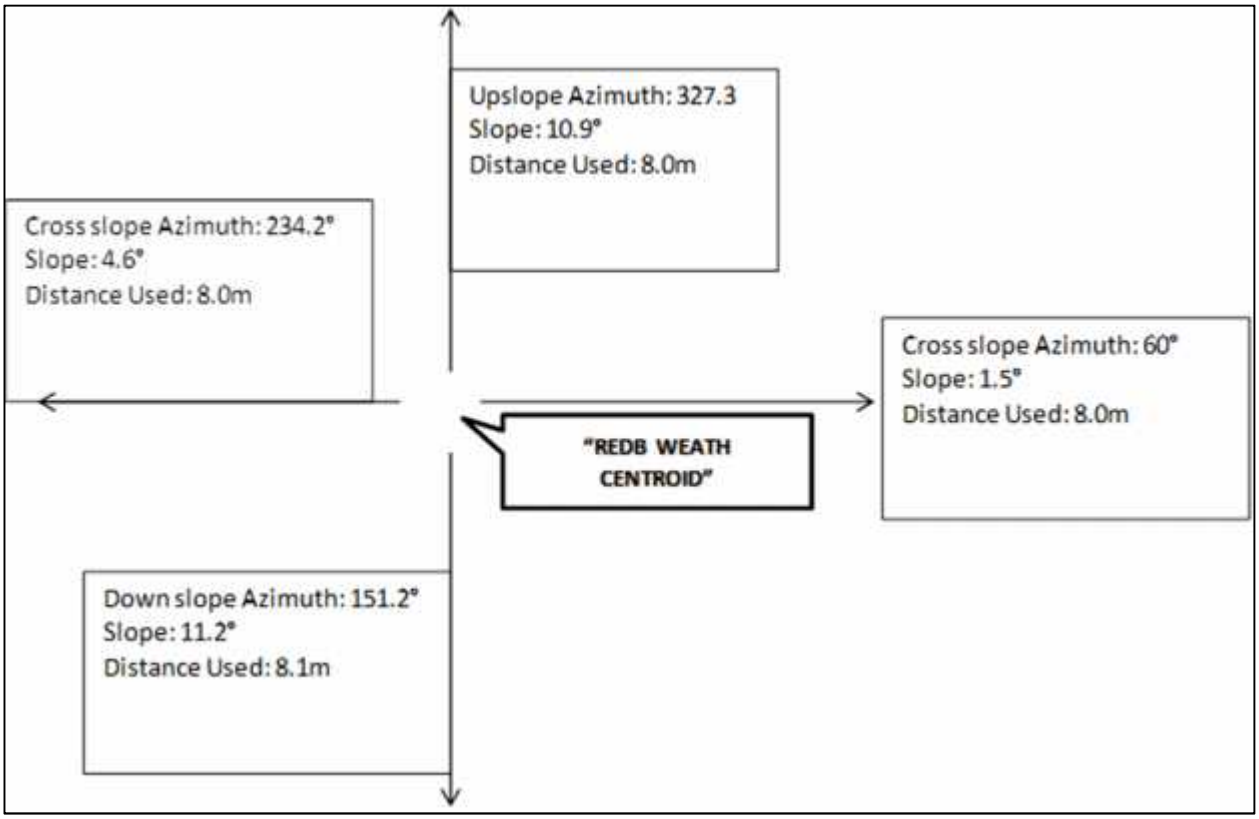

Figure 5 Ground Slope and Azimuth Angles Captured at DFIR Location.

Figure 6 Photo of Trees Nearest to DFIR. 4.2 m Tall Located 34.1 m Away *Note: these trees do not presently need to be removed.

Figure 7 Photo of S1 Location at D15 Red Butte Creek

Figure 8 Photo of S2 Location at D15 Red Butte Creek

3.1.3 Groundwater Wells

The groundwater observation wells network at the site (Figure 9, Table 5) will consist of 8 wells installed using either a direct-push or powered hand-auger system. Topography at the site is dominated by a relatively small undulating and rocky valley floor adjacent to the stream reach, with steeper gradients originating laterally away from the stream. The wells will be installed near the stream in the relatively flat rocky region near the stream. Wells will be located between 2-30 m (6.5 – 98.5 feet) from the stream edge. The required drilling depth will vary between 1.5 – 4.5 m (5-15 feet) below ground surface. Access to the site will be via the existing gravel road directly to the west of the stream. Access to the well locations is anticipated to be relatively straightforward and a defined path for drilling purposes will be established prior to work at the site.

The exact location of wells may vary during the drilling process due to the dense presence of boulders in the subsurface which were observed during the visit. These will be hard to detect from the surface using geophysical methods due to their size and may pose an issue if one is encountered during the drilling activities. Thus, actual locations of wells will vary slightly from the plan if subsurface obstructions are encountered.

AQU prefers the surface completion of the wells to include an above-grade stick-up protective cover and be minimally invasive. However, the State of Utah has several requirements for construction of groundwater monitoring wells that NEON will either need to meet, or apply for a waiver. Chief among the State requirements are 1) an acceptable grout to fill the annular space such as neat cement, bentonite chips, or a bentonite / cement mixture; 2) surface seal of the well requires a poured concrete or cement slab poured around a steel outer casing with a locking cap; and 3) a licensed well driller is required to be onsite.

Figure 9 Initial Groundwater Well Locations Based on EMS kmz File at D15 Red Butte Creek

Table 5 Groundwater Observation Well Locations

Well ID	Latitude	Longitude
D15-REDB-OW-01	40.784845°	-111.795668°
D15-REDB-OW-02	40.784706°	-111.795605°
D15-REDB-OW-03	40.784628°	-111.795603°
D15-REDB-OW-04	40.784730°	-111.795774°
D15-REDB-OW-05	40.784541°	-111.796469°
D15-REDB-OW-06	40.784482°	-111.796474°
D15-REDB-OW-07	40.783683°	-111.798159°
D15-REDB-OW-08	40.783638°	-111.798049°

3.1.4 Riparian Vegetation Cover

During 2010-2011 site visits, the following plant density and type were observed by the AQU team: Abundant hardwood trees and willows surround the stream. Grasses and shrubs comprise the understory. Hardwood %Cover = ~90%.

Figure 10 The Riparian Canopy at D15 Red Butte Creek

3.1.5 Bank Morphology

The bank angle is estimated from the top of the bank, where one might stand to observe the stream, to the top of the water. The estimated angle is from the water to the bank, as illustrated in Figure 11 below.

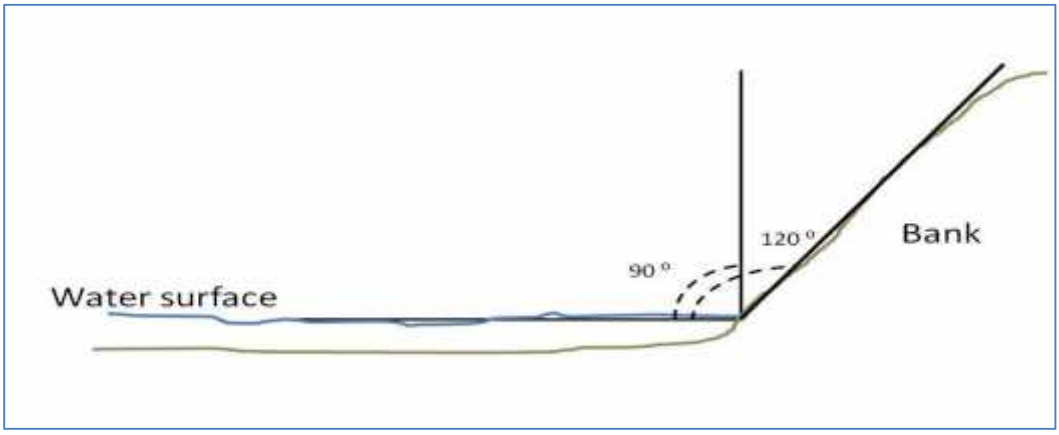

Figure 11 How Bank Angle is measured

During 2011 site visits, AQU observed the following bank conditions at S1 and S2:

Table 6 Bank Conditions At D15 Red Butte Creek In 2011

Morphology Type	**S1**	**S2**
RB* angle	100	90
LB* angle	125	100
Maximum water height	0.55 m	0.85 m
Bankfull width	4.25 m	10.0 m
Substrate composition	Sand and cobble	Sand and cobble

* RB (right bank) and LB (left bank) are determined by facing downstream.

Figure 12 Some Areas of the Reach Have Steep Banks and Some Banks are Eroding.

3.1.6 Site Photos

The following photos of are representative of the site.

Figure 13 Typical Substrate in D15 Red Butte Creek are Mostly Gravel and Cobble.

Figure 14 In Some Areas Substrate Can be Covered in Silt.

Figure 15 Riparian Vegetation Surrounding the Stream During Late Fall 2010.

Figure 16 Access Road Along Stream.

Figure 17 Access From Road to Stream.

Figure 18 Hillslope and Surrounding Vegetation**.**

3.1.7 Site Access Needs

No pathways, boardwalks, stairs, or ladders are needed at D15 Red Butte Creek for Science purposes.

3.1.7.1 Science Perspective on Access Needs (Pathways, Stairs, Etc.) to Reduce Site Erosion/Impact

See table in Appendix A for additional info needed

3.1.8 Communications at the Site

THE FOLLOWING INFO IS DESIRED (NOT REQUIRED) AND MAY SAVE AN ADDITIONAL TRIP TO SITE IF IT CAN BE OBTAINED DURING AN FCC OR AQU SITE VISIT: there is fiber that runs to the pump house which is located at 40.778435°, -111.811771°

The local communications company will be the same power company that FCC uses for the tower Pacificorp 801-521-0376 as we will drop power at the tower and then continue power to the Aquatic Portal with 100 amp 240V connection.

ALL - See table in Appendix C for additional IT info

3.1.9 Power at the Site

The local power utility company is Pacificorp 1407 West North Temple
Salt Lake City, UT 84116-3187
(801) 521-0376.

3.1.10 Site Science Construction Constraints and Limitations

Site-specific issues to consider at D15 Red Butte Creek are:
D15 is a snowmelt dominated system, and thus has a flow regime dominated by large peak flows during spring and early summer. Often the flows increase by a factor of 10 during spring snowmelt. Some of the banks are eroding and should be avoided during construction.

Driving and access constraints for D15 Red Butte Creek are:
D15 construction constraints include limited access during winter and spring months due snow-covered winters and muddy springs during snowmelt

3.1.11 Other Issues

No other science issues are identified at this time.

4 APPENDIX A. FCC SUMMARY TABLES FOR AIS SITE COMPONENTS AT D15

4.1 Red Butte Creek FCC Summary Table

Site Component	Latitude	Longitude	Units
Stream, Lake, or River	Stream		Description
Aquatic Auxiliary Power Portal location	40.780896°	-111.804852°	Lat, Long in degrees
Aquatic Portal location	40.780896°	-111.804845°	Lat, Long in degrees
Pathway needed? What is length?	No		Yes/no, description w/ length
Pathway start location	Site1-PathStartLat	Site1-PathStartLong	Lat, Long in degrees
Pathway end location	Site1-PathEndLat	Site1-PathEndLong	Lat, Long in degrees
Stairs or ladder needed?	No		Yes/no, description
Stairs top location	Site1-StairsTopLat	Site1-StairsTopLong	Lat, Long in degrees
Stairs length	Site2-StairsLength		Meters
Ladder top location	Site1-LadderTopLat	Site1-LadderTopLong	Lat, Long in degrees
Ladder length	Site1-LadderLength		Meters
Boardwalk needed? What is length?	NO		Yes/no, description w/ length
Boardwalk start location	Site1-BrdwlkStartLat	Site1-BrdwlkStartLong	Lat, Long in degrees
Boardwalk end location	Site1-BrdwlkEndLat	Site1-BrdwlkEndLong	Lat, Long in degrees
Shall stairs, boardwalk be installed during construction?	No		Yes/no, description
Fencing needs	No		Description
Site management			Description
Any additional site specific information			Description

5 APPENDIX B. EHS SUMMARY TABLES FOR AIS SITE COMPONENTS AT D15

5.1 Red Butte Creek EHS Summary Table

Site Component	Latitude	Longitude	Units
Sensor 1 (S1) location	40.784662	-111.795639	Lat, Long in degrees
Sensor 2 (S2) location	40.783624	-111.798108	Lat, Long in degrees
Met Station location	40.782270°	-111.805886°	Lat, Long in degrees
Met FDP	40.782152°	-111.805832°	Lat, Long in degrees
Primary Precipitation Gauge (DFIR)	40.782136°	-111.805954°	Lat, Long in degrees
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