



<i>Title:</i> NEON Site Research Coordination Guidelines		<i>Date:</i> 08/07/2023
<i>NEON Doc. #:</i> NEON.DOC.004312	<i>Author:</i> D. Tazik, H. Loescher, A. Thorpe, T. Baldwin, M. SanClements, K. Thibault, K. Kirby, A. Karam	<i>Revision:</i> E

NEON SITE RESEARCH COORDINATION GUIDELINES

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Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	12/10/2010	NEON.SYS.000280.CRE	Initial release
B	09/23/2011	ECO-00276	Update to new document numbers and template
C	06/23/2014	ECO-01688	Updated to incorporate more recent NEON Science, EHS and FOPS needs
D	08/25/2016	ECO-04100	Updated to remove STREON, change number of core and relocatable site, update sample plot numbers
E	08/07/2023	ECO-07030	Updated language from relocatable to gradient, migrated into template Rev J, consolidated aquatics descriptions, directed inquiries to Assignable Assets



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1 DESCRIPTION

1.1 Introduction

The National Ecological Observatory Network (NEON) is a continental-scale ecological observatory designed to enable understanding of the impacts of climate change, land-use change and invasive species on ecological systems. NEON is designed to gather ecological and climatic data over 30 years within 20 eco-climatic Domains across the continental United States, Alaska, Hawaii, and Puerto Rico; including 47 terrestrial and 31 aquatic sites.

NEON sites comprise 20 terrestrial and 19 aquatic core sites located in wildland areas that will remain in place for the planned 30 year lifespan of NEON, along with 27 terrestrial and 15 aquatic gradient sites that may periodically move location. Gradient sites are established in response to priority science questions identified by the scientific community (RD[03]).

NEON’s co-located physical, chemical, and biological measurements and observations are acquired via distributed sensor networks, field samples and human observations, and coordinated airborne observations. The intent is to facilitate the study of ecological responses of the biosphere to environmental change and resulting feedbacks to the hydrosphere and atmosphere. NEON data and data products will have maximum long-term value if additional observations and experiments can be carried out by other researchers in the same general area while maintaining consistency in NEON’s data collection methods and the environmental integrity of NEON sites.

1.2 Purpose

The purpose of this document is to establish a set of guidelines for coordination of field research activities in the vicinity of NEON measurement and sampling infrastructure. The intent is to ensure the integrity of NEON’s instrumental and observational systems and associated data and data products over the 30-year life of the Observatory, while also encouraging research by independent scientists.

1.3 Scope and Limitations

These guidelines apply across all of NEON’s 20 Domains to any research, scientific observation, or related activity in the vicinity of NEON instrumental or observational locations that could potentially have a measurable impact on NEON measurement and observation systems – i.e., the Terrestrial Instrument System (TIS), Terrestrial Observation System (TOS), Aquatic Instrument System (AIS), and Aquatic Observation System (AOS) (AD[01]).

As it will be difficult to anticipate all the circumstances and proposed research efforts that may arise in and around a NEON site, site specific adaptations likely will be necessary. Close coordination between NEON, the site host, and research investigators will be necessary to ensure the continued success of on-going and future proposed research efforts at the site.



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This document is not intended to replace existing land use agreements. Rather, it is to be used as a guide in conjunction with any existing site agreements. All activities will be approved under the terms and conditions of any land use agreements that are in effect. Researchers are responsible for obtaining any permits and agreements necessary for access and to perform research at the site.

These guidelines also are not intended to alter land management practices at NEON sites. Given that the purpose of these guidelines is to maintain the integrity of the NEON science theme designated for a particular site, these land management practices are expected to continue over the life of the NEON site.



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2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

Applicable documents contain information that shall be applied in the current document. Examples are higher level requirements documents, standards, rules, and regulations.

AD[01]	NEON.DOC.000001	NEON Observatory Design (NOD)
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2.2 Reference Documents

Reference documents contain information complementing, explaining, detailing, or otherwise supporting the information included in the current document.

RD[01]	NEON.DOC.000008	NEON Acronym List
RD[02]	NEON.DOC.000243	NEON Glossary of Terms
RD[03]	NEON.DOC.001478	Plan for Selection of Future Relocatable Sites
RD[04]	NEON.DOC.001304	Plan for Evaluating, and Approving PI Requests to Access NEON Biological Sampling Infrastructure Including Field Samples

2.3 External References

External references contain information pertinent to this document but are not NEON configuration-controlled. Examples include manuals, brochures, technical notes, and external websites.

ER[01]	Kormann, R. and F. X. Meixner. 2001. An Analytical Footprint Model for Non-Neutral Stratification. <i>Boundary-Layer Meteorology</i> 99: 207–224.
ER[02]	Schmid, H.P. 1997. Experimental design for flux measurements: matching the scales of observations and fluxes. <i>Agricultural and Forest Meteorology</i> 87: 179–200.



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3 DEFINITIONS

In this document, the term ‘location’ is used in the general sense to refer to an area where NEON will collect soil, water and biological samples, or where instruments are placed. NEON facilities at these locations include:

- **Tower Locations:** Tower, instrument hut, soil arrays, tower plots and access routes.
- **Terrestrial Sampling Locations:** All distributed, tower, and gradient plots.
- **Aquatic Sampling Locations:** Aquatic instrumental and observational locations, and groundwater wells.



4 NEON MEASUREMENT TYPES

4.1 Terrestrial Instrument System (TIS)

The TIS uses automated *in situ* sensors to provide fixed, representative measurements of physical and chemical climate drivers, ecosystem responses, and feedback mechanisms across the soil-plant-atmosphere continuum at all 20 NEON core and 27 gradient sites. Measurements include a variety of biophysical and biogeochemical variables (i.e., temperature, humidity, wind, precipitation, radiation, carbon dioxide, methane, and reactive nitrogen), and ecosystem functioning in terms of carbon, water, and energy fluxes. The TIS continuously measures these quantities at different local scales including incident, micro-climate and dynamic flux source areas with

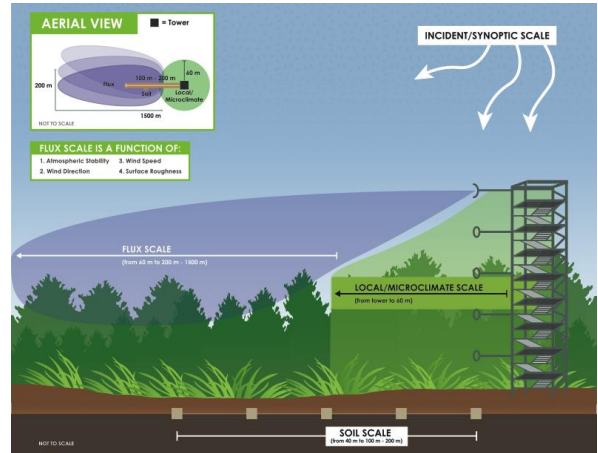


Figure 1. Concept drawing showing the different scales of TIS measurement.



Figure 2. Conceptual depiction of tower, instrument hut, boardwalks, and biological sampling.

tower-mounted instrumentation. It also takes similar measurements at the stand-level in soils adjacent to the tower. The tower infrastructure, instrument hut, and soil array are illustrated in **Figures 1** and **2**. For additional description of these scales, please refer to AD[01]. Tower plots, associated with the TOS, are located within the tower airshed – i.e., flux scale (see next section).

4.2 Terrestrial Observation System (TOS)

The TOS collects samples and observations from organisms and soils to identify and quantify indicators of change in terrestrial ecosystems, including species abundance, diversity, infectious diseases, biogeochemistry and phenology. These activities are focused on plants, soils, microbes, birds, small mammals, ticks, mosquitos and ground beetles, and take place at all terrestrial core and gradient sites. There are three types of TOS plots.

- **Tower Plots:** Between 4 and 30 sampling plots are placed within the 90% flux area of the primary and secondary (if applicable) airsheds of each NEON tower using a spatially balanced, random design. Measurements include above-ground plant productivity, below-ground plant biomass, plant phenology, soil and plant biogeochemistry, and soil microbial community diversity and function. Additionally, individual plants are marked for phenological measurements along a fixed, square ‘loop’ transect within the tower airshed. These plots



provide a direct link between NEON’s Terrestrial Observation System and Terrestrial Instrument System platforms.

- Distributed Plots:** There are between 20 and 50 sampling plots distributed according to a spatially balanced, stratified random design across each core and gradient site. The total number of plots depends on the size and diversity of major cover types. These plots are sampled for plant diversity, plant biomass and biogeochemistry; soil microbes and biogeochemistry; ground beetles, mosquitoes, birds, small mammals, and ticks.¹ While sampling for many components is collocated within a plot to the extent possible, most sampling protocols are followed in a smaller subset of plots. In addition, birds, small mammals, mosquitos, and ticks are sampled in plots without other sampling due to logistical constraints and the need to minimize sampling impacts.

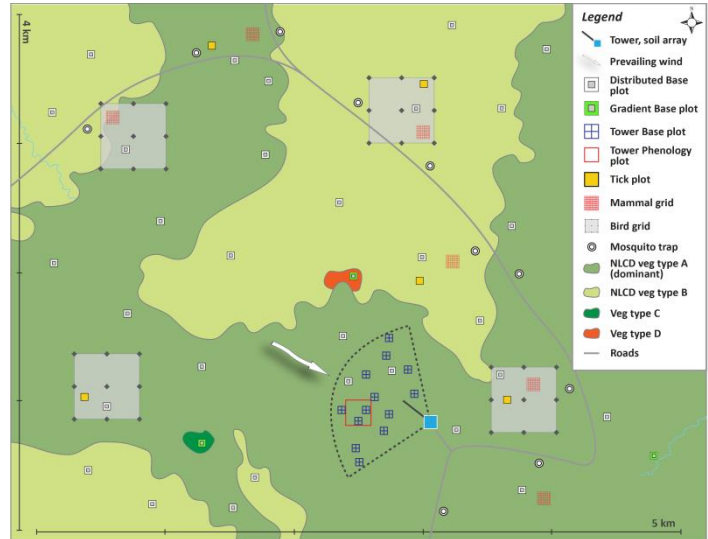


Figure 3. Generalized TOS sampling design showing locations of terrestrial plots and transects.

- Bird and Small Mammal Grids:** Small mammals are sampled on three to eight trapping grids in association with a sub-set of the *Distributed Plots*. Birds are monitored using point-counts at 5 – 15 nine-point grids also placed in association with *Distributed Plots* where possible.
- Tick Plots:** Tick sampling involves the collection of ticks using drag sampling on 6 plots on the site. Plots are placed near a subset of distributed plots where no other sampling will occur in order to minimize the impact of technician activity on tick-capture rates.
- Mosquito Plots:** Due to the frequency of sampling, mosquito sampling occurs at 10 plots located within 30m of a road.

Figure 3 schematically illustrates the placement of terrestrial observational sampling plots.

- Gradient Plots:** Additional Gradient Plots will be established at sites as needed to capture major topographical, vegetation, or hydrologic gradients to improve scalability between terrestrial and

¹ At some sites, the NEON site boundaries follow ownership boundaries. At others, particularly larger sites, boundaries have been drawn to constrain the sampling area.



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aquatic biogeochemical measurements and TOS and AOP data. These plots may include subplots for sampling plant biodiversity, soil and plant biogeochemistry, and soil microbes.

NEON encourages the use of terrestrial sampling locations as controls for other experiments and research activities, subject to the guidelines presented below. Sampling within these plots may be permissible under the assignable assets program (see RD[04]).

4.3 Aquatic Observation and Instrument Systems (AOS/AIS)

The aquatic component of NEON collects data to identify and quantify indicators of change in stream, river, and shallow lake ecosystems, as well as shallow groundwater wells. Data is gathered via *in situ* sensors as part of the Aquatic Instrument Systems (AIS) and samples collected through manual field activities as part of the Aquatic Observational Sampling (AOS). These activities take place across the observatory network at 34 aquatic sites (24 wadeable streams, 3 rivers, and 7 lakes), within a 1 km stream/river reach (**Figure 4**) or an entire lake (**Figure 5**), plus a 15 m buffer zone from each streambank or lake edge. Shallow groundwater wells are also located within a 200 m zone of impact. All instrumentation is located and measurements are made within these buffers and zones, as illustrated in **Figure 4** and **Figure 5**.

The aquatic sampling consists of chemical measurements of surface water (via grab samples of general water chemistry, nutrients, stable isotopes, and greenhouse gases, as well as sensor based measurements of dissolved oxygen, pH, conductivity, fDOM, turbidity, chlorophyll and nitrate), physical measurements (e.g., stream and river discharge, lake bathymetry and stream morphology, water and air temperature, wind speed and direction) and the diversity and distribution of algae, microbes, aquatic plants, invertebrates, and fish. Additionally, shallow groundwater wells are sampled for general chemistry, nutrients, and stable isotopes of water, while continuously monitoring conductivity, temperature, and level.

Aquatic sites span hydrologic and chemical gradients across the continent and these gradients provide the basis for scaling up across space and time. Likewise, the science designs of the Aquatic and Terrestrial components of NEON are co-developed so that the data from aquatic sites can be combined with terrestrial data to ask questions related to ecohydrology and biogeochemistry.

As with terrestrial sampling locations, NEON encourages the use of aquatic sites as controls for other experiments and research activities, subject to the guidelines presented below. Sampling or other activities within NEON stream reaches or lakes, or within the 15 m buffer zones surrounding them require approval under the assignable assets program.

Wadeable streams:

The AIS sensors are located within the 1 km stream reach. The instrument infrastructure consists of two sensor sets (S1-upstream and S2-downstream) that are installed between 200 and 500 m apart depending on the median water travel time. The site infrastructure also consists of a meteorological



station located in the riparian zone and a suite of up to eight instrumented shallow groundwater wells located within the 200 m permitted boundary. All AOS activities take place within the 1 km stream reach (Figure 4).

Rivers:

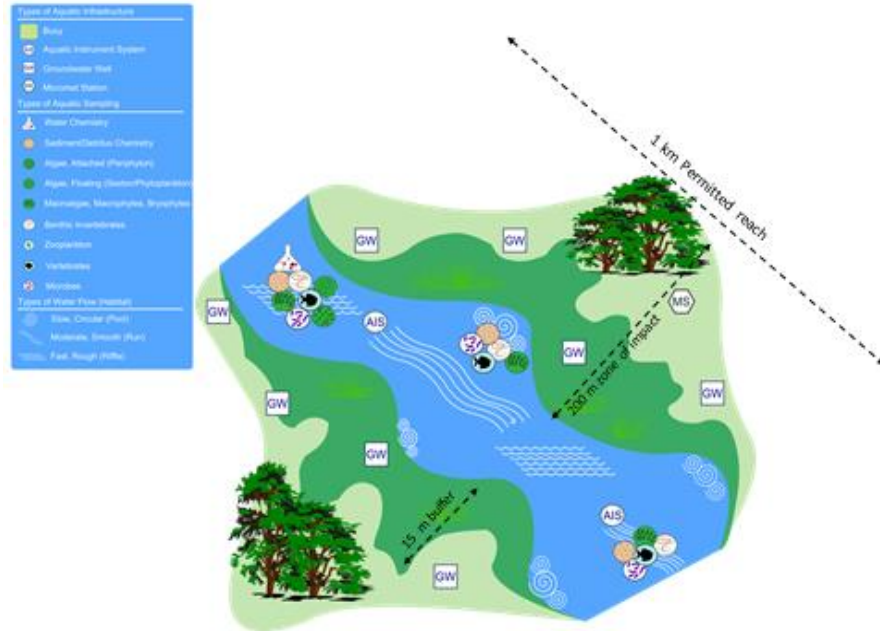


Figure 4. Generalized aquatic sampling scheme for a wadeable stream site denoting the location of instrumental infrastructure and observational sampling stations.

The AIS sensors are located within the 1 km stream reach. The instrument infrastructure consists of one sensor set equivalent to the S2 station installed in wadeable streams. Further infrastructure consists of a meteorological station located in the riparian zone and a suite of up to eight instrumented shallow groundwater wells located within the 200 m permitted boundary. All AOS activities take place within the 1 km stream reach.

Lakes:

The AIS sensors are located within the lake and surrounding 200 m permitted boundary. The instrument infrastructure consists of a buoy located in the deepest zone of the lake. For lakes which are deep enough to stratify, periodic vertical profiles of the water columns are collected. Two additional sensor sets (pressure, temperature and underwater photosynthetically active radiation (PAR)) located in the nearshore littoral zones, or near inlets and outlets of flow-through lakes. Further infrastructure consists of a meteorological station located in the riparian zone and a suite of up to eight instrumented



groundwater wells located within the 200 m permitted boundary. All AOS activities take place within the lake (Figure 5).

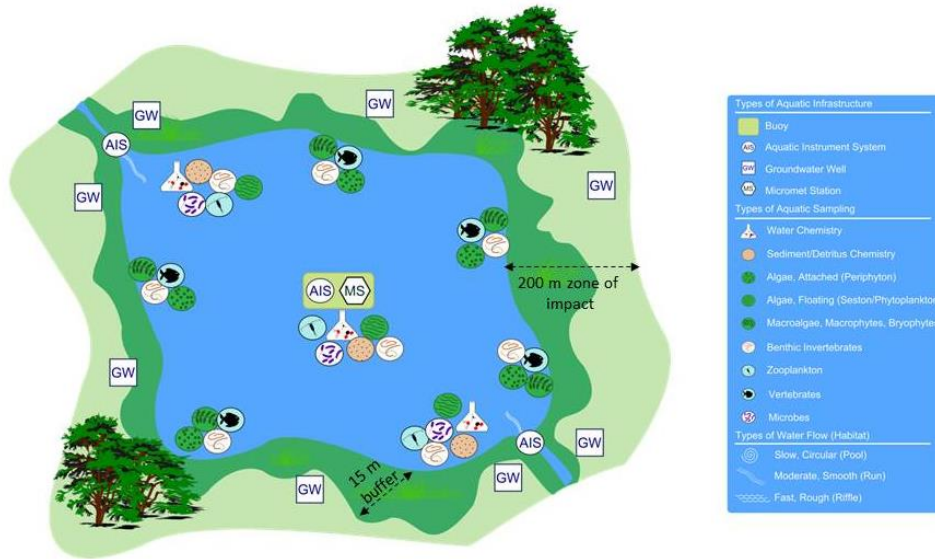


Figure 5. Generalized aquatic sampling scheme for a lake site denoting the location of instrumental infrastructure.



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5 RESEARCH AROUND NEON LOCATIONS

Much of the NEON infrastructure has been developed to accommodate additional sampling and experimentation by external researchers (though not all). However, the role of NEON observations as long-term controls or baseline observations can only be maintained if NEON and the site host coordinate to ensure the integrity of observations over time. While most external investigator-initiated research around NEON locations will likely have minimal to no impact on NEON measurements, NEON wishes to ensure that all impacts are understood and documented.

Ongoing research activities at each site were assessed when the site was initially proposed to become part of NEON. When new research activities within the exclusion areas and buffer zones around NEON locations (see details below) are proposed to the site host, NEON requests notification and the opportunity through a NEON Assignable Asset request to review and comment on the proposed activity, as needed, to provide specifics about the NEON operations and to avoid conflicts with the NEON sampling effort.² Similarly, if NEON proposes to add a new activity to existing infrastructure or plans to implement a new suite of measurements, NEON provides a proposal to the site host to secure authorization of the new activity.

² Note that it is the responsibility of the principal investigator (PI) to identify and secure all other required permits from the site host and other state and federal agencies as appropriate prior to beginning work as their activities are not covered under NEON's permits.



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6 LAND MANAGEMENT

NEON plans to collect data and biological samples for an extended period of time, with core sites being active for a minimum of 30 years, and gradient sites for at least five to ten years. The intent is to ensure, to the extent practicable, the integrity of its measurement and observation systems over the entire extent of its tenure on the site. This presents a challenge for site hosts accustomed to accommodating researchers for relatively short periods of time.

NEON assumes that the site will continue to be managed by the landowner or site manager following the site-specific strategies, procedures, and protocols in place at the time that the land use agreement was put into place, and that they will continue to do so in cooperation and coordination with NEON. Terrestrial sampling locations, tower infrastructure/management, and the aquatic infrastructure should not interfere with or change site management strategies related to, for example, grazing, fire, forest management, agriculture and/or scientific research. NEON sampling is conducted in a manner consistent with these site management activities.

Altering or disturbing any NEON infrastructure should be avoided without prior NEON approval in accordance with the extant land use agreements. NEON coordinates with site hosts to make sure that reasonable measures are in place to prevent vandalism of NEON facilities. The site host takes reasonable precautions to avoid or minimize impacts of other unapproved activities by external researchers, site guests, and the public.

NEON may participate in advisory structures that are established on sites, especially where significant ongoing research activities will continue to take place -- i.e., biological field stations and other locations established for research purposes. This helps to maintain an appropriate level of communication and coordination at these sites and to avoid inadvertent impacts on on-going and planned observational studies and research activities. The NEON Field Operations Manager serves as the liaison with these advisory bodies where they exist.



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7 RECOMMENDED EXCLUSIONS NEAR NEON LOCATIONS

General guidelines for avoiding impacts on the science associated with specific NEON sampling locations are provided in this section. It must be recognized that recommended restrictions related to one type of measurement or physical infrastructure are not mutually exclusive of one another. One requirement does not nullify another – all must be considered collectively. Charts in Appendix A provide a graphic illustration of the guidelines described below.

7.1 Tower Location

Information on TIS tower locations and flux source areas is detailed in the individual site metadata and will be made available via the NEON data portal. Specific site planning details can also be provided upon request. The following guidelines only consider site impact on TIS measurements -- TOS tower plot sampling is covered under Terrestrial Sampling Locations below.

7.1.1 Flux Scale

The tower airshed is the critical area within which flux measurements are obtained – i.e., CO₂, water and energy flux (see **Figure 1**). The tower airshed is delineated to ensure that the measured fluxes are from a source area representative of the dominant ecosystem at the site. Proposed access to and activities within the tower airshed that NEON wishes to control are those that have the potential to alter the sources and sinks of key measurement variables (scalars) or that cause changes to the physical flow over and through the ecosystem.

Conducting a project within the flux airshed will have some impact no matter how far away from the tower. As such, when there is a request for any external research to be performed at one of the NEON tower locations, the researchers should be encouraged to locate their research activity outside of the 90% source area (**Figure 6**).

The impact of disturbances caused by individual sampling activities has been extensively modeled at each of NEON’s tower locations to delineate “research exclusion zones” that surround TIS instrumentation. Exclusion zones vary depending upon the nature and scope of the sampling activities involved. The tower measurement areas are determined by defining a flux footprint (ER[01]) and a radiation footprint (ER[02]). A specific exclusion zone can then be defined to minimize mutual interference associated with specific research activities by considering annual visitation frequency, length and width of trail used when visiting the location, area disturbed by research, disturbance impact weighting factor, and scientific value factor.

1. Non-Destructive Sampling (Chart 1):

- a. Sampling may take place within the prevailing wind flux footprint of the 90% source area if the proposed research involves only seasonal-to-annual visits, does not change process rates or scalar measurements (e.g., addition of CO₂ for mosquito traps), and is unlikely to result in



impacts from travel through the area. NEON requests that the prospective researcher contact NEON so that NEON science staff can assist in determining the best approach to minimizing impact on NEON measurements.

- b. Sampling activities that involve daily-weekly-monthly visits have the potential to change process rates or scalar measurement, and/or have the potential to result in noticeable impacts from travel through the source area. NEON requests that the prospective researcher contact NEON so that NEON science staff can assist in determining the best approach to minimizing impact on NEON measurements.

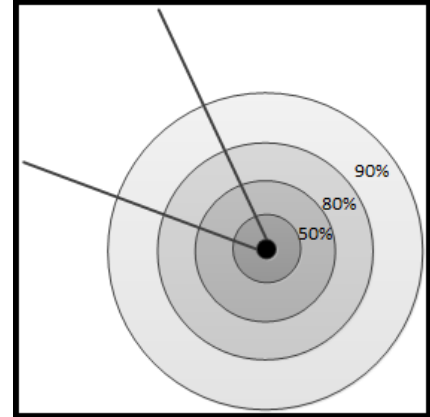


Figure 6. Schematic of the 90%, 80%, and 50% source areas around the tower as well as the prevailing wind flux footprint.

2. Destructive Sampling and Manipulative Experiments (Chart 1):

For sampling and experimentation that is destructive, manipulative, or otherwise results in changes in process rates -- e.g., due to biomass removal, enclosures or exclosures, and nutrient additions - NEON requests that the prospective researcher contact NEON so that NEON science staff can assist in determining the best approach to minimizing impact on NEON measurements.

3. Establishing Infrastructure in Shrubland or Forest (Chart 2):

- a. Physical infrastructure can be established in the direction of the prevailing wind flux footprint (**Figure 6**) if the infrastructure:
 - i. Does not affect wind flows – convective, turbulent structure, nighttime drainage, etc.
 - ii. Is outside of the 80% source area³, and any trees or shrubs removed are likely to have a minimal impact on the overall forest structure and canopy.
 - iii. Does not change local ecosystem process rates due to, e.g., fertilization, emissions, irrigation, rain-out shelters, warming experiment, land use change, etc.
 - iv. Has no more than minimal impact to the source area due to travel through the site – i.e., primarily involves seasonal to annual travel through the area.
- b. If otherwise, infrastructure must be established outside the 90% source area⁴ ±20° of the prevailing wind flux footprint (**Figure 6**).

³ The 80% source area is a function of the distance required to be outside of 80% of the accumulated flux footprint. It is determined on a site-by-site basis.

⁴ The 90% source area is a function of the distance required to be outside of 90% of the accumulated flux footprint. It is determined on a site-by-site basis.



4. Establishing Infrastructure in Grasslands or Tundra (canopy height < 1.75 meters) (Chart 3):

Physical infrastructure of any height will affect the wind flows (convective, turbulent structure, nighttime drainage, etc.) within these low stature communities.

a. Physical infrastructure may be established in the direction of the prevailing wind flux footprint but outside the 80% source area if it is placed a minimum of 5 length scales beyond the 80% source, where one length scale is equal to the height of the proposed object as illustrated in **Figure 7**.

b. Physical infrastructure should be placed outside the 90% source area and $\pm 20^\circ$ beyond the prevailing wind flux footprint (**Figure 6**) if the overall impact from travel through the source area is daily, weekly or monthly and/or likely to result in noticeable impacts.

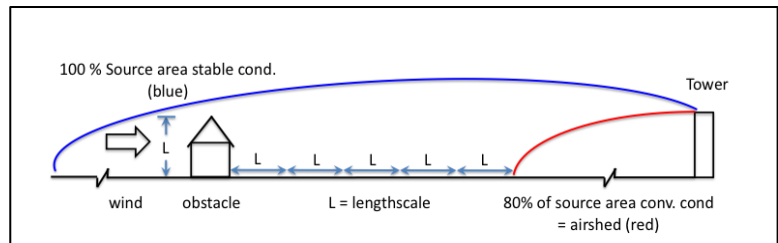


Figure 7. The three different use conditions around the tower infrastructure, (a) the 80 percent source area footprint under daytime convective conditions, (b) the distance (5L) away an obstacle has to be from the footprint, and (c) the 100% stable source.

In the event of any doubts regarding the above, NEON science staff is available and can assist in determining the best approach to minimizing impact on NEON measurements.

7.1.2 Microclimate Scale

The microclimate scale exclusion area is defined as an 80 m radius buffer centered on the NEON tower.⁵ Any research activity within the 80 m buffer has the potential to impact the tower microclimate and should be limited to the extent practicable. All traffic (public or otherwise) within the 80 m buffer should stay on designated boardwalks or paths.

1. Non-destructive Sampling (Chart 4A):

- Sampling may be permitted within the 80 m buffer if the proposed research involves only seasonal to annual visits, is likely to result in minimal impacts from travel through buffer area and is consistent with the exclusion zone described above.
- Sampling must take place on the leeward side of the tower and outside the 80 m buffer if the proposed research involves daily-weekly-monthly visits and/or has the potential to result in noticeable impacts from travel through the buffer area.

⁵ Typically, activities that are inadvisable at the flux scale would also be inadvisable at the microclimate and soil scales. Guidelines presented here for the microclimate and soil scales would apply for those activities that were found to be otherwise permissible at the flux scale. It is not clear how often this might occur – the guidelines are provided to account for such possibilities.



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2. Destructive Sampling and Experimental Manipulations (Chart 4B):

- a. NEON advises against destructive sampling (including limb shooting, soil coring and tree coring) and manipulation experiments anywhere within the 80 m buffer area.
- b. Destructive sampling and manipulation experiments may be permitted on the leeward side of the tower outside the 80 m buffer zone if the activity involves:
 - i. Only seasonal to annual visits and is likely to result in minimal impacts from travel through the buffer area, and
 - ii. The size and level of impact are deemed unlikely to impact the tower microclimate.

3. Establishing Infrastructure (Chart 4B):

- a. NEON advises against placing any physical infrastructure within the 80 m buffer zone.
- b. Physical infrastructure may be permitted on the leeward side of the tower outside the 80 m buffer zone if the activity involves:
 - i. Only seasonal to annual visits and is likely to result in minimal impacts from travel through the buffer area, and
 - ii. The size and level of impact are deemed unlikely to impact the tower microclimate.

7.1.3 Soil Scale

The soil array exclusion area is defined as a 10 m buffer zone around the array and is typically located within the flux footprint.⁶ The specific arrangement of the soil array may vary from site to site -- information can be provided separately that is specific to each site. All traffic (public or otherwise) must stay on designated boardwalks or paths within area of the soil array unless prior approval is granted.

- 1. **Non-destructive Sampling (Chart 5A):** Sampling may be permitted within the 10 m buffer if the proposed work is consistent with the exclusion zones (note that the soil array is located within the flux footprint).
- 2. **Destructive Sampling and Manipulative Experiments (Chart 5B):** Limited destructive sampling and manipulative experiments, such as soil coring, may be permitted within the 10 m buffer area if it is consistent with the exclusion zones.
- 3. **Establishing Infrastructure (Chart 5B):** NEON advises against placing any physical infrastructure within the soil array buffer zone.

⁶ Ibid



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7.2 Terrestrial Sampling Locations

While it is understood that limiting people from incidentally walking through a plot is difficult, as a rule, active and repetitive access through a sampling plot – i.e., daily, weekly or monthly – should be avoided and actively discouraged. Any and all sampling on or within any of NEON’s terrestrial sampling locations is prohibited save for activities approved under NEON’s Assignable Asset Program (RD[04]).

7.2.1 Tower Plots

Between 4 and 20 ecosystem productivity and plant phenology Tower plots are placed within the TIS tower airshed using a spatially-balanced, random design (**Figure 1** and **Figure 3**). The exclusions described above for the TIS airshed (flux scale) apply here as well.

1. **Destructive and Non-destructive Sampling and Manipulative Experiments:** Any sampling within the vicinity of Tower plots should be consistent with the flux scale guidelines above.
2. **Establishment of Infrastructure:** NEON advises against placement of physical structures of any sort in the vicinity of the Tower plots, consistent with tower infrastructure guidelines above.

7.2.2 Distributed and Gradient Plots (Including Tick Plots)

1. **Non-destructive Sampling (Chart 6A):** NEON advises limiting research activities within 20 m of distributed and gradient plots, especially if the proposed research involves daily-weekly-monthly visits and/or has the potential to result in noticeable impacts from travel through the area.
2. **Destructive Sampling and Manipulative Experiments (Chart 6B):** Destructive sampling and manipulative experimentation has the potential to impact NEON measurements if conducted in the vicinity of these plots. NEON advises prohibiting any such research within 20 m of these plots.
3. **Establishing Infrastructure (Chart 6C):** Physical infrastructure may be permitted in the vicinity of these plots if it is unlikely to impact the quality or quantity of samples collected from the sampling location, particularly if it involves only seasonal to annual visits and is likely to result in minimal impacts from travel through the area.
4. **Additional Considerations for Beetle Pitfall Sampling (Chart 6D):** It may be appropriate to restrict additional beetle pitfall trapping as it is possible that beetles could be oversampled, especially where threatened, endangered or other at-risk species may be known to exist.^{7,8}

⁷ Includes species of concern but not on an official list of protected species; e.g., candidates for listing or species of concern as recognized in databases such as NatureServe. These will generally be known to the site host or local conservation groups and may have been determined in conjunction with the NEON programmatic Environmental Assessment.

⁸ Note that access to and use of beetle and other by-catch will be subject to separate policies and procedures currently being developed.



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- 5. Additional Considerations for Mosquito Traps (Chart 6E):** Additional concurrent sampling for mosquitos using a CO₂ baiting system should be avoided within a 300m buffer around NEON mosquito sampling points in order to avoid trap competition. Non-concurrent sampling within this buffer would be acceptable.

7.2.3 Small Mammal Grids

The biological integrity of the sampled populations should be maintained, as NEON will collect data on population and community dynamics.

- 1. Non-destructive Sampling (Chart 7A):** NEON advises limiting research activities within 20 m of the small mammal grids, especially if the proposed research involves daily-weekly-monthly visits and/or has the potential to result in noticeable impacts from travel through the area.
- 2. Destructive Sampling and Manipulative Experiments (Chart 7B):** Destructive sampling and manipulative experimentation have the potential to impact NEON measurements if conducted in the vicinity of small mammal grids. NEON advises prohibiting any manipulative research within 20 m of these grid plots.
- 3. Establishing Infrastructure (Chart 7C):** Physical infrastructure in the vicinity of small mammal plots is problematic to the extent that it may attract predatory bird species that can use the infrastructure as a hunting perch. NEON requests to be advised of any infrastructure greater than 2 m in height that is proposed to be placed within 200 m of any small mammal grid so that potential impacts can be evaluated by the NEON vertebrate ecologist.
- 4. Additional Considerations (Chart 7D):** Additional small mammal trapping near NEON sampling locations may result in over-sampling and stress to the small mammal populations and, therefore, should generally be avoided if possible. Additional sampling that is proposed within 100 m of NEON small mammal grids should be coordinated to the extent practical to identify synergies and minimize the overall impact on the local population.⁹ NEON further requests that sampling involving the lethal collection of small mammals be setback 600 m from current small mammal grids to ensure the integrity of our long-term sampled populations. This takes into account the potential for dispersal to population sinks and provides a buffer of several home range sizes for most of our target taxa to ensure that there isn't any noticeable dispersal from the rodent populations we sample.

7.2.4 Bird Grids

Activity in the immediate vicinity of bird point-count grids while counting (or acoustic recording) is occurring should be avoided as it may interfere with bird activity and bias results.

⁹ Note that proposals to take additional measurements from small mammals captured by NEON personnel would be handled through the NEON Assignable Asset Program (RD[04])



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1. **Non-destructive Sampling (Chart 8A):** NEON advises limiting research activities within 200m of the center point of bird grids during the breeding and early nesting periods (dates vary by site), especially if the proposed research involves frequent visits and/or has the potential to result in noticeable impacts from travel through the area. Sampling that takes place outside of the breeding and early nesting periods is preferable.
2. **Destructive Sampling and Manipulative Experiments (Chart 8B):** Destructive sampling and manipulative experimentation has the potential to impact NEON measurements if conducted in the vicinity of bird grids. NEON advises prohibiting any such research activity within 200m of the center point of the bird grids, and, if permitted, to avoid such activities during the breeding and early nesting periods (dates vary by site).
3. **Establishing Infrastructure (Chart 8C):** Physical infrastructure >2m tall in the vicinity of bird grids is problematic to the extent that it may attract predatory bird species that can use the infrastructure as a hunting perch. NEON requests to be advised of any infrastructure that is proposed to be placed within 250 m of the center of any bird grid so that potential impacts can be evaluated by the NEON vertebrate ecologist.

7.3 Aquatic Locations

NEON measurements at a stream, river or lake site are intended to sample the chemical, biological and physical conditions relative to existing flow regime, as affected by climate, large scale land use and other ambient factors. Any and all sampling on or within NEON’s aquatic 15 m buffer zones is prohibited save for activities approved under NEON’s Assignable Asset Program (RD[04]).

7.3.1 Aquatic Streams, Rivers, and Lakes

The following guidelines are suggested to minimize impacts to the aquatic stream, river, and lake locations.

1. **General Access (Chart 9A):**
 - a. Access and alterations should be minimized when working near or on the shorelines.
 - b. Wading in the stream or nearshore areas of rivers and rivers, and erosion on banks from human presence should be minimized.
 - c. NEON advises against any alterations to the landscape within the 200 m zone of impact of the NEON water body (unless part of a site land management plan) that may affect physical, chemical or biological condition in the aquatic system.
 - d. When necessary, access to wadeable stream should occur downstream of the NEON reach or at designated entry points.
 - e. When necessary, access to rivers and streams should occur at designated entry points.
 - f. Access should not be within a 15 m radius of NEON infrastructure.



2. **Non-destructive Sampling (Chart 9B):** Sampling may take place upstream or downstream of a NEON stream reach if it:
 - a. Does not modify water volume, water travel time, flow regime or discharge (e.g., dams, weirs) upstream or downstream such that the reach is impounded in any way.
 - b. Does not modify chemical or biological conditions upstream of or within the NEON reach, thereby, leaving a research footprint.
 - c. Involves only seasonal to annual visits and is likely to have minimal impact on stream biology and geomorphology.
 - d. Does not occur within 5 m radius or directly upstream of wadeable stream sensors (**Figure 8**).
 - e. Does not occur within a 10 m radius, directly upstream, or directly upwind of river and lake sensors (**Figure 8**).

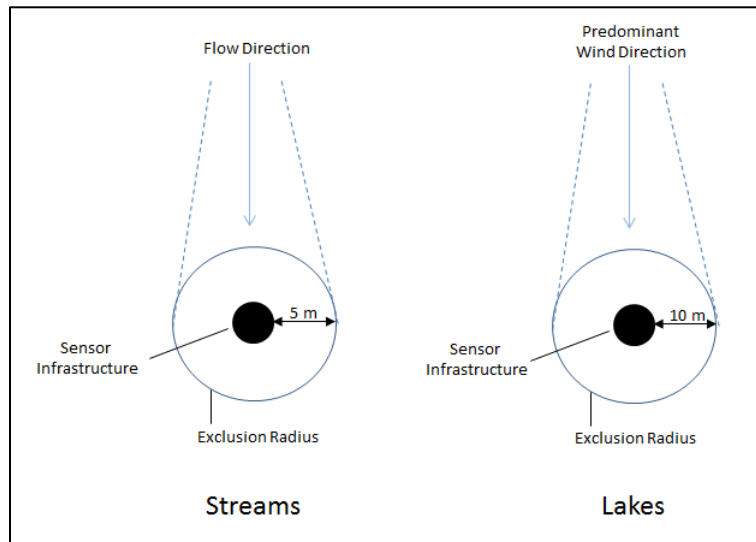


Figure 8. Conceptual illustration of the exclusion area around sensor infrastructure in streams and lakes as a function of flow and predominant wind direction.

3. **Destructive Sampling and Manipulative Experiments (Chart 9C):** NEON advises against destructive sampling and experimental manipulations upstream of NEON’s aquatic reach. This includes the addition of any biological or chemical, tracer, or nutrient discharges upstream within or lateral to these locations.¹⁰
4. **Establishing Infrastructure (Chart 9D):**

¹⁰ The lateral distance is to be determined on a site specific basis and is a function of subsurface flows, topography and ecosystem structure.



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- a. NEON advises against placing physical infrastructure that may modify flow regimes and conditions within 200 m upstream or downstream of the NEON stream reach or laterally from the stream/lake bank, and requests notification if any such infrastructure placement is proposed.
- b. NEON requests to be notified of physical infrastructure proposed to be located greater than 200 m upstream or downstream of the NEON reach or laterally from stream/riverbank if it has the potential to alter:
 - i. Water volume, water travel time, flow regime or discharge (e.g., dams, weirs) upstream or downstream such that the reach is impounded in any way.
 - ii. Chemical or biological conditions upstream of and within the NEON reach, thereby leaving a research footprint.
 - iii. Riparian vegetation and/or stream geomorphology.

7.3.2 Groundwater Wells

NEON advises against terrestrial sampling within 30 m of NEON’s permitted groundwater wells if it has the potential to impact ground water chemical, biological or physical conditions. **(Chart 10A)**

NEON requests to be notified of any manipulative experiments within the NEON zone of impact that may affect groundwater chemical, biological or physical conditions. **(Chart 10B)**



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8 CONTACTS

If there are general questions, please send an inquiry request to our Contact Us web page at: <https://www.neonscience.org/about/contact-us>, or seek further information from the webpages below.

Webpage	Link
NEON Assignable Assets Program	https://www.neonscience.org/resources/research-support
NEON Assignable Assets Program FAQ	https://www.neonscience.org/resources/research-support/assignable-assets-faqs

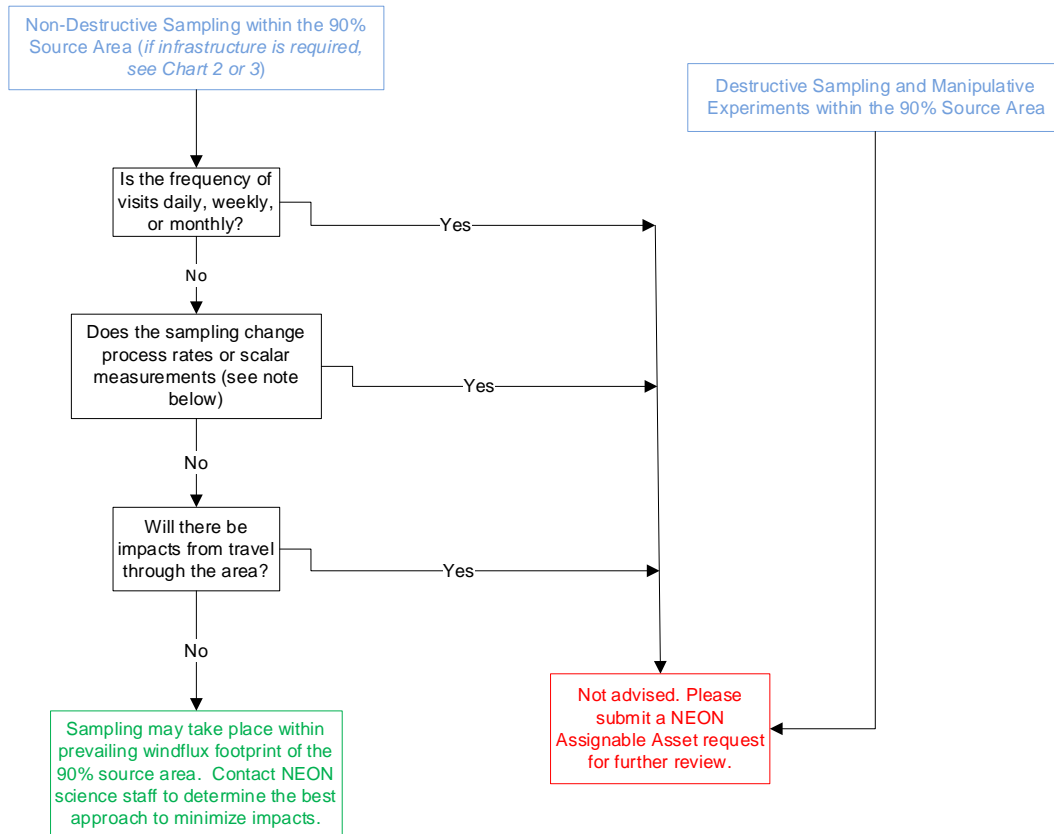


APPENDIX A NEON SITE RESEARCH COORDINATION FLOWCHARTS

TOWER LOCATION: FLUX SCALE (CO₂, WATER, ENERGY FLUX)
TERRESTRIAL SAMPLING LOCATIONS: TOWER PLOTS

CHART 1

Non-destructive & Destructive Sampling and Manipulative Experiments



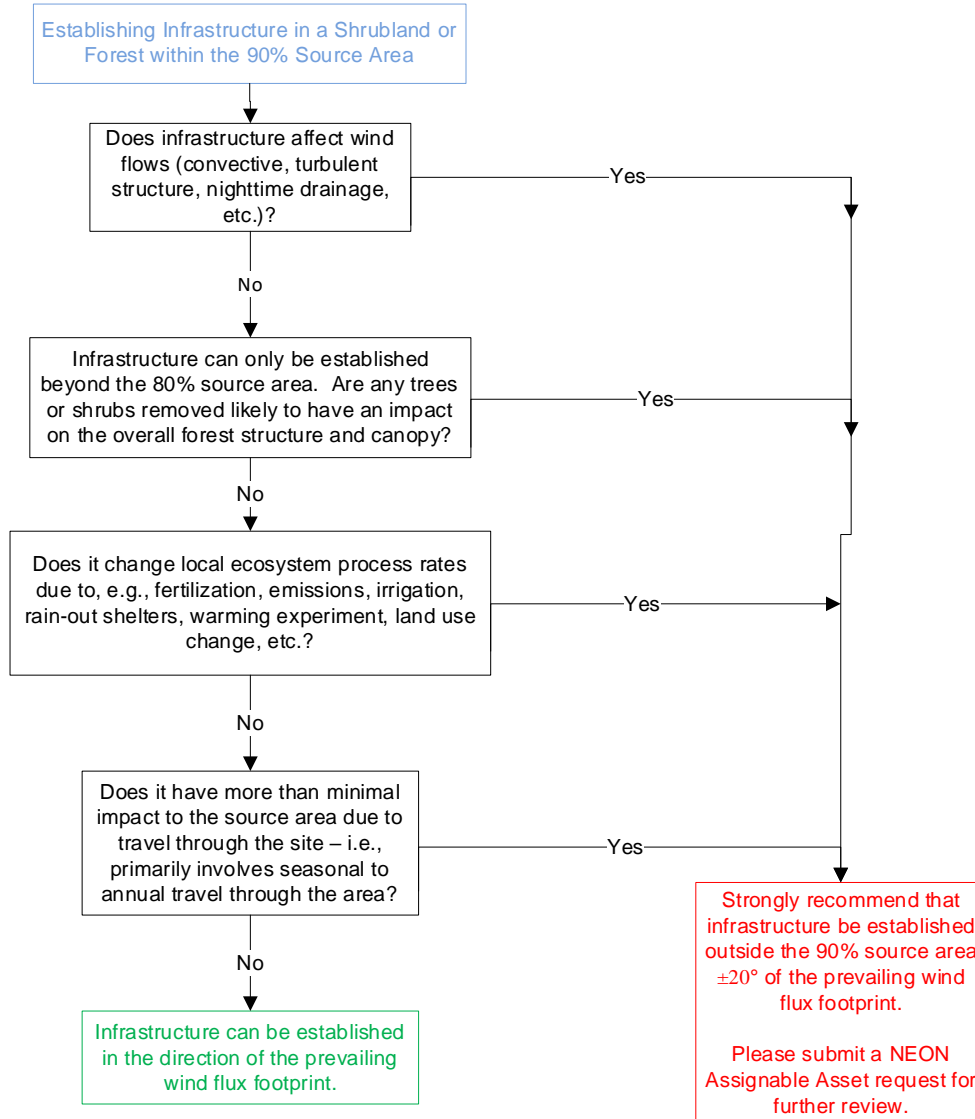
Note: Process rates & scalars: e.g. addition of CO₂ traps for mosquitos; anything that would alter atmospheric or soil chemistry, or water availability.



**TOWER LOCATION: FLUX SCALE (CO₂, WATER, ENERGY FLUX)
TERRESTRIAL SAMPLING LOCATIONS: TOWER PLOTS**

CHART 2

Establishing Infrastructure in Shrubland or Forest





TOWER LOCATION: FLUX SCALE (CO₂, WATER, ENERGY FLUX) TERRESTRIAL SAMPLING LOCATIONS: TOWER PLOTS

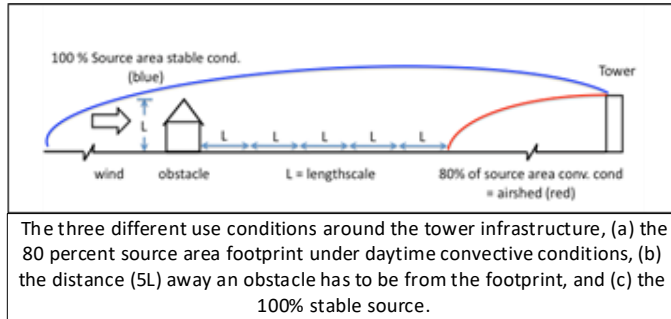
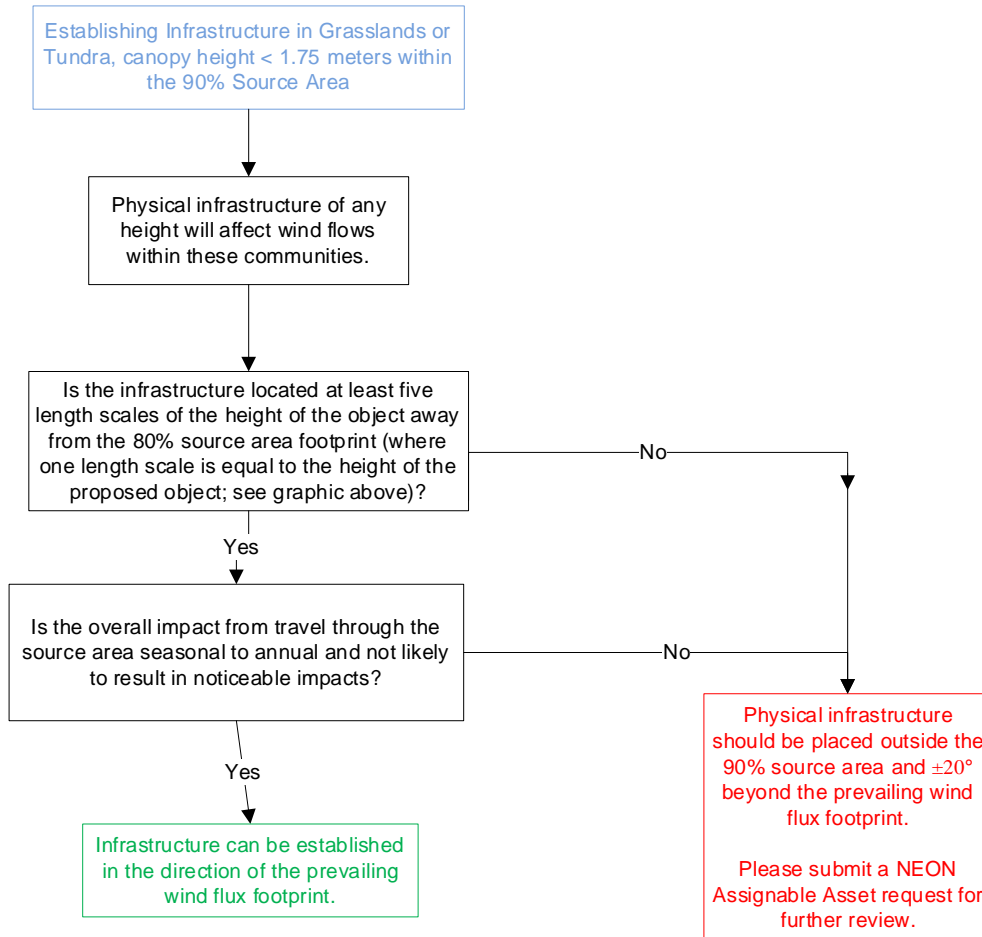


CHART 3

Establishing Infrastructure in Grassland or Tundra





TOWER LOCATION: MICROCLIMATE SCALE (80 M BUFFER SURROUNDING THE TOWER)

CHART 4A Non-destructive Sampling

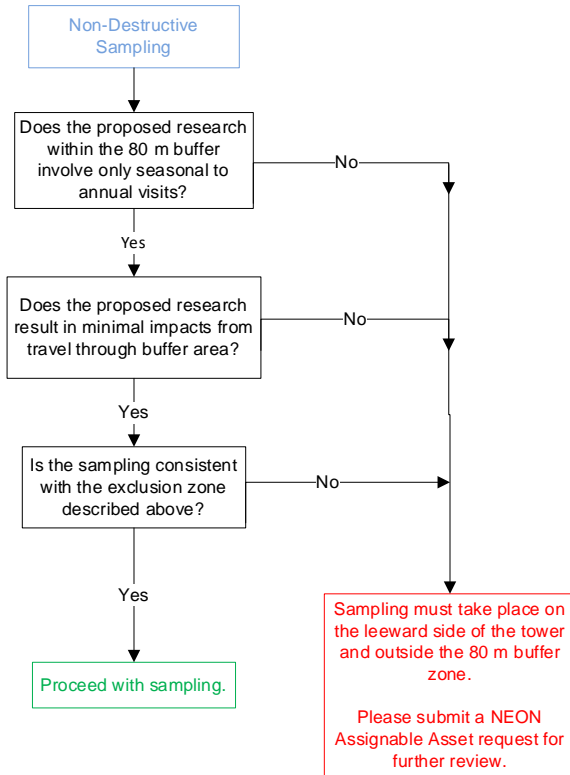
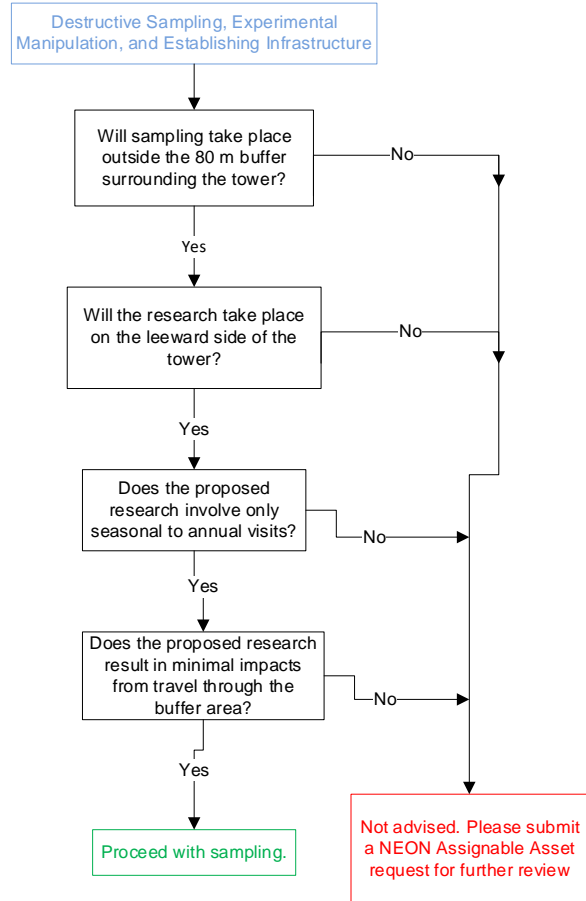


CHART 4B Destructive Sampling & Experimental Manipulations

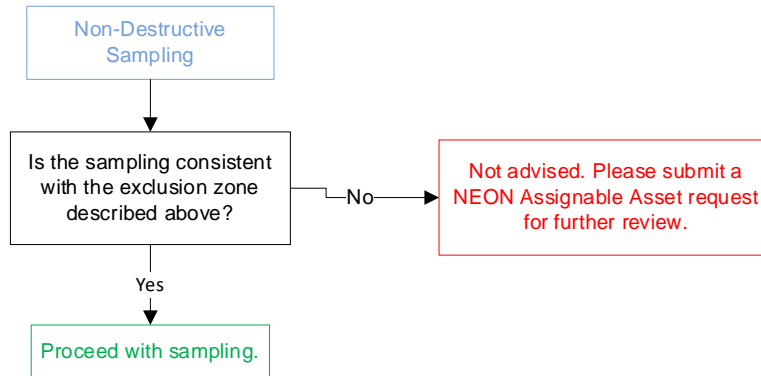


Use the suggested buffer limits above with caution; if you know there might be a significant impact even when sampling is conducted outside a buffer, please submit a NEON Assignable Asset request..

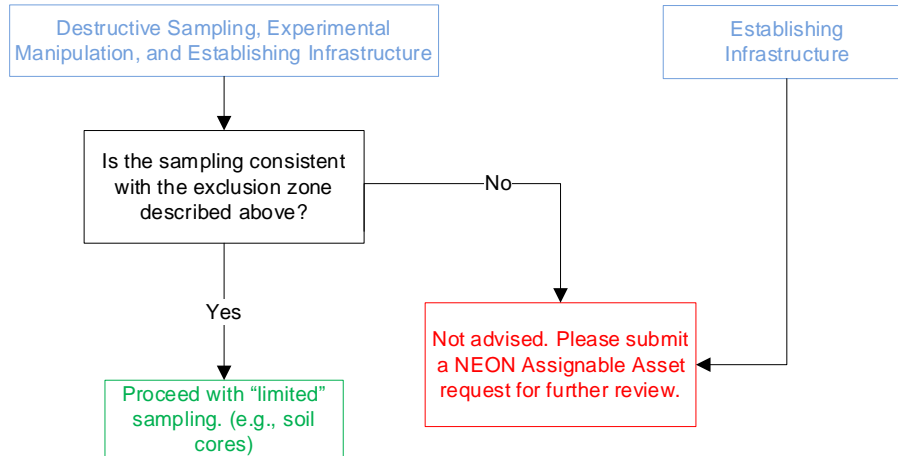


TOWER LOCATION: SOIL SCALE (10 M BUFFER SURROUNDING THE SOIL ARRAY)

**CHART 5A
Non-destructive Sampling**



**CHART 5B
Destructive Sampling, Manipulative Experiments & Establishing Infrastructure**



Use the suggested buffer limits above with caution; if you know there might be a significant impact even when sampling is conducted outside a buffer, please submit a NEON Assignable Asset request.



TERRESTRIAL SAMPLING LOCATIONS: DISTRIBUTED AND GRADIENT PLOTS (INCLUDING TICKS)

CHART 6A Non-destructive Sampling

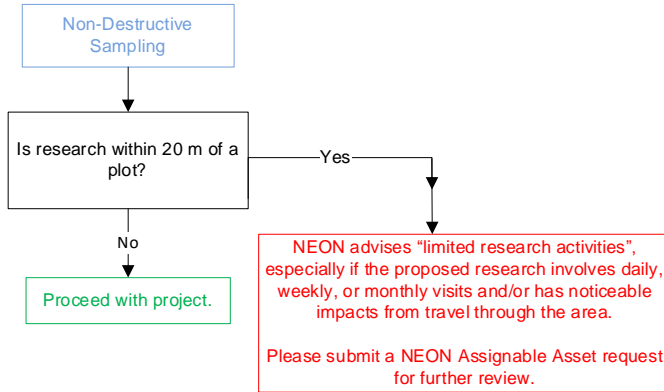


CHART 6B Destructive Sampling & Manipulative Experiments

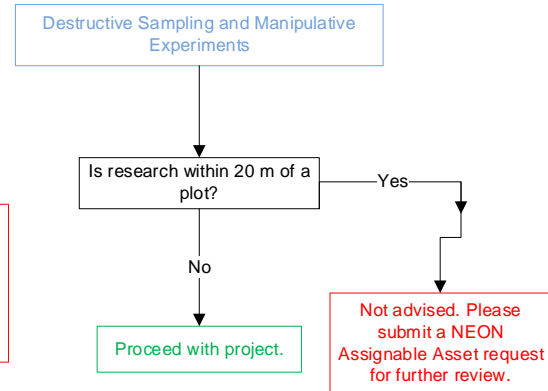


CHART 6C Establishing Infrastructure

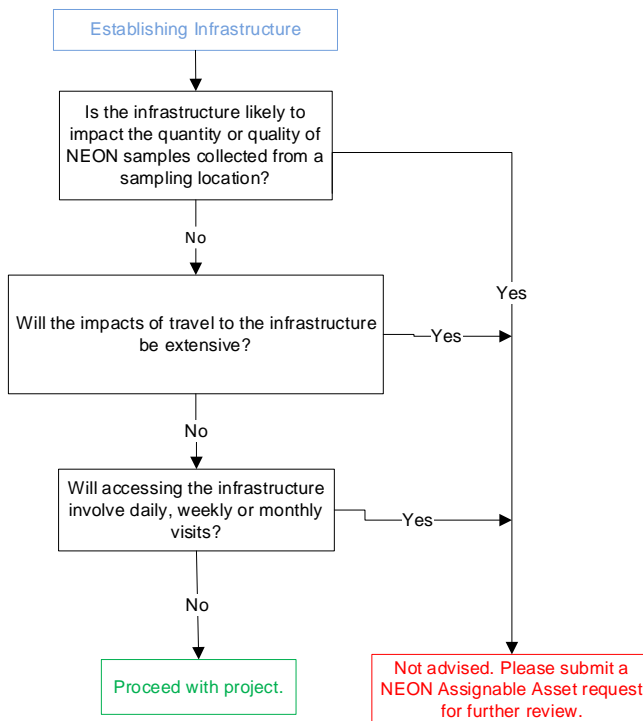


CHART 6D Additional Consideration for Beetle Pitfall Sampling

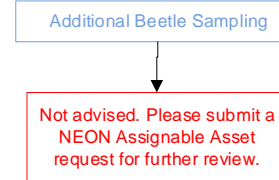
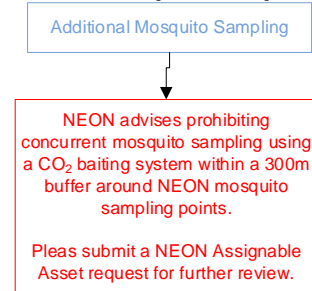


CHART 6E Additional Considerations for Mosquito Traps

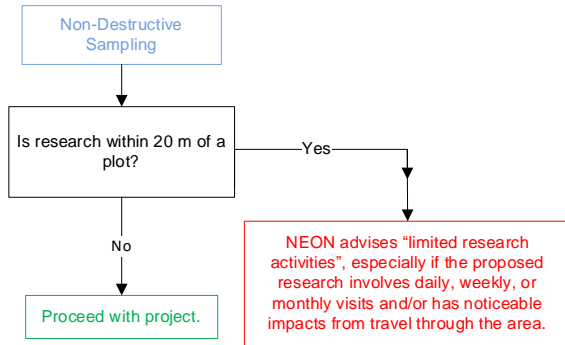


Use the suggested buffer limits above with caution; if you know there might be a significant impact even when sampling is conducted outside a buffer, please submit a NEON Assignable Asset request.

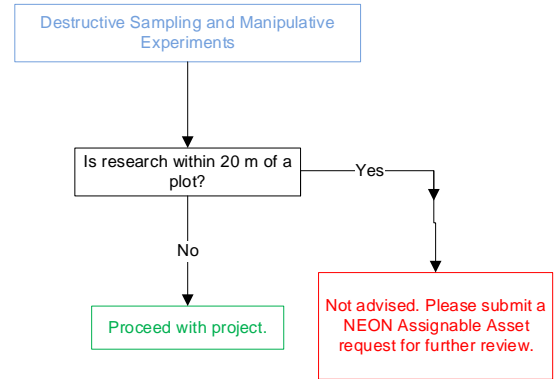


TERRESTRIAL SAMPLING LOCATIONS: SMALL MAMMAL GRIDS

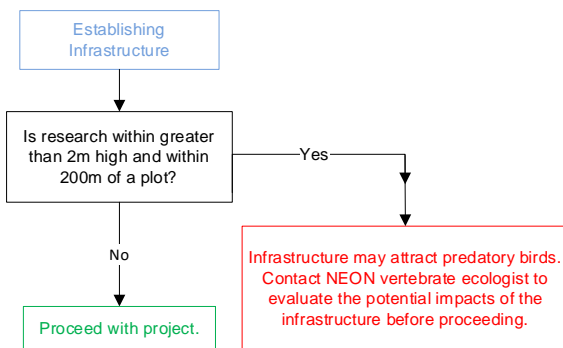
**CHART 7A
Non-destructive Sampling**



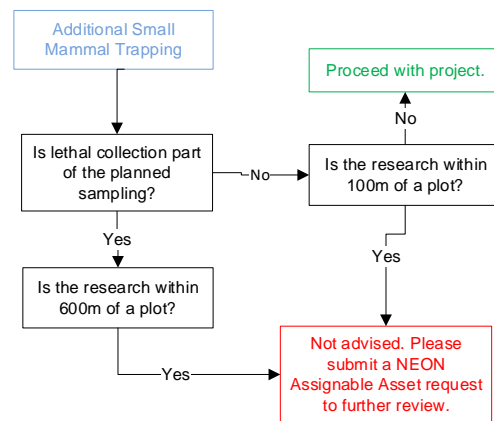
**CHART 7B
Destructive Sampling & Manipulative Experiments**



**CHART 7C
Establishing Infrastructure**



**CHART 7D
Additional Considerations**



Use the suggested buffer limits above with caution; if you know there might be a significant impact even when sampling is conducted outside a buffer, please submit a NEON Assignable Asset request.



TERRESTRIAL SAMPLING LOCATIONS: BIRD GRIDS

CHART 8A Non-destructive Sampling

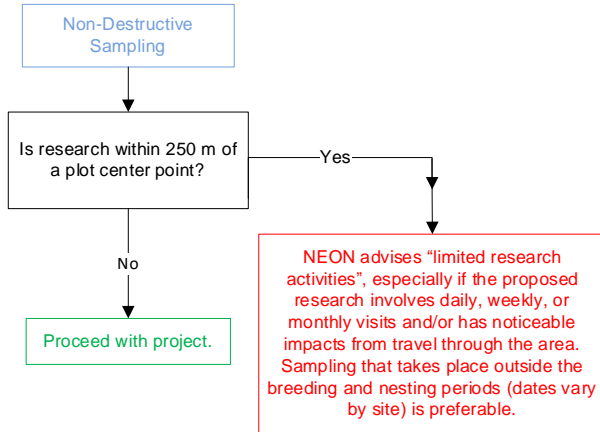


CHART 8B Destructive Sampling & Manipulative Experiments

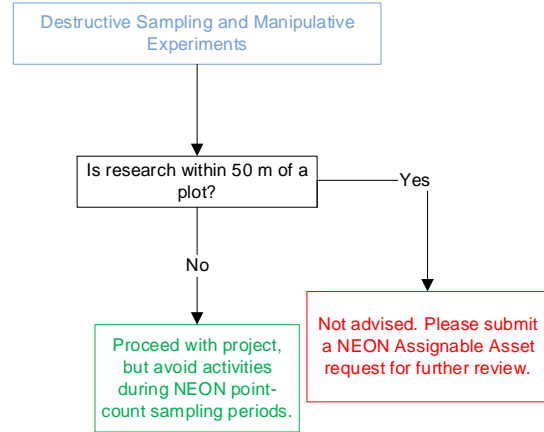
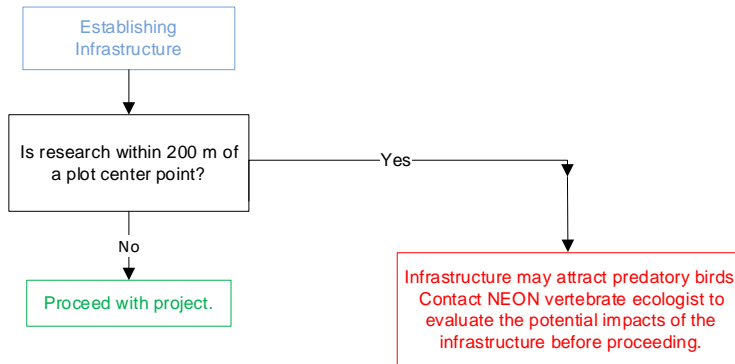


CHART 8C Establishing Infrastructure

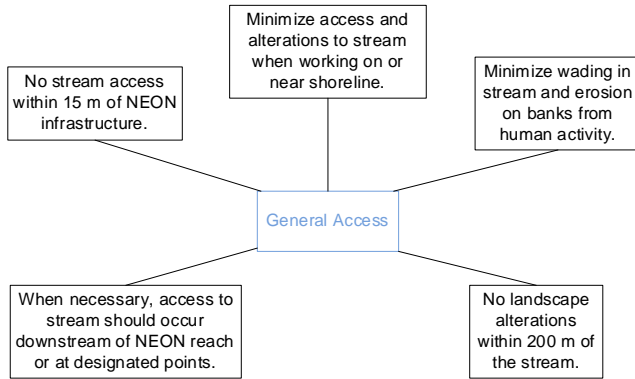


Use the suggested buffer limits above with caution; if you know there might be a significant impact even when sampling is conducted outside a buffer, please submit a NEON Assignable Asset request.

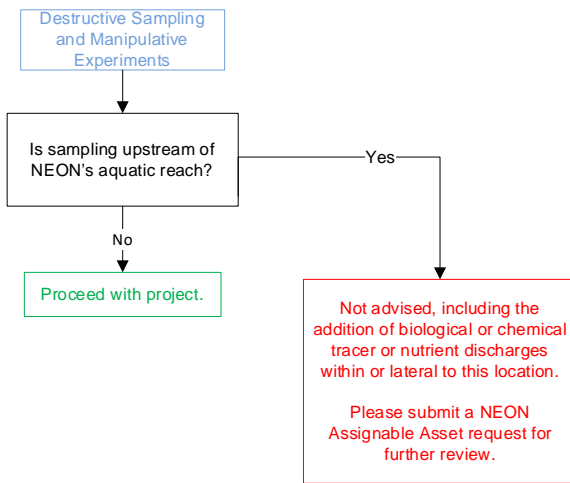


AQUATIC LOCATIONS: STREAMS, RIVERS, AND LAKES

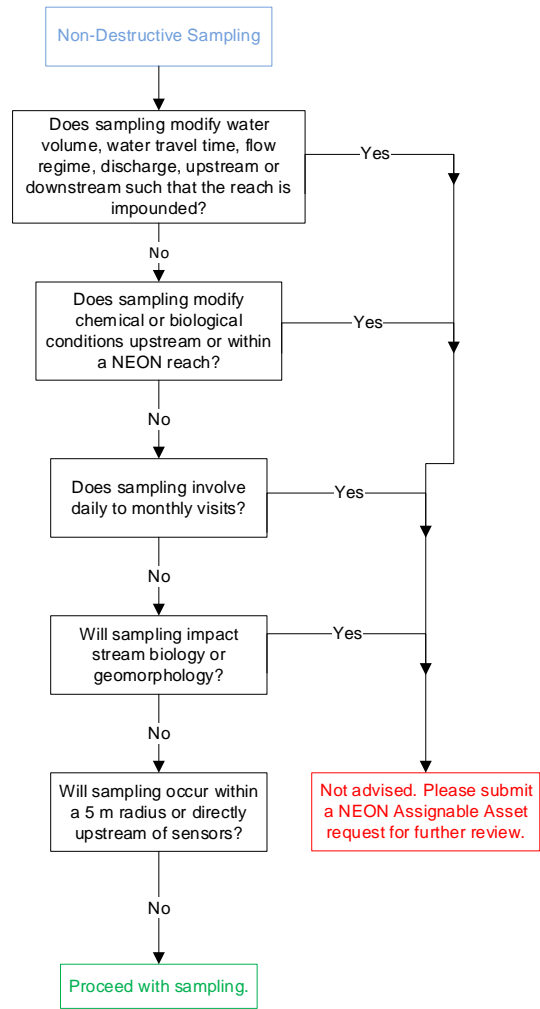
**CHART 9A
General Access**



**CHART 9C
Destructive Sampling & Manipulative Experiments**



**CHART 9B
Non-destructive Sampling**

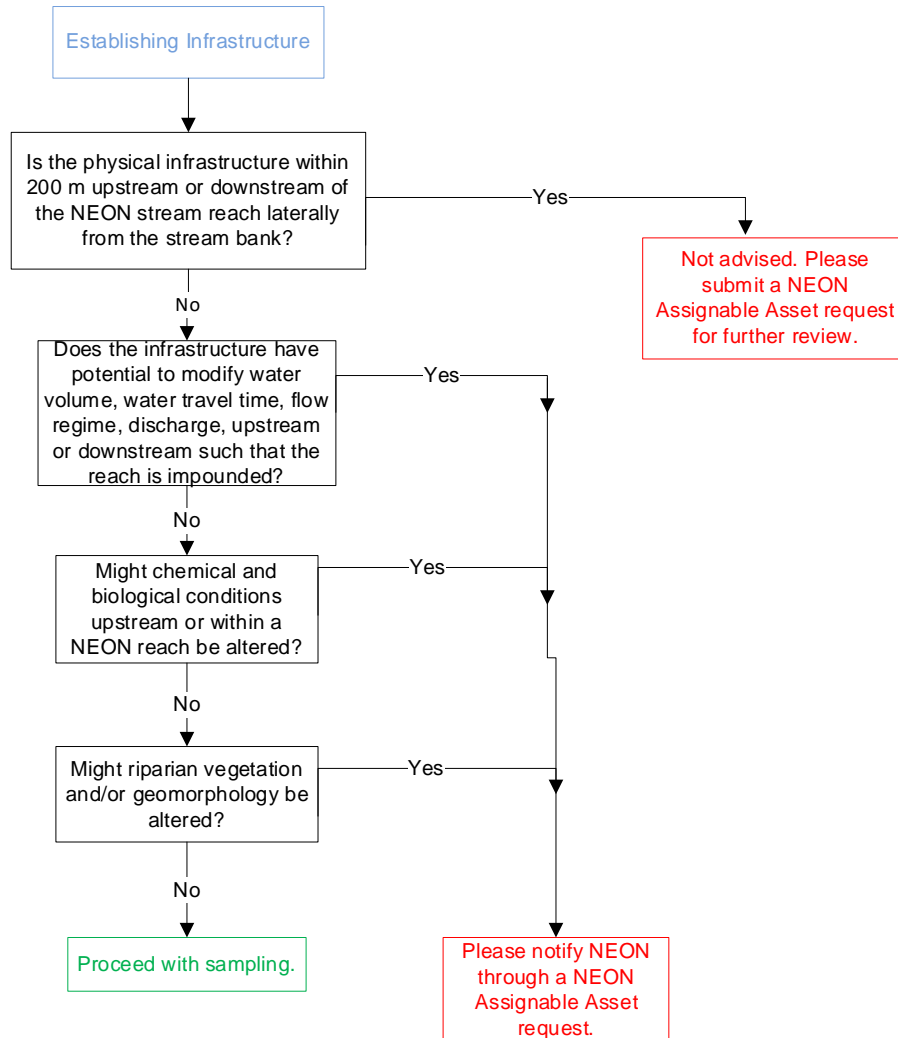


Use the suggested buffer limits above with caution; if you know there might be a significant impact even when sampling is conducted outside a buffer, please submit a NEON Assignable Asset request.



AQUATIC LOCATIONS: STREAMS, RIVERS, AND LAKES

**CHART 9D
Establishing Infrastructure**



Use the suggested buffer limits above with caution; if you know there might be a significant impact even when sampling is conducted outside a buffer, please submit a NEON Assignable Asset request.



AQUATIC LOCATIONS: GROUNDWATER WELLS

CHART 10A

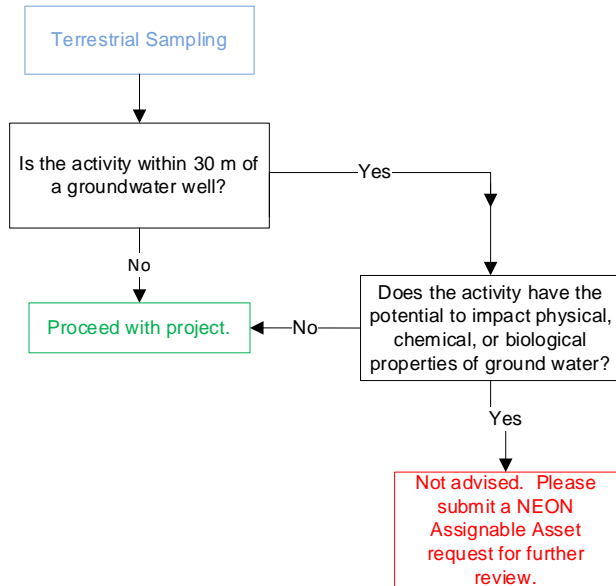
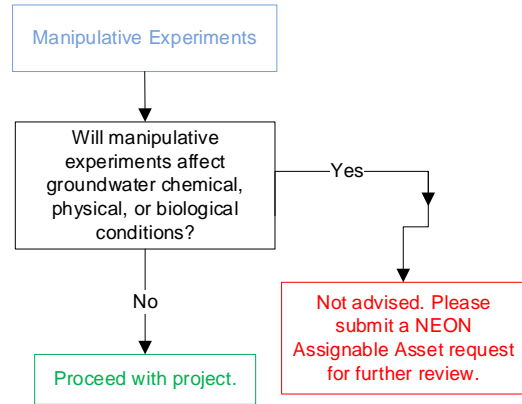


CHART 10B



Use the suggested buffer limits above with caution; if you know there might be a significant impact even when sampling is conducted outside a buffer, please submit a NEON Assignable Asset request.