D12 AQUATIC INSTRUMENT SYSTEM (AIS) SITE CHARACTERIZATION REPORT

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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)/STREON (STR) 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 D12 aquatic locations: Blacktail Deer Creek (core), Bozeman Creek (relocatable). 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)]

2.3 Verb Convention

"Shall" is used whenever a specification expresses a provision that is binding. The verbs "should" and "may" express non-mandatory provisions. "Will" is used to express a declaration of purpose on the part of the design activity.

3 D12 AIS SITE CHARACTERIZATION REPORT

3.1 Blacktail Deer Creek

The Blacktail Deer Creek site is a wadeable stream in northern Yellowstone National Park, Wyoming. The stream can be accessed from a pullout off the Grand Loop Road, with a gated access road running parallel to the stream.

The stream flows through relatively open terrain, with a dense riparian willow canopy on the stream banks. The stream has clear water, is shallow, and has the potential to flood during snowmelt and heavy rainfall events. The area is visited by tourists and fisherman regularly during the summer.

3.1.1 Aquatic Auxiliary and Aquatic Portal Locations for Construction

The initial estimated location for the Aquatic Auxiliary Portal is depicted in Figure; locations are defined in Table 1.

Figure 1 A Google-Earth-Derived Image of Aquatic Auxiliary Portal for D12 Blacktail Deer Creek

Table 1 Aquatic Auxiliary Portal Location

Aquatic Auxiliary Portal	Latitude	Longitude
Location	44.95005	-110.58847

The initial estimated location for the Aquatic Portal is:

Table 2 Aquatic Portal Location

Aquatic Portal	Latitude	Longitude
Location	44.95021	-110.58751

3.1.2 Sensor Locations for Construction

AQU, with support from EHS, has the following field GPS coordinates for S1 and S2 and Met station locations. 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 <1m). 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 Sensor 1 & Sensor 2 Locations

Sensor	Latitude	Longitude
S1	44.949016	-110.586323
S2	44.951526	-110.588460

Table 4 Met Sensor Location

Sensor	Latitude	Longitude
Met Station	44.949348	-110.586763

Figure 2 Kmz File of D12 Blacktail Deer Creek Denoting Locations of S1, S2, and Met Station

S1 is located downstream of an area where a former forest fire has affected the large vegetation. Dead tree trunks have fallen across the stream, and alter flow at some locations. The S1 location is chosen to below this downfall, with enough area between the downfall and S1 to inject gas tracers.

The S1 and S2 locations include pools, which may be used as installation areas for sensors thus reducing the potential for drying.

Figure 3 Photo of S1 Location at D12 Blacktail Deer Creek, looking upstream. A pool is present underneath the dense willow canopy on the left bank.

Figure 4 Photo of S2 Location at D12 Blacktail Deer Creek. This site contains a pool.

Figure 5 Photo of Met Station Location at D12 Blacktail Deer Creek, to the west of the S1 location.

Figure 6 Photo of injection site upstream of S1. S. Parker stands near downed trees from a historic forest fire.

3.1.3 Groundwater Wells

The groundwater observation wells network at the site (Figure 7, 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 small rolling hills near the stream reach, which amplify in size at you move away from the reach. Vegetation at the site is composed of short grasses in the fields surrounding the stream and a dense corridor of cottonwoods and briar bushes at the streams edge extending approximately up to 40 feet laterally in both directions from the stream banks. The wells will be installed near the stream, where the required drilling depth will vary between 10-20 feet below ground surface. Access to the site will be via the existing gravel road directly to the west of the stream. Wells located in the dense vegetation may require selective mild trimming to allow for access, and the wells will be installed in a way that minimizes disturbance to the vegetation. Access to the well locations is anticipated to be relatively straightforward and a defined path for drilling purposes will be defined prior to work at the site. Surface completion of the wells will follow procedures to reduce visibility by park visitors.

The exact location of wells may vary during the drilling process due to the potential presence of boulders in the subsurface. 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 Wyoming 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 7 Initial Groundwater Well Locations Based on EMS kmz File at D12 Blacktail Deer Creek

Table 5 Coordinates for Groundwater Observation Wells

Well ID	Latitude	Longitude
D12-BLDE-OW-01	44.948954°	-110.586425°
D12-BLDE-OW-02	44.949052°	-110.586208°
D12-BLDE-OW-03	44.949722°	-110.587243°
D12-BLDE-OW-04	44.950315°	-110.587011°
D12-BLDE-OW-05	44.950431°	-110.586845°
D12-BLDE-OW-06	44.951111°	-110.588019°
D12-BLDE-OW-07	44.951553°	-110.588371°
D12-BLDE-OW-08	44.951482°	-110.588562°

3.1.4 Riparian Vegetation Cover

During 2010-2011 site visits, the following plant density and type were observed by the AQU team:

The riparian vegetation at Blacktail Deer Creek is composed primarily of willows. Willow shrubs are dense along the stream channel for the majority of the stream reach. The location for S2, however, is relatively open with some smaller willow shrubs along the bank. The upstream portion of the reach has some surrounding lodgepole pines that have been burned in a forest fire (not recent). Some of these trees have fallen across the stream, and obstruct flow in the channel. AQU has places all sensor locations downstream of these fallen trees. Understory vegetation also consists of willow, roses, and grasses.


a)
stream channel

Figure 8 The Riparian Canopy at D12 Blacktail Deer Creek. a) Upstream canopy near S1 is composed of thick willows overhanging the stream. b) Downstream canopy near S2 is sparse willow cover.

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 the figure below.

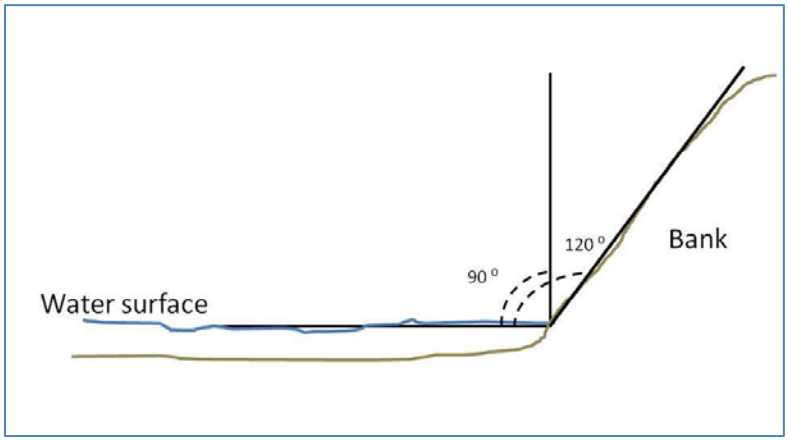

Figure 9 How Bank Angle is Measured

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

The stream bank at Blacktail Deer Creek varies along the AQU reach. Some areas show signs of erosion during floods (Fig. 10a) with high, cut banks. These areas are composed of organic matter and willow roots. In other sections of the reach, the banks are composed of cobble and gravel, and have a more gradual slope (Fig. 10b). At S1, the bank is composed of sand, cobble, and organic matter, with dense willow roots on the left bank. At S2, the bank is composed cobble, gravel, and fine organic matter.

Table 5 Bank Conditions At D12 Blacktail Deer Creek in 2011.

Morphology Type	S1	S2
RB* angle	180	180
LB* angle	180	180
Maximum water height	1.58 m	1.83 m
Bankfull width	8.25 m	15.65 m
Substrate composition	90% cobble, 10% sand + gravel	90% cobble, 10% gravel

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

a)

b)

Figure 10 a) K. Goodman walks by a portion of the stream where the bank has eroded due to flooding. b) K. Goodman sits on a bank composed of cobble and gravel. Photos taken in 2011.

3.1.6 Site Photos

The following photos of are representative of the site.

Figure 11 Typical Substrate in D12 Blacktail Deer Creek is composed mostly of cobbles, with some gravel.

Figure 12 A past forest fire has burned several lodgepole pines near the upper end of the reach.

Figure 13 Deadfall in the stream channel as a result of past forest fires in the watershed. These trees may be swept downstream over time.

Figure 14 J. Coleman and L. Wright walk to the stream site from the access road, 2011.

Figure 15 Willow shrubs surround the stream channel at Blacktail Deer Creek. Once away from the stream channel, the landscape is mainly grassland.

3.1.7 Site Access Needs

No pathways, stairs, or ladders are needed at D12 Blacktail Deer Creek for Science purposes.

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

3.1.8 Power at the Site

The local power utility company is Northwestern Energy. The contact person is Tom Stewart at 406-582-4602 (office) 406-223-0573 (cell).

Estimated cost for 100 amp single phase 240 volt service is between $45,000 - $60,000.

3.1.9 Site Science Construction Constraints and Limitations

Site-specific issues to consider at D12 Blacktail Deer Creek are:

- This site is within Yellowstone National Park, visitation may be high during the summer months. The site is also located on a popular stream for fishermen.
- Past forest fires in the upper watershed may eventually drop more dead trees into the stream channel, and trees that have already fallen in the stream channel may become mobile and wash downstream during future flood events.
- Elk sign (fur in the willow thickets) was very common along the stream bank. Elk are reported to rub against trees and infrastructure. Site designs for infrastructure will need to be able to withstand a full grown elk rubbing and pulling on any fixed physical pieces (e.g. junction boxes, sensor installations). Fencing may not be permittable.
- The site may be inaccessible during the elk rutting season; sensor and infrastructure maintenance plans should account for delays of 90+ days with no access.
- The AQU team was asked to camouflage the infrastructure at the aquatic site to reduce visibility to the public.

Driving and access constraints for D12 Blacktail Deer Creek are:

- The site may be accessed by a gated dirt road from the Grand Loop Road. Contact EH&S for more information.

3.1.10 Other Issues

No other science issues are identified at this time.

3.2 Bozeman Creek

The Bozeman Creek site is a wadeable stream. The stream site is in Gardner Park, west of the intersection of Gardner Park Drive and Goldenstein Lane. Gardner Park is a multi-use park with the Sourdough Trail (for walking and biking) along the side of the stream, and a parking lot on Goldenstein Lane. The park appears to be well visited by hikers, bikers, fishermen, and dogs.

The stream flows through thick riparian canopy, with residential homes on the right bank (east side) and the park on the left bank (west side). The stream has clear water and is relatively shallow in summer, but can experience bed-moving floods during snowmelt in the springtime.

3.2.1 Aquatic Auxiliary and Aquatic Portal Locations for Construction

The initial estimated location for the Aquatic Auxiliary Portal is:

Table 6 Aquatic Auxiliary Portal Location

Aquatic Auxiliary Portal	Latitude	Longitude
Location	45.637195	-111.032060

The initial estimated location for the Aquatic Portal is:

Table 7 Aquatic Portal Location

Aquatic Portal	Latitude	Longitude
Location	45.637195	-111.032060

3.2.2 Sensor Locations for Construction

The GPS coordinates for in stream sensor sets S1, S2, secondary precipitation, NADP and the Met Station locations obtained by AQU, with input from EHS, are presented in Tables 8 & 9. 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 <1m). 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 8 Sensor 1 & Sensor 2 Locations

Sensor	Latitude	Longitude
S1	45.635860	-111.031766
S2	45.638639	-111.031379

Table 9 Met Station Location

Sensor	Latitude	Longitude

Met Station	45.638871	-111.032364
Precipitation	45.638860	-111.032548
NADP	45.638910	-111.032618

Figure 16 Kmz File of D12 Bozeman Creek Denoting Locations of S1, S2, Met Station, NADP location and secondary Precipitation Station location.

S1 is located in a pool downstream of the Goldenstein Lane bridge (Figure 17). It is accessible off of the Sourdough Trail on the left bank, however is well-hidden from the trail itself. The right bank appears to be the yard of a private landowner. Both banks are heavily covered with riparian vegetation.

S2 is located in a pool directly off of the Sourdough Trail (Figure 18). There is easy public access to this location on the left bank. The right bank appears to be the yard of a private landowner, with a lawn that has been mowed all the way to the stream bank.

Figure 17 Photo of S1 Location at D12 Bozeman Creek, looking downstream. K. Goodman holds the survey rod during the cross-sectional survey. Note the dense riparian vegetation on each side of the stream.

Figure 18 Photo of S2 Location at D12 Bozeman Creek. S. Parker collects GPS coordinates in the photo, the pool behind her is the S2 location.

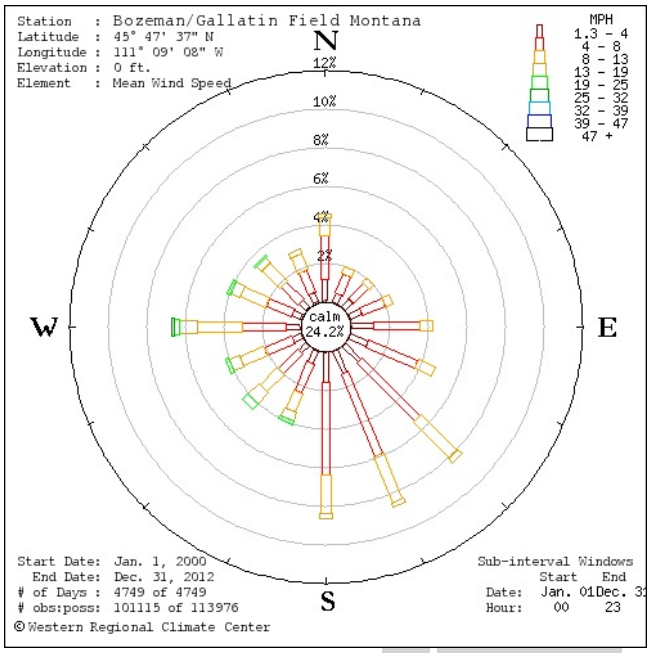

Figure 19 Wind rose near D12 Bozeman Creek

3.2.3 Groundwater Wells

The groundwater observation wells network at the site (Figure 20, Table 10) 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 flat flood plain near the stream reach. Vegetation at the site is composed of short grasses in the fields left of the stream and a dense corridor of cottonwoods and briar bushes at the streams edge extending approximately 40 feet laterally in both directions from the stream banks. The wells will be installed mainly in the flood plain region, where the required drilling depth will vary between 10-20 feet below ground surface. Access to the site will be via the existing gravel road directly to the west of the stream. Wells located in the dense vegetation will require selective mild trimming to allow for access, and the wells will be installed in a way that minimizes disturbance to the vegetation. Access to the well locations is anticipated to be relatively straightforward and a defined path for drilling purposes will be defined prior to work at the site.

The exact location of wells may vary during the drilling process due to the potential presence of boulders in the subsurface. 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 Montana 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 20 Initial Groundwater Well Locations Based on EMS kmz File at D12 Bozeman Creek

Table 10 Coordinates for Groundwater Observation Wells

Well ID	Latitude	Longitude
D12-BOZC-OW-01	45.635820°	-111.031976°
D12-BOZC-OW-02	45.636529°	-111.031870°
D12-BOZC-OW-03	45.636606°	-111.032841°
D12-BOZC-OW-04	45.636905°	-111.032128°
D12-BOZC-OW-05	45.637435°	-111.032533°
D12-BOZC-OW-06	45.637686°	-111.031812°
D12-BOZC-OW-07	45.638256°	-111.032169°
D12-BOZC-OW-08	45.638484°	-111.031520°

3.2.4 Riparian Vegetation Cover

During 2010-2011 site visits, the following plant density and type were observed by the AQU team:

The vegetation at Bozeman Creek consists primarily of willows, cottonwoods, and alders. The brush is very dense in some locations (e.g., S1; Figure 21a). The understory vegetation consists of deciduous shrubs and berries. Large woody debris is abundant throughout the channel. In a few locations, landowners have mowed their lawns up to the stream bank (Figure 21b). The canopy cover at S1 and S2 are both approximately 30% closed.

a)

b)

Figure 21 The Riparian Canopy at D12 Bozeman Creek. a) The riparian canopy near S1 is very dense on both sides of the stream with willow and alder bushes. b) Private landowners have mown the lawn all the way to the streambank just upstream of S2.

3.2.5 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 the figure below.

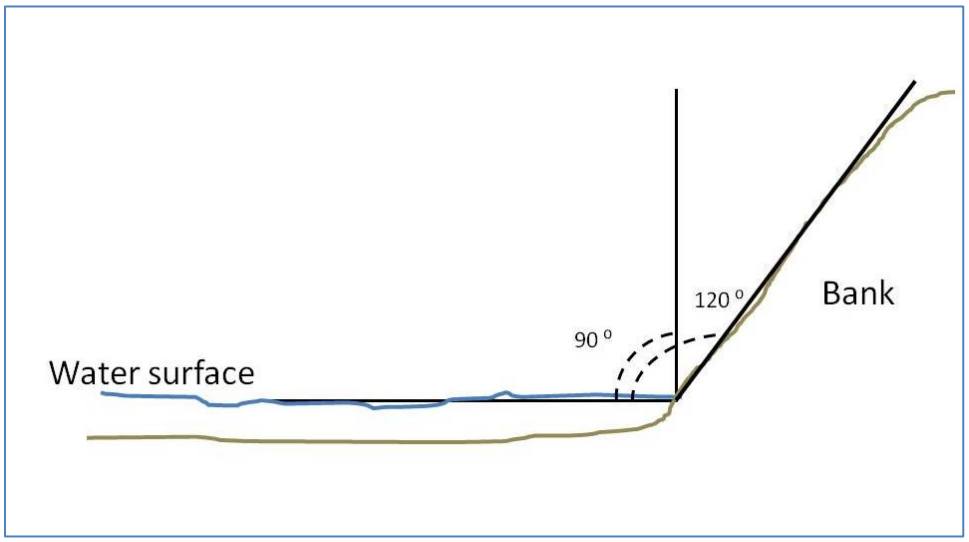

Figure 22 How Bank Angle is Measured

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

The stream bank at Bozeman Creek varies along the length of the AQU reach. Some areas show signs of erosion during floods (Figure 23a).

Table 11 Bank Conditions At D12 Bozeman Creek in 2012.

Morphology Type	S1	S2
RB* angle	110°	90°
LB* angle	145°	175°
Maximum water height	~2 m (estimate)	1.46 m
Bankfull width	~8 m (estimate)	16 m
Substrate composition	Silt, gravel, cobble	Gravel ,cobble

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

a)

b)

Figure 23 Bank erosion is highly likely along the Bozeman Creek AQU reach. a) A cut bank is visible across the stream from K. Goodman. b) Four large trees have overturned uprooting a large section of stream bank just upstream of the S1 location.

3.2.6 Site Photos

The following photos of are representative of the site.

Figure 24 Typical substrate in D12 Bozeman Creek is cobble and pebble.

Figure 25 The right bank appears to be private property, and is eroding in several locations especially just upstream from S2 (photo).

Figure 26 The Sourdough Trail runs along the left bank of the stream. In some locations, it is on the streambank (see trail and park bench in photo, at S2), in others there is a dense riparian buffer between the trail and the stream channel.

Figure 27 A metal diversion structure, likely for irrigation purposes, has been built downstream of S2.

3.2.7 Site Access Needs

No pathways, boardwalks, stairs, or ladders are needed at D12 Bozeman Creek for Science purposes.

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

3.2.8 Communications at the Site

ALL - See table in Appendix C for additional IT info

3.2.9 Power at the Site

The local power utility company is Northwestern Energy. The contact person is Tom Stewart at 406-582-4602 (office) 406-223-0573 (cell).

3.2.10 Site Science Construction Constraints and Limitations

Site-specific issues to consider at D12 Bozeman Creek are:

- Private landowners on the right bank.
- Public park and hiking trail on the left bank

Driving and access constraints for D12 Bozeman Creek are:

- No known constraints.

3.2.11 Other Issues

Intense spring flooding due to snowmelt can significantly alter the morphology of the stream. For example, the S2 pool was not formed until spring 2011, according to a local fisherman.

4 APPENDIX A. FCC SUMMARY TABLES FOR AIS SITE COMPONENTS AT D12

4.1 Blacktail Deer Creek FCC Summary Table

Site Component	Latitude	Longitude	Units
Stream, Lake, or Stream+STREON			Description
Aquatic Auxiliary Power Portal location	44.95005	-110.58847	Lat, Long in degrees
Aquatic Portal location			m away from bank, direction
Secondary Precipitation			
NADP			
Met Station	44.949348	-110.586763	Lat, Long in degrees
Pathway needed? What is length?			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?			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?			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?			Yes/no, description
Fencing needs			Description
Site management			Description
Any additional site specific information			Description

4.2 Bozeman Creek FCC Summary Table

Site Component	Latitude	Longitude	Units
Stream, Lake, or Stream+STREON			Description
Aquatic Auxiliary Power Portal location	45.637195	-111.032060	Lat, Long in degrees
Aquatic Portal location			m away from bank, direction
Secondary Precipitation	45.638860	-111.032548	Lat, Long in degrees
NADP	45.638910	-111.032618	Lat, Long in degrees
Met Station	45.638871	-111.032364	Lat, Long in degrees
Pathway needed? What is length?			Yes/no, description w/ length
Pathway start location	Site2-PathStartLat	Site2-PathStartLong	Lat, Long in degrees
Pathway end location	Site2-PathEndLat	Site2-PathEndLong	Lat, Long in degrees
Stairs or ladder needed?			Yes/no, description
Stairs top location	Site2-StairsTopLat	Site2-StairsTopLong	Lat, Long in degrees
Stairs length	Site2-StairsLength		Meters
Ladder top location	Site2-LadderTopLat	Site2-LadderTopLong	Lat, Long in degrees
Ladder length	Site2-LadderLength		Meters
Boardwalk needed? What is length?			Yes/no, description w/ length
Boardwalk start location	Site2-BrdwlkStartLat	Site2-BrdwlkStartLong	Lat, Long in degrees
Boardwalk end location	Site2-BrdwlkEndLat	Site2-BrdwlkEndLong	Lat, Long in degrees
Shall stairs, boardwalk be installed during construction?			Yes/no, description
Fencing needs			Description
Site management			Description
Any additional site specific information			Description

5 APPENDIX B. EHS SUMMARY TABLES FOR AIS SITE COMPONENTS AT D12

5.1 Blacktail Deer Creek EHS Summary Table

Site Component	Latitude	Longitude	Units
Sensor 1 (S1) location	44.949016	-110.586323	Lat, Long in degrees
Sensor 2 (S2) location	44.951526	-110.588460	Lat, Long in degrees
Discharge Sensor location (if needed)	Site1-DSLat	Site1-DSLong	Lat, Long in degrees
Met Station location	44.949348	-110.586763	Lat, Long in degrees
Aquatic Auxiliary Power Portal location	44.95005	-110.58847	Lat, Long in degrees
Aquatic Portal location	44.95021	-110.58751	Lat, Long in degrees

5.2 Bozeman Creek EHS Summary Table

Site Component	Latitude	Longitude	Units
Sensor 1 (S1) location	45.635860	-111.031766	Lat, Long in degrees
Sensor 2 (S2) location	45.638639	-111.031379	Lat, Long in degrees
Discharge Sensor location (if needed)	Site2-DSLat	Site2-DSLong	Lat, Long in degrees
Met Station location	45.638871	-111.032364	Lat, Long in degrees
Aquatic Auxiliary Power Portal location	45.637195	-111.032060	Lat, Long in degrees
Aquatic Portal location	Site2-APLat	Site2-APLong	Lat, Long in degrees

6 APPENDIX C. IT SUMMARY TABLES FOR AIS SITE COMPONENTS AT D12

6.1 Blacktail Deer Creek IT Summary Table

Site Component	Latitude	Longitude	Units
REQUIRED			
Aquatic Auxiliary Power Portal location	44.95005	-110.58847	Lat, Long in degrees
Aquatic Portal location	44.95021	-110.58751	Lat, Long in degrees
DESIRED			
Cell tower visible from site			Yes/no
Cell phone signal at site			Yes/no, which carrier?
Strength of cell phone signal			Description
Facility on property			Yes/no
Internet connectivity at facility			Yes/no, description
Phone number at facility location			Area code & first 3 needed

6.2 Bozeman Creek IT Summary Table

Site Component	Latitude	Longitude	Units
REQUIRED			
Aquatic Auxiliary Power Portal location	45.637195	-111.032060	Lat, Long in degrees
Aquatic Portal location	Site2-APLat	Site2-APLong	Lat, Long in degrees
DESIRED			
Cell tower visible from site			Yes/no
Cell phone signal at site			Yes/no, which carrier?
Strength of cell phone signal			Description
Facility on property			Yes/no
Internet connectivity at facility			Yes/no, description
Phone number at facility location			Area code & first 3 needed