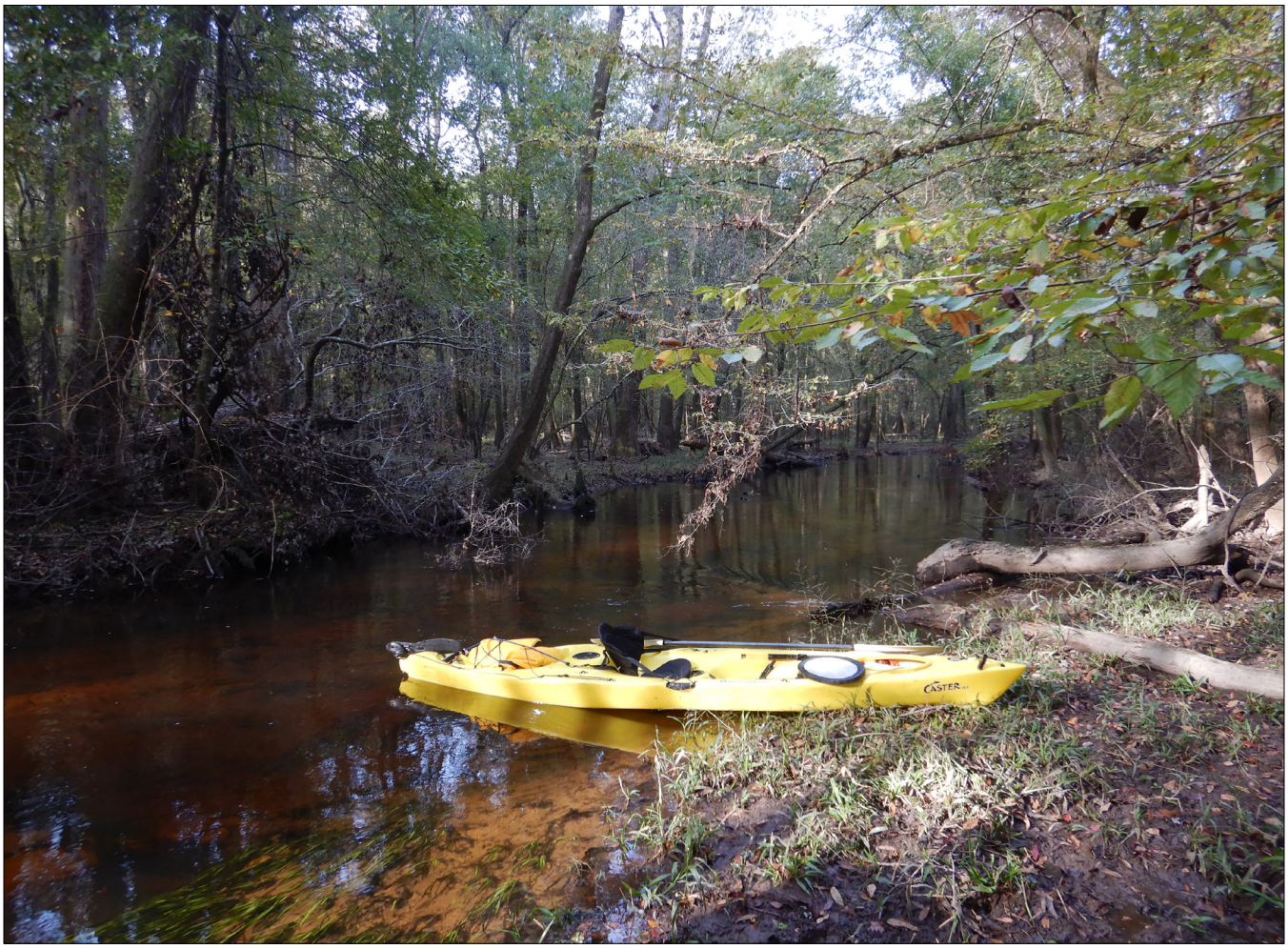
National Park Service
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Natural Resource Stewardship and Science

Wadeable Stream Suitability Assessment for Long-Term Monitoring

Congaree National Park

Natural Resource Data Series NPS/SECN/NRDS—2018/1184



ON THE COVER
Cover photograph was taken looking upstream on Cedar Creek near stream monitoring suitability assessment point C007. NPS photo / SECN.

Wadeable Stream Suitability Assessment for Long-Term Monitoring

Congaree National Park

Natural Resource Data Series NPS/SECN/NRDS—2018/1184

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Fort Collins, Colorado

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Executive Summary

The Southeast Coast Network (SECN) initiated a monitoring effort to assess habitat conditions in wadeable streams at national parks, recreation areas, battlefields, and monuments in Alabama, Georgia, and South Carolina (McDonald et al. 2018a). These parks include Chattahoochee River National Recreation Area, Kennesaw Mountain National Battlefield Park, Congaree National Park, Horseshoe Bend National Military Park, and Ocmulgee National Monument.

Wadeable stream monitoring, implemented in 2016, focuses specifically on providing relevant data to assess the physical condition of Piedmont and upper Coastal Plain streams with respect to aquatic and riparian habitats and how these habitats may be changing over time. The habitat assessment methods outlined in the protocol rely on standard data collection methods and standard operating procedures currently in use by the U.S. Geological Survey, U.S. Environmental Protection Agency, and U.S. Forest Service that have been modified to better meet the needs of National Park Service (NPS) managers.

The *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks* protocol (McDonald et al. 2018a) was developed to begin a monitoring program that will provide insight into the status of, and trends in, stream and riparian habitat conditions. The number of reaches surveyed at each park is dependent on the spatial extent of the park and the total number of wadeable streams that are present within park boundaries. Regardless of the size of the park and the number of reaches that are to be monitored, selected reaches (1) are representative of the processes influencing the streams in each park; (2) can address current and anticipated management concerns, and (3) offer the most utility for future complementary studies.

The purpose of this report is to document the stream suitability survey that was conducted at Congaree National Park (Congaree NP) to determine which streams should be chosen for long-term monitoring (McDonald et al. 2018a). On 1–3 November 2017, fifteen stream segments at Congaree National Park were assessed to determine their suitability for long-term monitoring (Table 1 and Figure 1). Stream segments were classified as suitable for long-term monitoring if they could be safely accessed, were part of a single channel, wadeable stream system, and were not greatly influenced by upstream impoundments.

Of the fifteen stream segments, six were determined to be potentially suitable for long-term monitoring and the remaining nine were determined not to be suitable (Table 1). The Dry Branch reaches (c015 and c016) were classified as not suitable for monitoring because the gradient is too low, they are part of a multi-channel system, and heavily affected by an upstream reservoir. The Cedar Creek segments (c008–c014) are not wadeable (deep water and mucky bottom) and are difficult to access (requires a watercraft and there are a large number of portages [more than 20] leading up to the sites).

The remaining six streams were only initially classified as potentially suitable for monitoring because the streams at Congaree National Park are much different than streams the monitoring protocol was designed to monitor. While the six potentially suitable stream segments all have definable banks and are mostly part of a single-thread system, all of the sites need to be accessed either through wetlands (Toms and McKenzie Creeks) or by watercraft (sites on Cedar Creek). Additionally, all of these streams are low energy and lack the diversity of geomorphic channel units (i.e., riffles, runs, pools) that characterize the in-stream habitats present at the majority of the streams at the other SECN parks. In spite of these drawbacks, these potential monitoring sites can provide an understanding of how upstream development and disturbance are influencing the movement of water and sediment into the park.

The sites on McKenzie Creek and Toms Creek would provide an understanding of the water coming into the eastern portion of the park. The nested sites on Cedar Creek would provide an understanding of whether or how sediment is being propagated downstream from the non-NPS managed portions of Cedar Creek above Bannister Bridge. After further reconnaissance, the two Toms Creek sites (c001 and c003) were determined to be unsuitable for long-term monitoring (Table 2). Toms Creek upstream (c001) was determined to be unsuitable because it is a multi-channel system for much of its course. Toms Creek downstream (c003) was determined to be unsuitable because it is nonwadeable for much of the year. The remaining four sites (c002 and c007–c007) were chosen for long-term monitoring.

Introduction

On 1–3 November 2017, fifteen stream segments at Congaree NP were assessed to determine their suitability for long-term monitoring (Table 1 and Figure 1). Stream segments were classified as suitable for long-term monitoring if they could be safely accessed, were part of a single-channel wadeable stream system, and were not greatly influenced by upstream impoundments. Of the fifteen stream segments, six were determined to be potentially suitable for long-term monitoring and the remaining nine were determined not to be suitable (Table 1). The Dry Branch reaches (C015 and C016) were classified as not suitable for monitoring because the gradient is too low, they are part of a multi-channel system, and are heavily affected by an upstream reservoir. The downstream Cedar Creek segments (C008–C014) are not suitable because they are not wadeable (deep water and mucky bottom) and are difficult to access (requires a watercraft and there are a large number of portages [more than 20] leading up to the sites). The reason why the remaining six streams were only initially classified as potentially suitable for monitoring was because the streams at Congaree National Park are much different than the streams the wadeable stream monitoring protocol was designed to monitor.

While the six potentially suitable stream segments all have definable banks and are, mostly, part of a single-thread system, all of the sites need to be accessed either through wetlands (Toms and McKenzie Creeks) or by watercraft (sites on Cedar Creek). Additionally, all of these streams are low energy and lack the diversity of geomorphic channel units (i.e., riffles, runs, pools) that characterize the in-stream habitats present in the majority of the streams at the other SECN parks. In spite of these drawbacks, these potential monitoring sites can provide an understanding of how upstream development and disturbance are influencing the movement of water and sediment into the park.

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Congaree National Park

Congaree National Park is located at the confluence of the Congaree and Wateree Rivers, and covers more than 26,000 acres (10,521 hectares [ha]) of biologically and geomorphically diverse flood plain forest (11,000 acres [4,452 ha] are old-growth bottomland forest; Figure 3). Congaree NP has the largest concentration and highest diversity of fluvial features in the parks monitored by the Southeast Coast Network, and includes both wadeable and non-wadeable perennial streams. Congaree NP also contains a complex group of natural channel features such as meander channels, crevasse channels, meander-scroll swales, and chute channels that typically form on large alluvial flood plains (Meitzen 2011). These channel-like features are not typically found in upland areas and do not function as traditional hierarchal stream systems. The flow of water through Congaree NP is closely tied to flooding and flow volume on the Congaree and Wateree Rivers (Meitzen 2011). During most of the year, the channel-like features on the floodplain may be completely dry and at other times have even been shown to exhibit reverse flows depending on the stage of the Congaree and Wateree Rivers. Up to 90 percent of the park may be flooded annually by major high-flow events in the Congaree River (Knowles et al. 1996). These flows are driven primarily by the Broad River and releases from the Monticello and Parr Reservoirs, as well as flows from the Saluda River and releases from Lake Murray at the Dreher Shoals (Saluda) Dam. Natural flows in the Congaree River have been altered since the late 1920s by the construction of Lake Murray, and since 1978 by Lake Monticello and the Parr Reservoir.

Methods and Results

Stream segments were chosen for long-term monitoring based on GIS analyses of relevant, reliable, and accurate data layers, their relevance to management concerns, and based on field assessments of their safety and accessibility. Field evaluations are necessary because the resolution of available geospatial data is often too imprecise for a determination of the suitability of any given sample reach. In order to provide the most relevant information for management, stream reaches are either: (1) paired (based on drainage area and stream type) to determine the influence of different upstream watershed characteristics and land use/land cover; or (2) chosen to represent conditions/processes affecting similar-sized streams within the park. A probabilistic approach to reach selection was not used due to the limited number of stream segments within the park.

Stream segments were selected for long-term monitoring in five stages:

1. identification of potential stream segments in GIS;
2. consultation with park staff;
3. field suitability evaluation;
4. basin-scale assessment in GIS; and
5. final decision (with park staff input).

Each of these stages is discussed in detail in McDonald et al. (2018a) and step-by-step instructions are provided in SOP 1.2.14 *Wadeable Stream Reach Selection and Location of Sampling Points—Version 1.0* (McDonald et al. 2018b). A brief description of each stage and the results of the each analysis is provided below.

Identification of Potential Stream Segments in GIS

Potential stream segments were identified in a GIS using the National Hydrography Dataset high definition (NHDhd) dataset and the park ownership boundaries. A point coverage was created to represent the potential stream segments within the park. This point coverage was used to discuss potential survey reaches with park staff as well as locate the stream segments in the field. All stream segments were classified as perennial, were within park ownership boundaries, and each segment was at least 400 feet (122 meters [m]) in length. Fifteen perennial stream segments were identified within or on the boundaries of Congaree National Park (Figure 1).

Consultation with Park Staff

Once all of the potentially wadeable stream segments were identified, SECN staff met with park staff to (1) identify reaches with current or potential management concern; (2) determine issues that may prevent accessing the segment; and (3) determine the long-term applicability of each stream segment. During the meeting, one site was discarded due to issues with access (c004) and two additional sites were added (c015 and c016) so that Dry Branch could be assessed near the park boundary (c015) and near where it empties into Cedar Creek (c016).

Field Suitability Evaluation

Field surveys were conducted on each accessible stream segment to determine if the stream segment was suitable for long-term monitoring and to locate a potential reach within the candidate segment that is representative of the stream segment. The width, water depth, and bank height characteristics of the stream and an interpretation of the geomorphic conditions that characterize the segment were recorded. Additionally, any conditions that make the stream unsuitable for sampling were also recorded. Conditions that make a stream segment unsuitable for sampling include (but are not limited to): presence of beaver dams or ponds; lack of a defined channel; or hazardous conditions such as treacherous wading conditions or difficult access to the stream (high undercut banks). The results of the suitability assessments and a map showing the location of each stream segment (and how to access it) can be found in Appendix A.

Basin-Scale Assessment in GIS

A basin analysis was conducted to characterize the watershed characteristics (i.e., geomorphic basin characteristics and land cover conditions) of the stream segments that were classified as potentially suitable (Table 2). This stage of segment selection determined the basin-scale similarities between segments so that paired segments could be selected and representative segments could be chosen that provide an understanding of similar streams in the park. The measures used to determine the geomorphic and land cover conditions represented by each stream segment are described in McDonald et al. (2018a) and detailed methods used to calculate these measures can be found in SOP 1.2.15 *Wadeable Stream Basin- and Segment-Scale Data Summary—Version 1.0* (McDonald et al. 2018c).

Final Decision

The results of the basin-scale assessment were used to assist in the final selection of stream segments (Table 2). Final stream segment selection was done by SECN staff that could provide the best professional judgment required to adequately assess reach utility, safety, and suitability issues. Chosen stream segments struck a balance between being relevant to management goals, being complementary to future studies, and representative of conditions within the park.

The two Toms Creek sites were not selected for long-term monitoring because a suitable reach could not be identified within the candidate segment. Though these segments were determined to be potentially suitable during the first visit (November 2017), the stream segments were determined to be unsuitable for monitoring during leaf-on conditions (May 2018). A suitable single thread reach of sufficient length could not be identified on the upstream Toms Creek site (c001) and the downstream Toms Creek site (c003) was not wadeable two of the three times that the site was visited.

Three of the four stream segments that were chosen for long-term monitoring are located on Cedar Creek above Bridge B (c005–c007; Table 3). Though these sites are not optimal according to the methods outlined in McDonald et al. (2018a), they will provide an understanding of whether changes and development upstream of the park are influencing the geomorphic characteristics of Cedar Creek. The remaining stream segment chosen for monitoring is located on McKenzie Creek (c002). This segment will provide an understanding of how historical disturbances (i.e., an old gravel road crossing) can affect the evolution of small streams in the park.

Table 1. List of all of the stream segments at Congaree NP assessed in November 2017.

pSite	Stream Name	Suitable	Latitude	Longitude	Stream Order	DA (km²)	TSL (km)
c001	Toms Creek (Up)	Maybe	33.8999	-80.7457	3	99	124
c002	McKenzie Creek	Yes	33.8526	-80.7061	2	24	35
c003	Toms Creek (Dn)	Maybe	33.8905	-80.7380	3	124	160
c004	Dry Branch (Mid)	–	33.8249	-80.8159	3	40	61
c005	Cedar Creek	Yes	33.9392	-80.8499	4	174	204
c006	Cedar Creek	Yes	33.9389	-80.8500	4	175	205
c007	Cedar Creek	Yes	33.9348	-80.8509	4	182	207
c008	Cedar Creek	No	33.9323	-80.8509	4	187	215
c009	Cedar Creek	No	33.9316	-80.8508	4	188	216
c010	Cedar Creek	No	33.9275	-80.8505	4	194	229
c011	Cedar Creek	No	33.9274	-80.8505	4	194	230
c012	Cedar Creek	No	33.9200	-80.8404	4	242	301
c013	Cedar Creek	No	33.9199	-80.8403	4	242	302
c014	Cedar Creek	No	33.9146	-80.8367	4	260	331
c015	Dry Branch (Up)	No	33.9018	-80.7939	3	40	61
c016	Dry Branch (Dn)	No	33.9009	-80.7941	3	40	62

Table 2. Sites chosen for long-term monitoring.

pSite	Site Name	Stream Name	Lat	Long	SO	DA (km²)	WW (m)	BfW (m)	BH (m)	Pairs
c002	CONG004	McKenzie Creek	33.8526	-80.7061	2	24	2.50	4.25	0.50	–
c005	CONG001	Cedar Creek	33.9392	-80.8499	4	174	8.00	9.75	0.80	1
c006	CONG002	Cedar Creek	33.9389	-80.8500	4	175	8.50	10.25	0.30	1
c007	CONG003	Cedar Creek	33.9348	-80.8509	4	182	9.75	13.50	0.30	1

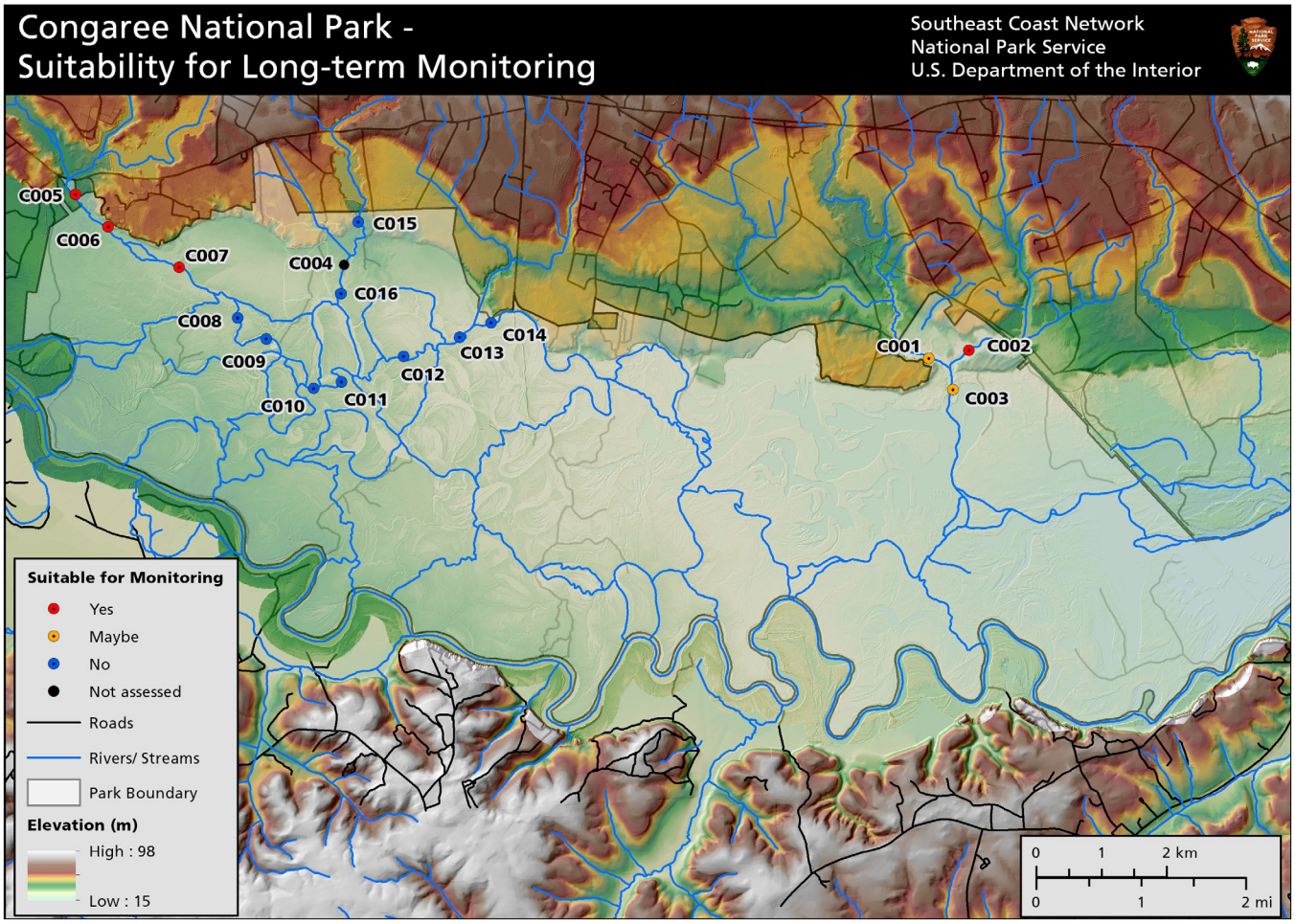


Figure 1. Overview map of the stream segments that were assessed to determine their suitability for long-term monitoring according to the criteria outlined in *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks (McDonald et al. 2018a).* Segment c004 was not assessed due to issues with accessibility.

Literature Cited

Knowles, D. B., M. M. Brinson, R. A. Clark, and M. D. Flora. 1996. Water resources management plan, Congaree Swamp National Monument. National Park Service, US Department of the Interior.

McDonald, J. M., M. B. Gregory, J. W. Riley, and E. N. Starkey. 2018a. Monitoring wadeable stream habitat conditions in Southeast Coast Network parks: Protocol narrative. Natural Resource Report NPS/SECN/NRR—2018/1715. National Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/Reference/Profile/2254874 (last accessed September 2018).

McDonald, J. M., E. N. Starkey, J. W. Riley, and M. B. Gregory. 2018b Wadeable stream habitat assessments and characterizations: Reach selection and location of sampling points. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—1.2.14. Southeast Coast Network, Athens, Georgia. Available at: https://irma.nps.gov/DataStore/Reference/Profile/2253887 (last accessed August 2018).

McDonald, J. M., M. B. Gregory, and J. Riley. 2018c. Wadeable stream habitat assessments and characterization: Basin- and segment-scale data summary. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—1.2.15. Southeast Coast Network, Athens, Georgia. Available at: https://https://irma.nps.gov/DataStore/Reference/Profile/2254012 (last accessed August 2018).

Meitzen, K. M. 2011. Flood processes, forest dynamics, and disturbance in the Congaree River floodplain, South Carolina. (Doctoral dissertation). University of South Carolina.

Appendix A. Stream Segment Suitability Assessments



Proposed Site Number: c001

Park Unit: CONG

Stream Name: Toms Creek

Date: 11.1.2017

Time: 2:55 p.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: Yes

Recommend for Monitoring: Maybe

Best Point of Access/Parking: Griffin Creek road, road side of railroad tracks

Directions from Parking to Site: From parking, cross railroad tracks and follow two-track road to the left to 33.813 N 80.711 W. Cut into the woods and head approximately south to McKenzie Creek (c002). From c002, walk west over land to c001.

Management Issues Noted: Old mill dam below site.

Safety Concerns: Trek in and Cypress knee tripping hazard.

Site Summary—Toms Creek upstream (fifth order stream) is a sandy bedded stream with some fines and organics draped over the bed. Wetted width was estimated to be approximately 7.25 meters (23.8 feet [ft]) and bankfull width around 11.75 meters (38.5 ft). Water depth was estimated to be approximately 0.3 meter (1 ft) at its deepest point (thalweg near middle of channel). The channel is roughly trapezoidal and the banks are of uniform height (approximately 0.25 meter [0.8 ft]). Banks are sparsely vegetated (mostly grasses) and covered with leaves. There is a well-developed floodplain on both sides of the stream. The higher bluff is approximately 20 meters (65.6 ft) from river right and greater than 50 meters (164 ft) from the stream on river left. A potential mill dam remnant is approximately 30 meters (98.4 ft) downstream from the assessment point. Floodplain vegetation on both banks is comprised of grasses and trees, with an abundance of cypress knees. Large woody debris is prevalent (above and below water surface). Flow is steady and discernable. Toms Creek bifurcates below the mill dam remnant and can be classified as anastomosing downstream to the confluence with McKenzie Creek.

Monitoring Recommendation—This site is potentially recommended for monitoring (Figure A-1) because it is immediately downstream from non-park lands and will be an indicator of how upstream land use/land cover is influencing park waters. The main problems with this site are the potentially difficult trek to the assessment point (through wetlands) and the multi-thread nature of the stream.

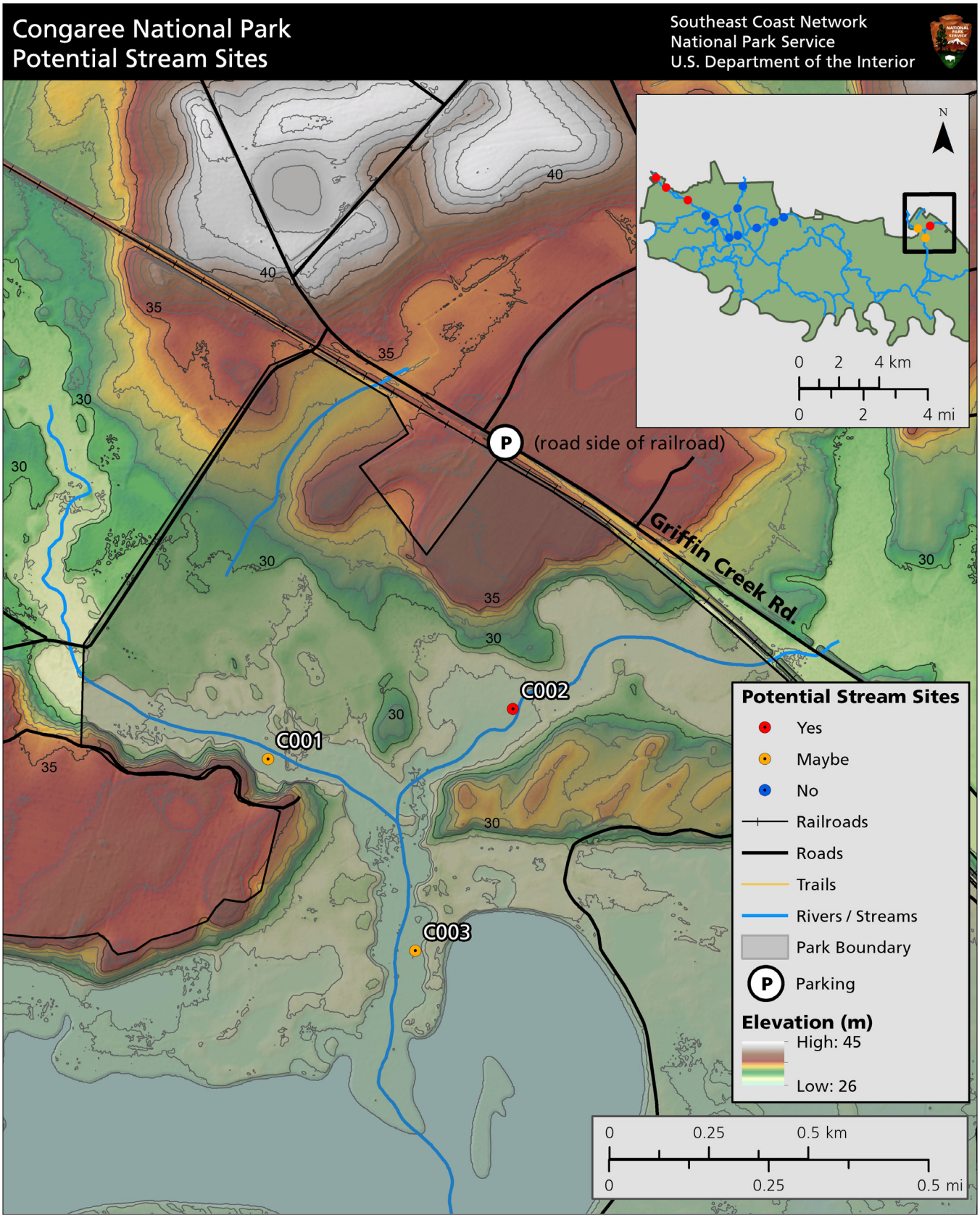


Figure A-1. Map of the sites on Toms Creek (c001 and c003) and McKenzie Creek (c002). Toms Creek upstream (c001) is upstream of the confluence of Toms Creek and McKenzie Creek and upstream of a potential mill dam remnant.



Proposed Site Number: c002

Park Unit: CONG

Stream Name: McKenzie Creek (CONG0004)

Date: 11.1.2017

Time: 1:35 p.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: Yes

Recommend for Monitoring: Yes

Best Point of Access/Parking: Griffins Creek road near railroad tracks (road side of tracks).

Directions from Parking to Site: From parking, cross the railroad tracks and follow two-track road to the left to 33.813 N 80.711 W. Cut into the woods and head approximately south to McKenzie Creek (c002).

Management Issues Noted: Hog rooting nearby in floodplain.

Safety Concerns: Trek in, snags, visit with park natural resource manager regarding neighbors and any safety concerns.

Site Summary—McKenzie Creek (third order stream) is a muck-bottomed stream at the assessment point. Upstream and downstream of the assessment point, the stream lacks a definable channel and spreads out across the bottomland. Wetted width was estimated to be approximately 2.5 meters (8.2 ft) and bankfull width around 4.25 meters (13.9 ft). Water depth was estimated to be approximately 0.3 meter (1 ft) at its deepest point (thalweg near middle of channel). The banks are of uniform height (approximately 0.45 meter [1.5 ft] high) and are sparsely vegetated (mostly grasses) and covered with leaves. There is a well-developed floodplain on both sides of the stream. Floodplain vegetation on both banks is comprised of grasses and trees, with an abundance of cypress knees. Large woody debris is prevalent (above and below water surface) and is creating a diversity of habitat. Flow is sluggish.

Monitoring Recommendation—This site is recommended for monitoring (Figure A-2) because it is immediately downstream from non-park lands and will be an indicator of how upstream land use/land cover is influencing park waters. The main problems with this site are the potentially difficult trek to the site and the lack of a defined channel upstream and downstream of the assessment point and the stream was nonwadeable two of three times the segment was visited.

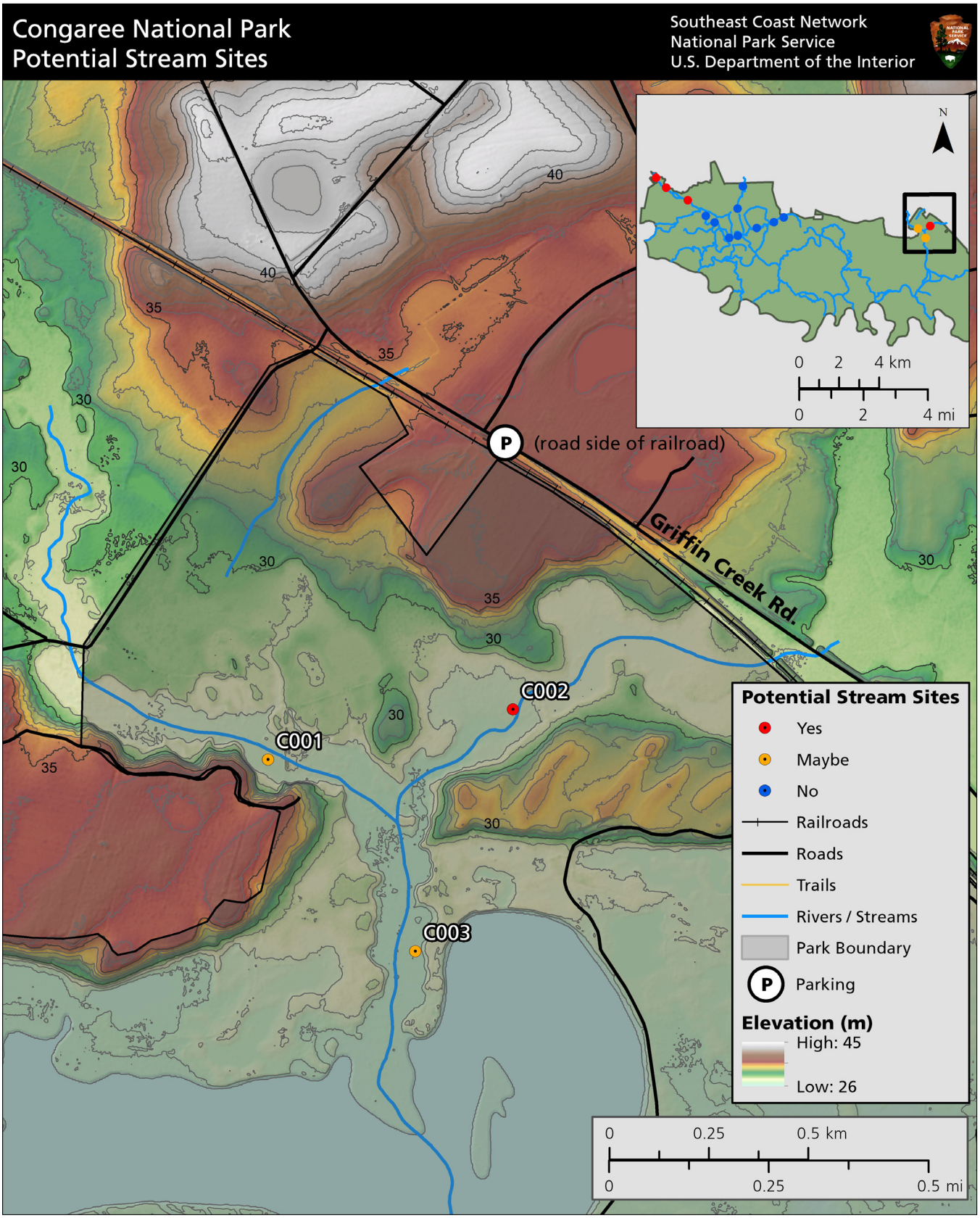


Figure A-2. Map of the sites on Toms Creek (c001 and c003) and McKenzie Creek (c002). The site on McKenzie Creek (c002) is upstream of the confluence of Toms Creek and McKenzie Creek and downstream from the multi-thread portion of McKenzie Creek that is immediately downstream of the railroad bridge.



Proposed Site Number: c003

Park Unit: CONG

Stream Name: Toms Creek

Date: 11.1.2017

Time: 2:15 p.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: Yes (chest wader)

Recommend for Monitoring: Maybe

Best Point of Access/Parking: Griffins Creek road, road side of railroad tracks.

Directions from Parking to Site: From parking, cross the railroad tracks and follow two-track road to the left to 33.813 N 80.711 W. Cut into the woods and head approximately south to McKenzie Creek (c002). From c002, walk southwest along the ridge to the confluence of McKenzie Creek and Toms Creek and then south to c003.

Management Issues Noted: Hog damage.

Safety Concerns: Steep trek in, deep piles of leaves.

Site Summary—Toms Creek downstream (fifth order stream) is a black water sandy bedded stream with some fines and organics draped over the bed. Wetted width was estimated to be approximately 11 meters (36 ft) and bankfull width around 12 meters (39.3). Water depth was estimated to be approximately 0.5 meter (1.6 ft) and was consistent across the channel. The channel is trapezoidal and the banks are of uniform height (0.45 meter [1.5 ft]). Banks are sparsely vegetated (mostly grasses) and covered with leaves. There is a well-developed floodplain on both sides of the stream. This portion of Toms Creek flows between the higher bluff on both sides of the stream. Floodplain vegetation on both banks is comprised of grasses and trees, with an abundance of cypress knees. Large woody debris is prevalent (above and below water surface). There are lot of trees growing on and along both banks. Flow is sluggish.

Monitoring Recommendation—This site is potentially recommended for monitoring (Figure A-3) because it is immediately downstream from the confluence of Toms and McKenzie Creeks. The main problems with this site are the potentially difficult trek to the assessment point and the stream was nonwadeable two of the three times the segment was visited.

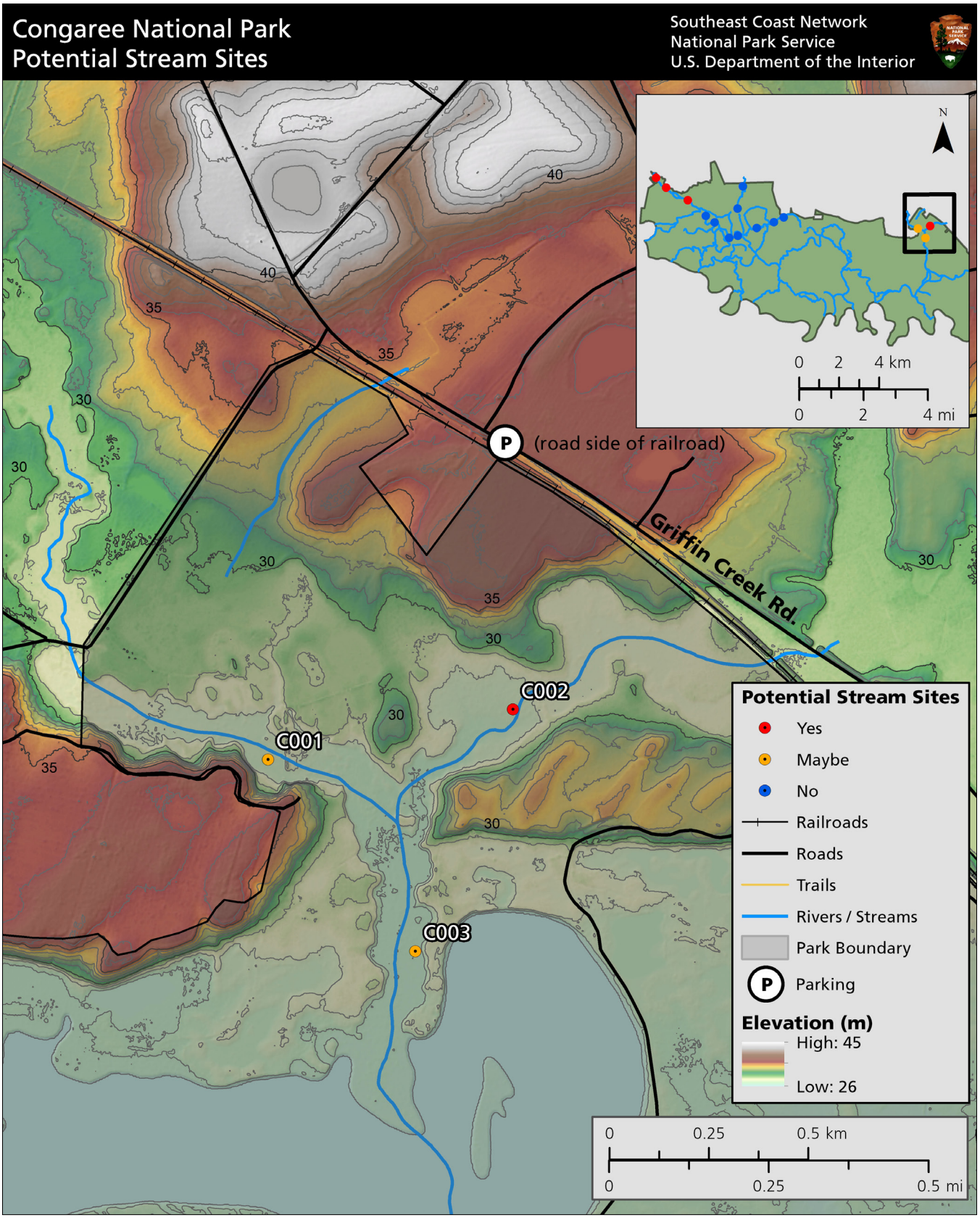
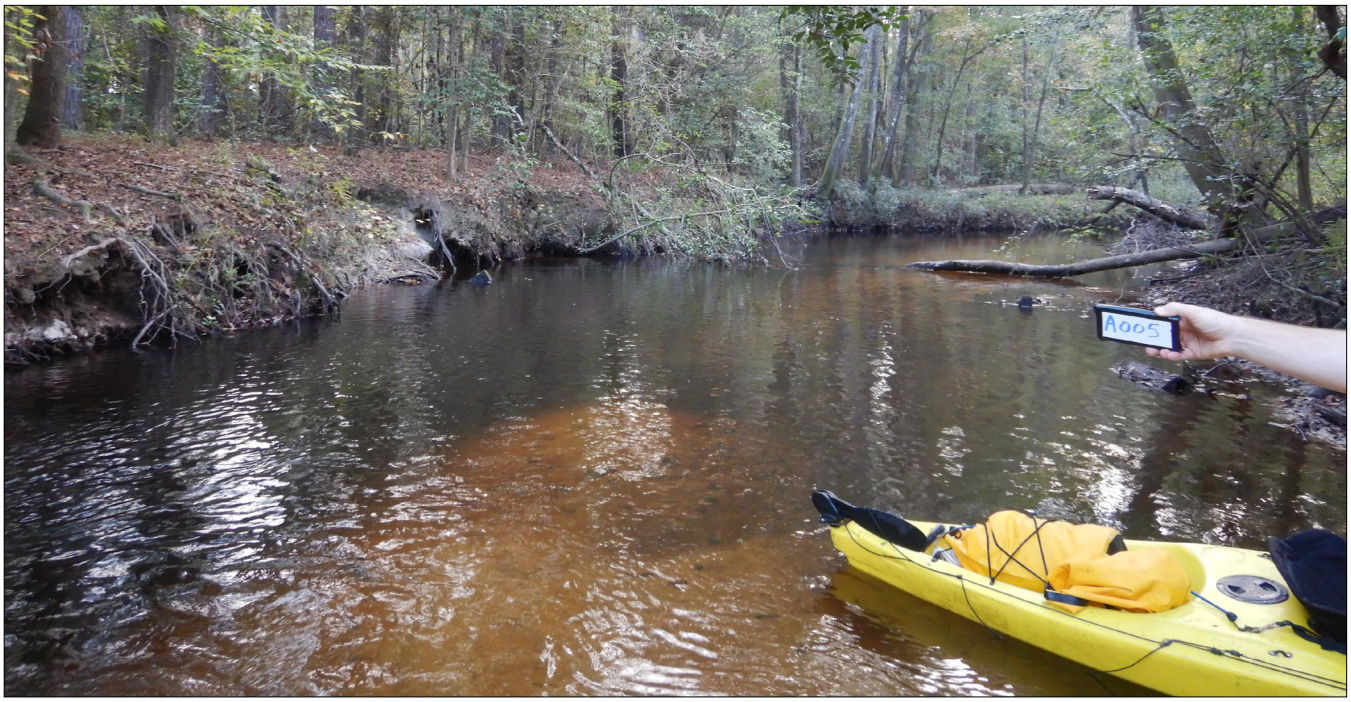


Figure A-3. Map of the sites on Toms Creek (c001 and c003) and McKenzie Creek (c002). Toms Creek downstream (c003) is downstream of the confluence of Toms Creek and McKenzie Creek.



Proposed Site Number: c005

Park Unit: CONG

Stream Name: Cedar Creek (CONG001)

Date: 11.2.2017

Time: 8:20 a.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: Yes

Recommend for Monitoring: Yes

Best Point of Access/Parking: Banister Bridge.

Directions from Parking to Site: Kayak to point.

Management Issues Noted: Debris jam upstream.

Safety Concerns: Deep holes.

Site Summary—Cedar Creek 1 (fifth order stream) is a black water sandy bedded stream with some fines and organics draped over the bed. Wetted width was estimated to be approximately 8 meters (26.2 ft) and bankfull width around 9.75 meters (32 ft). Water depth was estimated to be approximately 1.1 meters (3.6 ft) and, due to the black water, there are some deceptively deep holes. The banks were slightly higher on river left (0.8 meter [2.6 ft] versus approximately 0.6 meter [2 ft]). Banks are sandy and tree roots are prevalent. There is a well-developed floodplain on river right and a slightly higher surface on river left. This portion of Cedar Creek is relatively close to the high bluff (on river left). Floodplain vegetation on both banks is comprised of grasses and trees. Large woody debris is prevalent (large jam just upstream of assessment point).

Monitoring Recommendation—This site is recommended for monitoring (Figure A-4) because it is downstream from the boat landing at Bannister Bridge. Additionally, monitoring this site will provide an understanding of how upstream additions of sediment are affecting Cedar Creek.

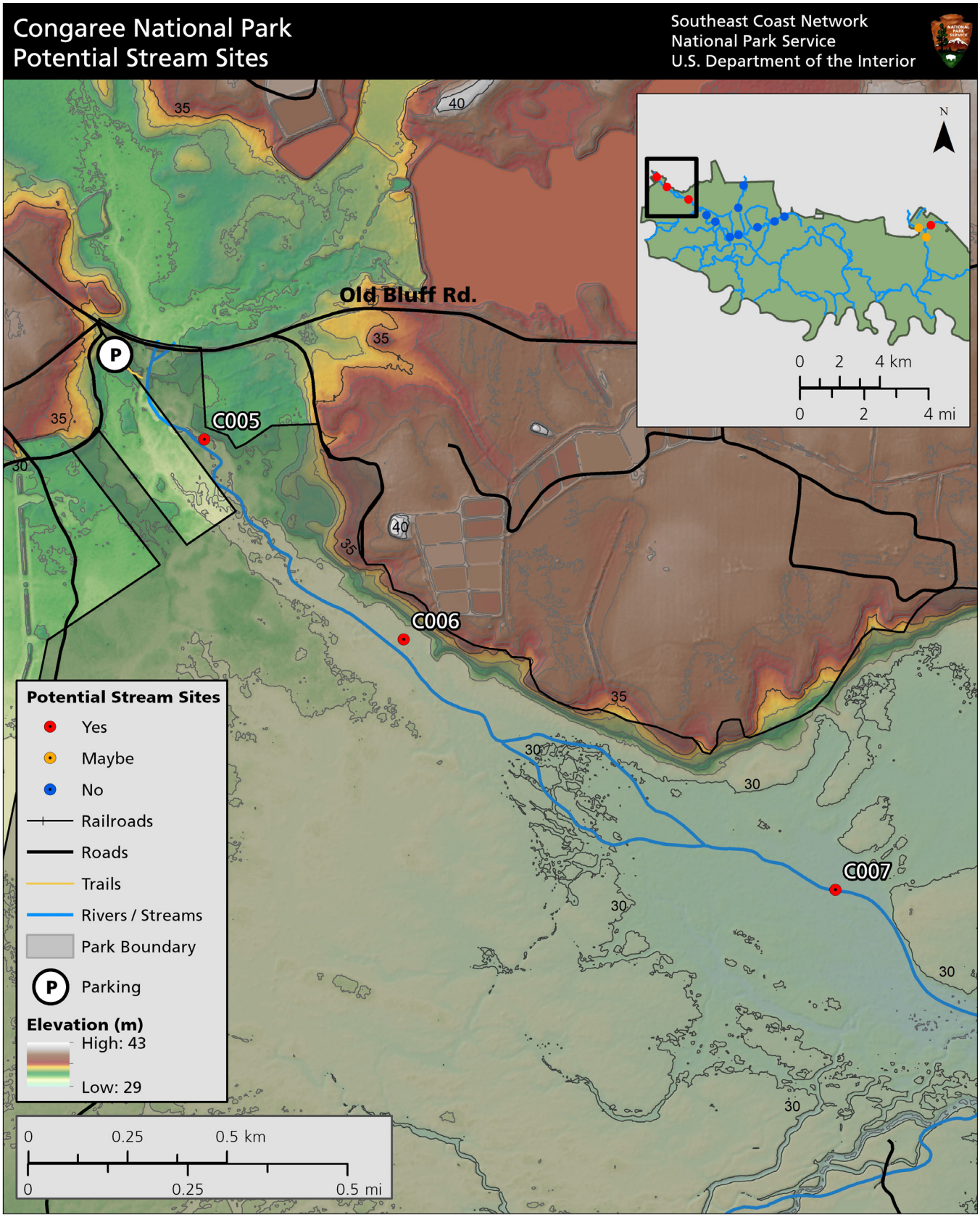


Figure A-4. Map of three sites on Cedar Creek (c005, c006, and c007). Cedar Creek 1 (c005) is downstream of the canoe launch at Bannister Bridge.



Proposed Site Number: c006

Park Unit: CONG

Stream Name: Cedar Creek (CONG002)

Date: 11.2.2017

Time: 4:47 p.m.

Assessed by: JMM and ENS

Accessible: Yes

Gate Key Required: No

Wadeable: Yes

Recommend for Monitoring: Yes

Best Point of Access/Parking: Banister Bridge.

Directions from Parking to Site: Kayak to point.

Management Issues Noted: Hogs present.

Safety Concerns: Deep holes.

Site Summary—Cedar Creek 2 (fifth order stream) is a black water sandy bedded stream with some fines and organics draped over the bed. Wetted width was estimated to be approximately 8.5 meters (28 ft) and bankfull width around 10.25 meters (33.6 ft). Water depth was estimated to be approximately 1 meter (3.3 ft). The banks were slightly higher on river left (0.6 meter [2 ft] versus approximately 0.3 meter [1 ft]). Banks are sandy (with some fines) and tree roots are prevalent. There is a well-developed floodplain on river left and a slightly higher surface on river right. This portion of Cedar Creek is relatively close (approximately 75 meters [246 ft]) to the high bluff (on river left). Floodplain vegetation on both banks is comprised of grasses and trees (little understory). Large woody debris is prevalent (large jam just upstream of assessment point). The point bar on river right is heavily damaged by pig rooting.

Monitoring Recommendation— This site is recommended for monitoring (Figure A-5) because it is downstream from Cedar Creek 1 (c005) and will provide an understanding of how upstream additions of sediment are affecting Cedar Creek. The main problem with this site is that the site likely can only be accessed by kayak or canoe and the boats need to be portaged at least seven times.

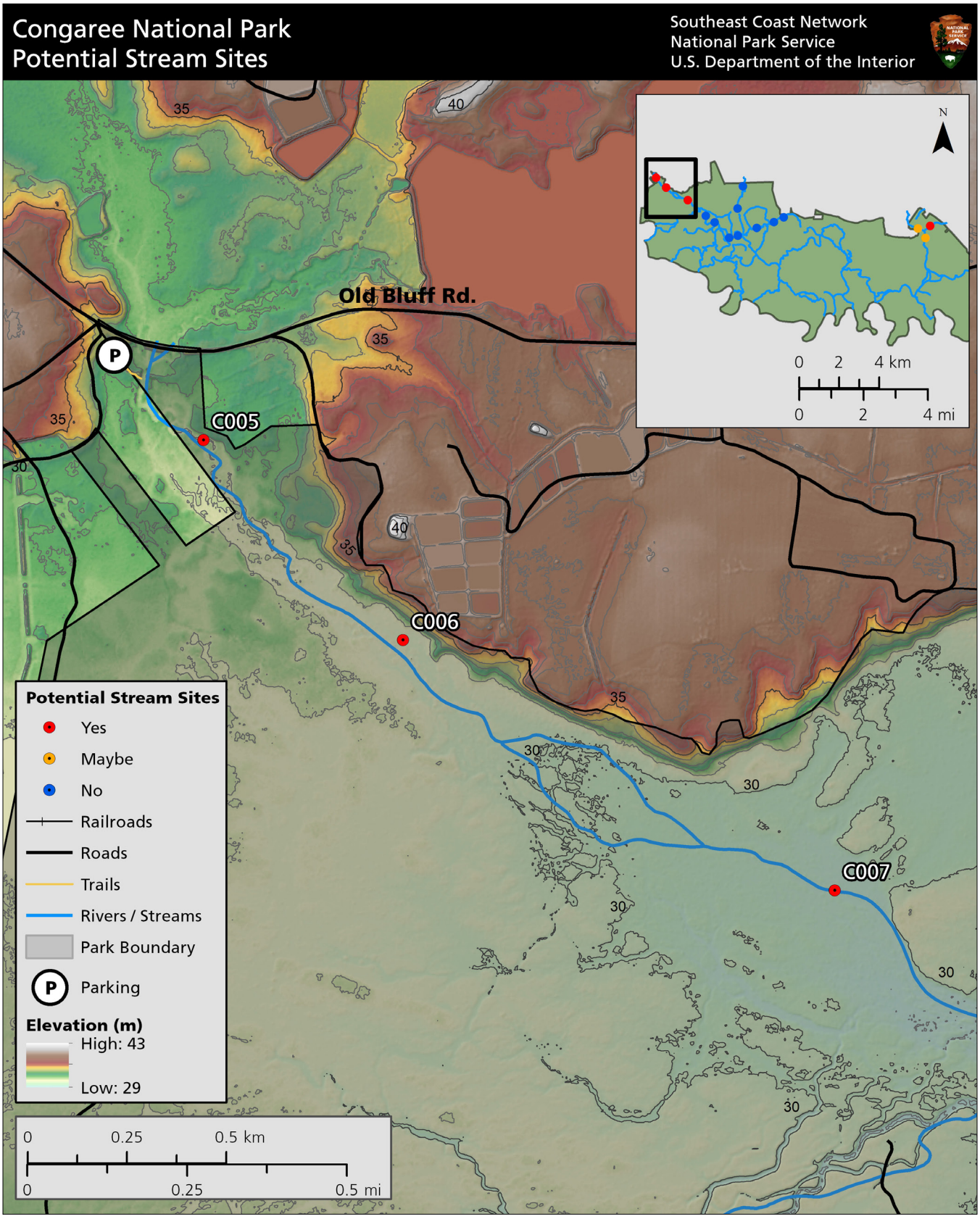


Figure A-5. Map of three sites on Cedar Creek (c005, c006, and c007). Cedar Creek 2 (c006) is downstream of the canoe launch at Bannister Bridge and upstream of the bifurcation of Cedar Creek.



Proposed Site Number: c007

Park Unit: CONG

Stream Name: Cedar Creek (CONG003)

Date: 11.2.2017

Time: 9:20 a.m.

Assessed by: JMM and ENS

Accessible: Yes

Gate Key Required: No

Wadeable: Yes

Recommend for Monitoring: Yes

Best Point of Access/Parking: Banister Bridge.

Directions from Parking to Site: Kayak to point.

Management Issues Noted: Hogs present.

Safety Concerns: Deep holes.

Site Summary—Cedar Creek 3 (fifth order stream) is an amber water (not deep enough to be black water) sandy bedded stream with some fines and organics draped over the bed. Wetted width was estimated to be approximately 9.75 meters (32 ft) and bankfull width around 13.5 meters (44.3 ft). Water depth was estimated to be approximately 0.4 meter. The banks were of uniform height (0.3 meter [1 ft]. Banks are mucky sand and tree roots are prevalent. There is a well-developed floodplain on both sides of the stream. Floodplain vegetation on both banks is comprised of grasses and trees (little understory). Cypress knees are now prevalent along river right. Emergent aquatic vegetation was observed along river left. Large woody debris is prevalent. The point bar on river left was very mucky (sunk up to knees).

Monitoring Recommendation—This site is recommended for monitoring (Figure A-6) because it is downstream from Cedar Creek 1 and 2 (c005 and c006) and will provide an understanding of how upstream additions of sediment are affecting Cedar Creek. The main problem with this site is that the site likely can only be accessed by kayak or canoe and the boats need to be portaged at least 10 times.

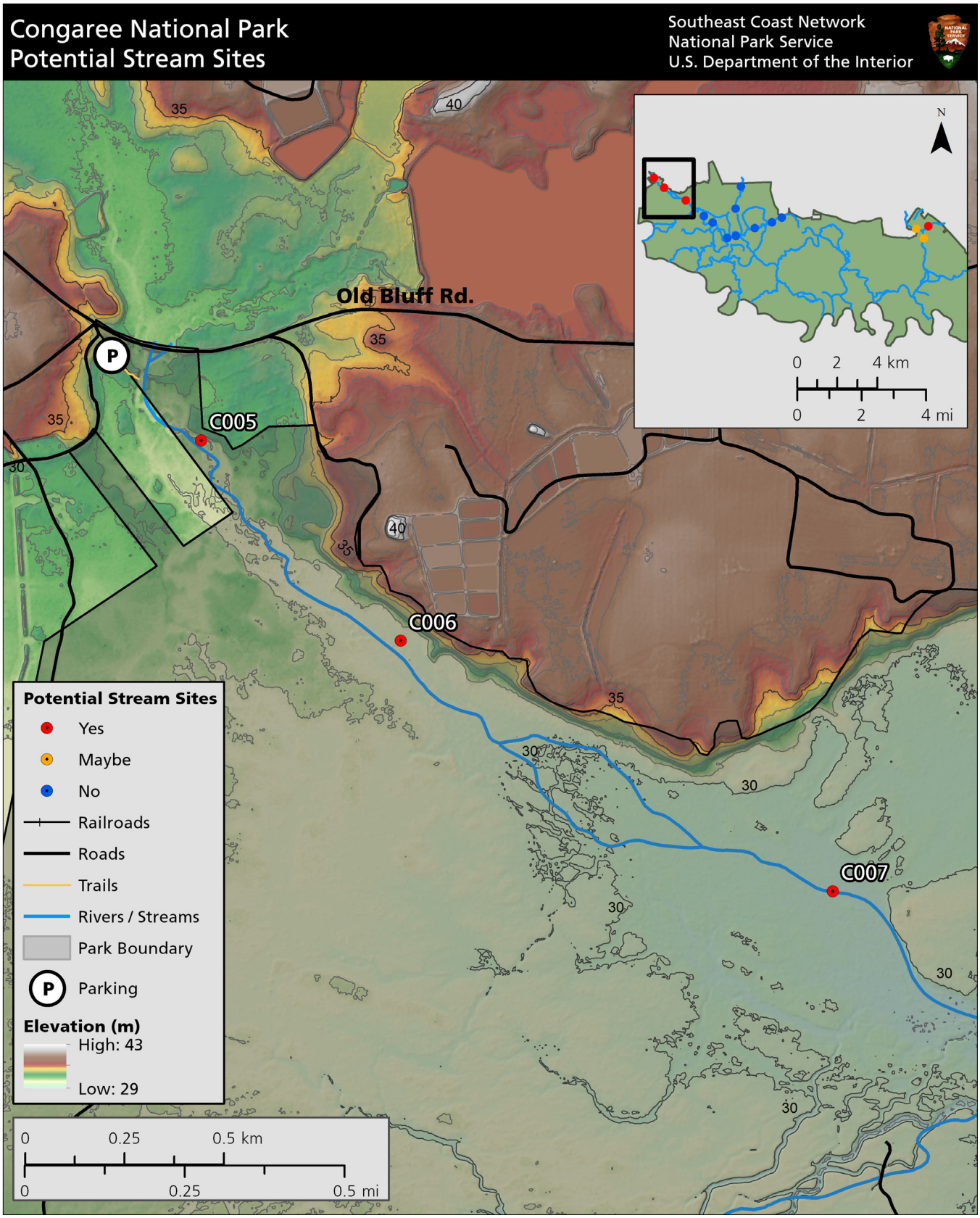


Figure A-6. Map of three sites on Cedar Creek (c005, c006, and c007). Cedar Creek 3 (c007) is downstream of the bifurcation of Cedar Creek.



Proposed Site Number: c008

Park Unit: CONG

Stream Name: Cedar Creek

Date: 11.2.2017

Time: 10:20 a.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: No

Recommend for Monitoring: Maybe

Best Point of Access/Parking: Banister Bridge.

Directions from Parking to Site: Kayak to point.

Management Issues Noted: Hogs present.

Safety Concerns: Reach is very deep, mostly non-wadeable.

Site Summary—Cedar Creek 4 (fifth order stream) is black water sandy muck bedded stream. Wetted width was estimated to be approximately 14 meters (46 ft) and bankfull width around 17 meters (55.8 ft). Water depth was estimated to be approximately 1.1 meters (3.6 ft). The banks were higher on river left (0.95 meter [3.1 ft] versus 0.6 meter [2 ft]). Banks on river left are sandy and tree roots are prevalent (mucky on river right). There is a well-developed floodplain on river right. The channel full surface represented by the bank on river left is also present on river right (approximately 15 meters [49.2 ft] from the stream). Floodplain vegetation has transitioned to mostly Cypress. Large woody debris is likely still prevalent though the black water prevents identification of any below the water surface. The in-stream habitat is pools and glides.

Monitoring Recommendation—This site is not recommended for monitoring (Figure A-7) because the water is too deep and the mucky bottom adds to the effective depth of the water. Additionally, the site can only be accessed by kayak or canoe and the boats need to be portaged at least 16 times.

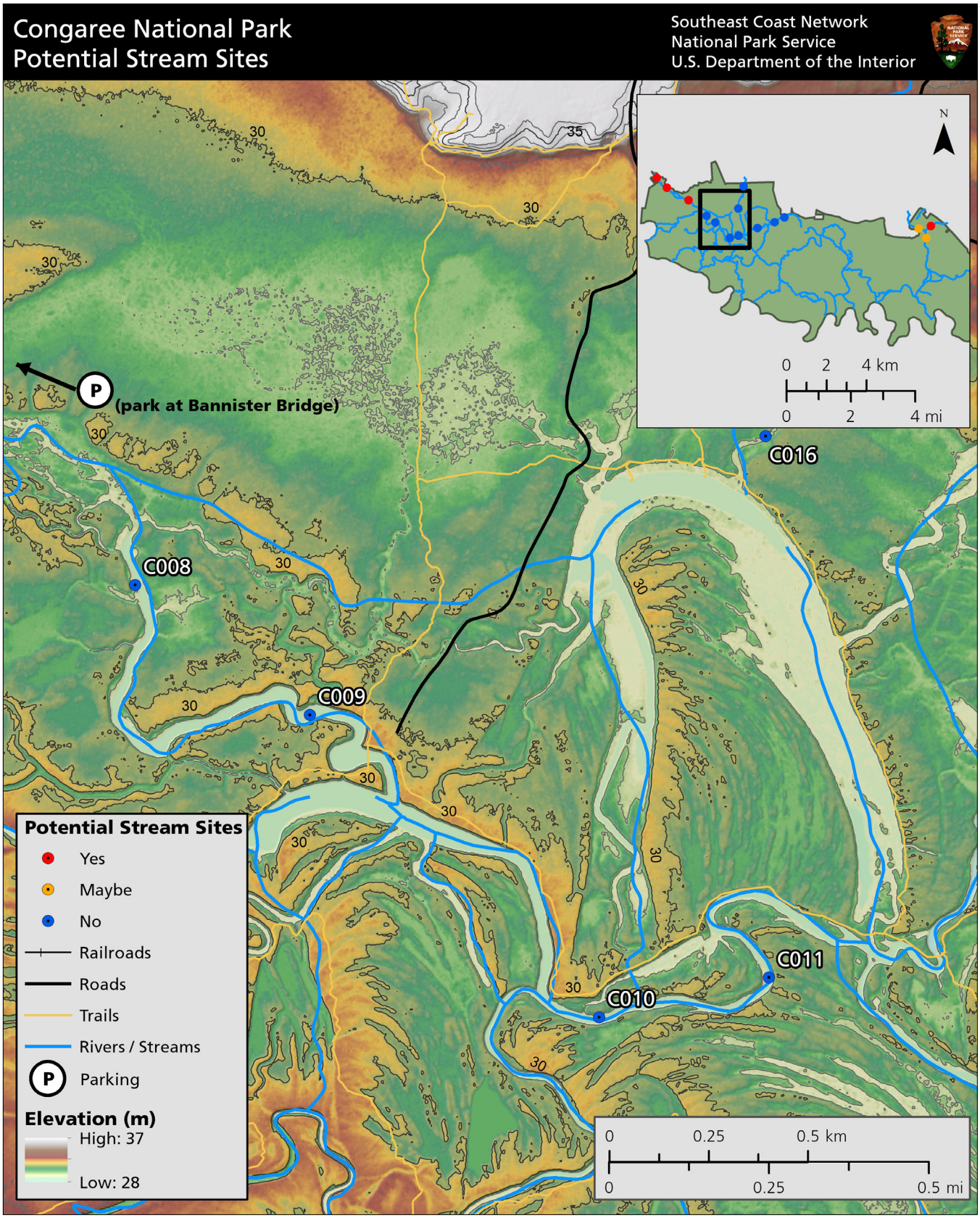


Figure A-7. Map of four sites on Cedar Creek (c008, c009, c010, and c011). Cedar Creek 4 (c008) is upstream of Bridge B.



Proposed Site Number: c009

Park Unit: CONG

Stream Name: Cedar Creek

Date: 11.2.2017

Time: 10:55 a.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: Yes/No

Recommend for Monitoring: No

Best Point of Access/Parking: Banister Bridge.

Directions from Parking to Site: Kayak to point.

Management Issues Noted: Hogs present.

Safety Concerns: Deep water.

Site Summary—Cedar Creek 5 (fifth order stream) is black water muck bottom stream. Wetted width was estimated to be approximately 14 meters (45.9) and bankfull width around 40 meters (131.2 ft). Water depth was estimated to be approximately 0.7 meter (2.3 ft). The banks were higher on river right (1.41 meters [4.6 ft] versus 0.6 meter [2 ft]). Banks on river right are sandy, steep, and unvegetated. River left active channel is full of Cypress knees. There is a well-developed floodplain on river left. Floodplain vegetation is mostly Cypress on river left and floodplain forest on river right. Large woody debris is prevalent.

Monitoring Recommendation— This site is not recommended for monitoring (Figure A-8) because the water is deep and the mucky bottom adds to the effective depth of the water. Additionally, the site can only be accessed by kayak or canoe and the boats need to be portaged at least 18 times.

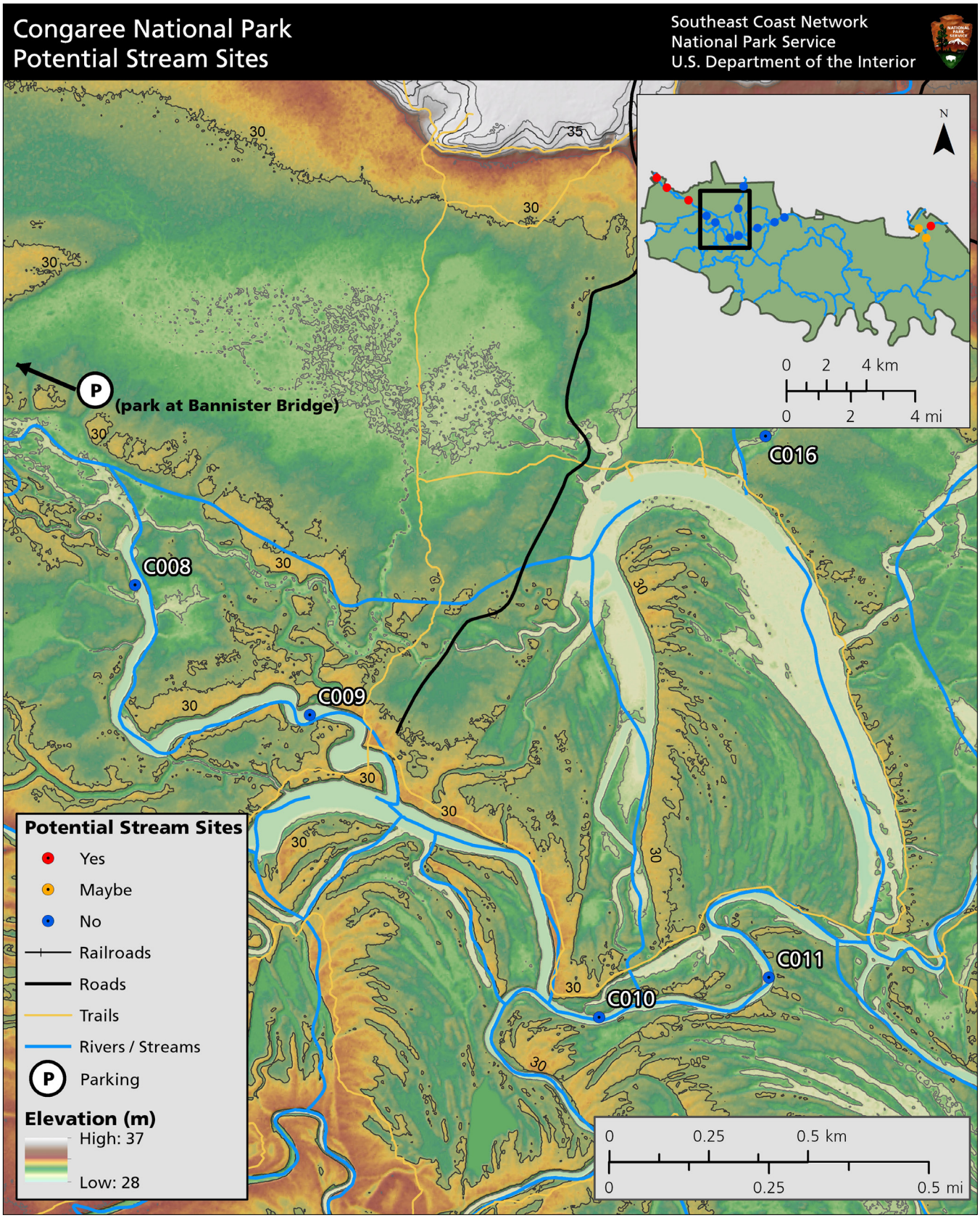


Figure A-8. Map of four sites on Cedar Creek (c008, c009, c010, and c011). Cedar Creek 5 (c009) is immediately upstream of Bridge B.



Proposed Site Number: c010

Park Unit: CONG

Stream Name: Cedar Creek

Date: 11.2..2017

Time: 11:35 a.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: No

Recommend for Monitoring: No

Best Point of Access/Parking: Banister Bridge

Directions from Parking to Site: Kayak to point.

Management Issues Noted: Hogs present.

Safety Concerns: Deep water.

Site Summary—Cedar Creek 6 (fifth order stream) is black water muck bottom stream. Wetted width was estimated to be approximately 14.5 meters and bankfull width around 26.5 meters. Water depth was estimated to be approximately 1.1 meters. The banks were higher on river right (1.46 meters versus approximately 0.6 meter). Banks on river right are sandy, steep, and unvegetated. River left bank slopes gently up to bankfull. The left bank is also hog rooted. There is a well-developed floodplain on river left. Floodplain vegetation is mostly Cypress on river left and floodplain forest on river right. Large woody debris is prevalent.

Monitoring Recommendation— This site is not recommended for monitoring (Figure A-9) because the water is deep and the mucky bottom adds to the effective depth of the water. Additionally, the site can only be accessed by kayak or canoe and the boats need to be portaged at least 22 times.

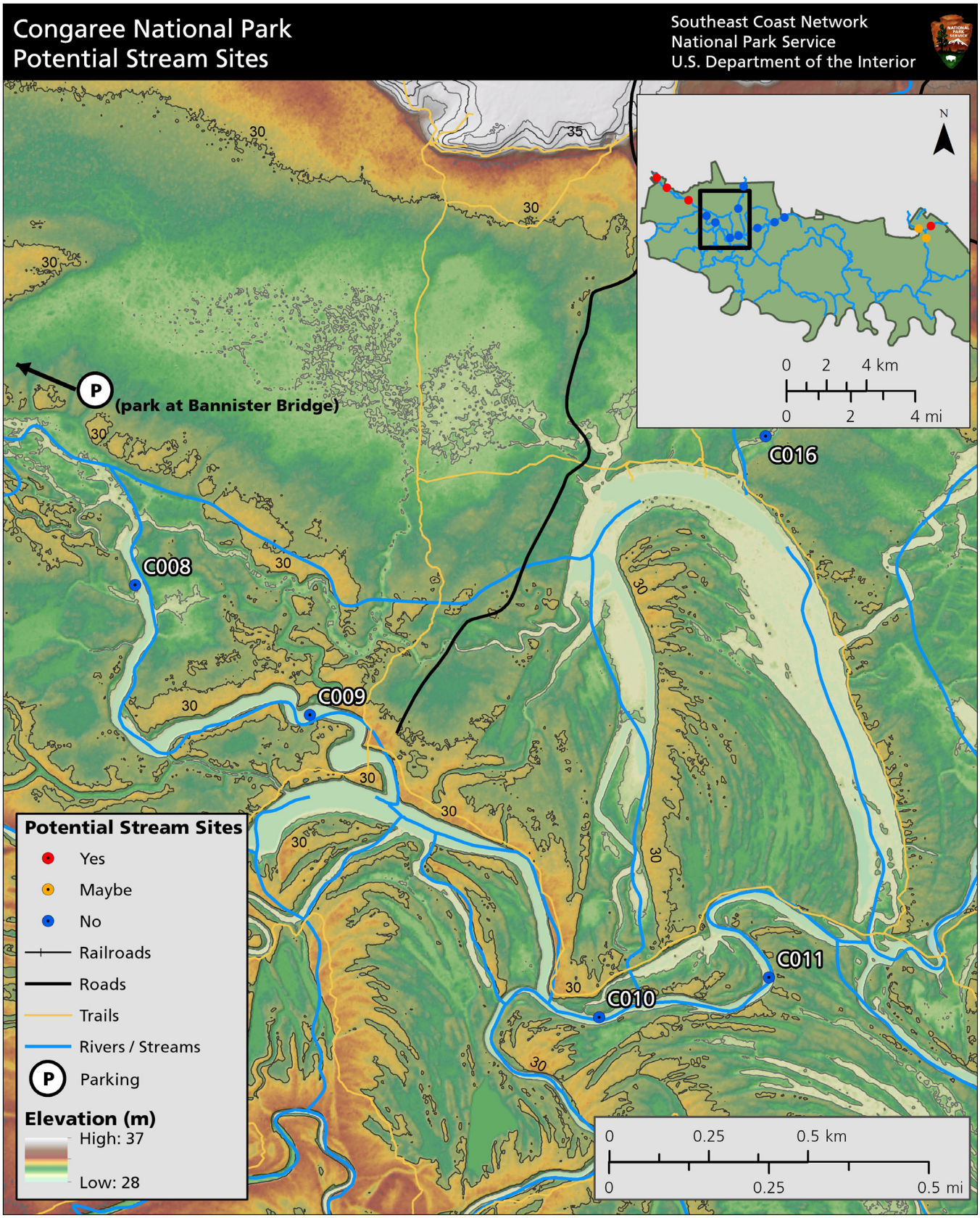


Figure A-9. Map of four sites on Cedar Creek (c008, c009, c010, and c011). Cedar Creek 6 (c010) is downstream of Bridge B and immediately upstream of Weston Lake.



Proposed Site Number: c011

Park Unit: CONG

Stream Name: Cedar Creek

Date: 11.2.2017

Time: 12:22 p.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: No

Recommend for Monitoring: No

Best Point of Access/Parking: Banister Bridge, maybe Cedar Creek canoe access.

Directions from Parking to Site: Kayak to point.

Management Issues Noted: Hog damage on river left.

Safety Concerns: Deep water.

Site Summary—Cedar Creek 7 (fifth order stream) is black water muck bottom stream. Wetted width was estimated to be approximately 12 meters (39.3 ft) and bankfull width around 16 meters (52.5 ft). Water depth was estimated to be approximately 0.8 meter (2.6 ft). The banks were higher on river right (1.5 meters [4.9 ft] versus approximately 0.6 meter [2 ft]). Banks on river right are sandy, steep, and unvegetated. River left bank slopes gently up to bankfull. The left bank is hog rooted and stripped of all understory vegetation. A sizeable flood chute is present on river left behind the bankfull bank top. Floodplain vegetation is mostly Cypress on river left and floodplain forest on river right. Large woody debris is prevalent.

Monitoring Recommendation—This site is not recommended for monitoring (Figure A-10) because the water is deep and the mucky bottom adds to the effective depth of the water. Additionally, the site can only be accessed by kayak or canoe and the boats need to be portaged more than 25 times.

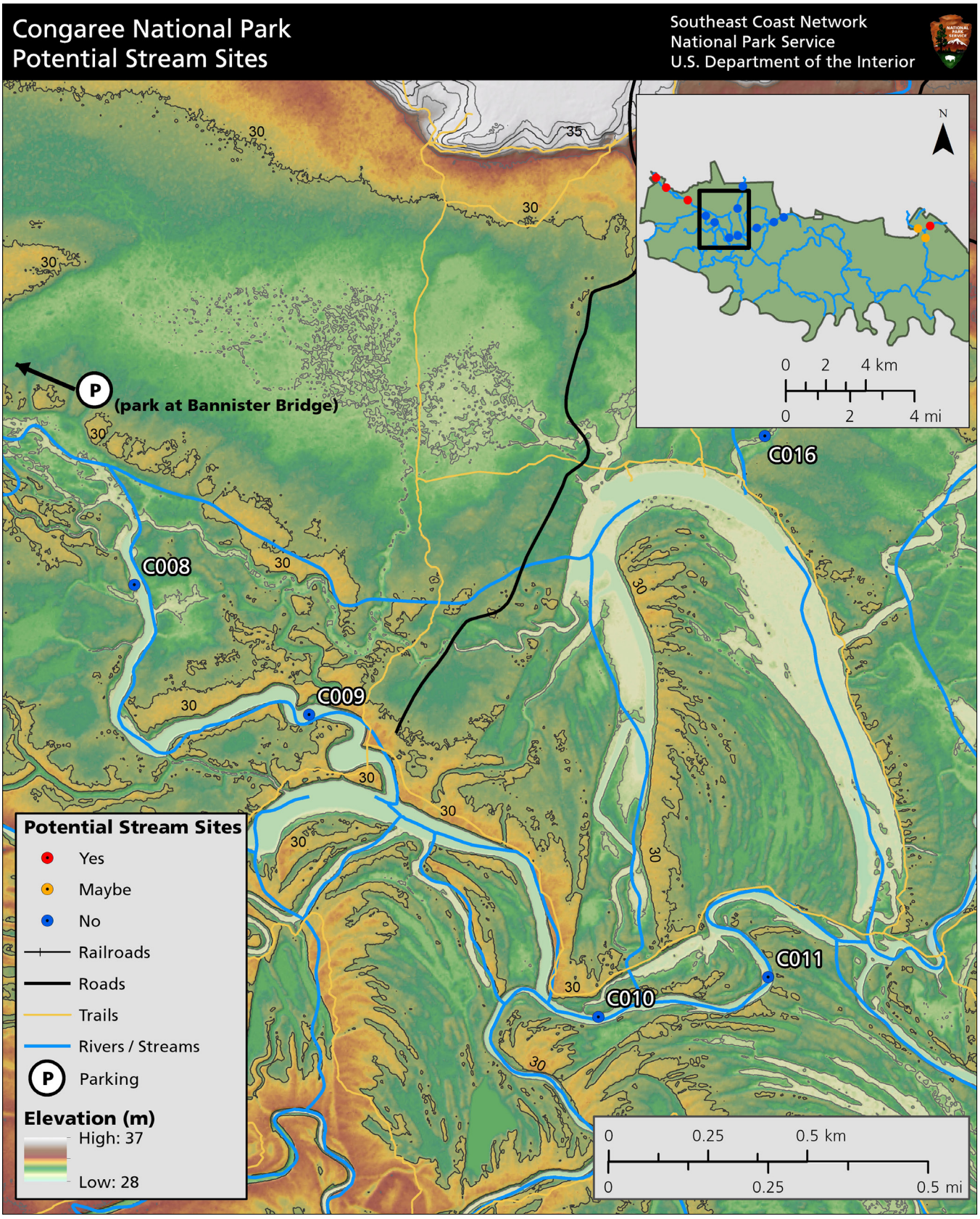


Figure A-10. Map of four sites on Cedar Creek (c008, c009, c010, and c011). Cedar Creek 7 (c011) is downstream of Bridge B and immediately upstream of the outlet of Weston Lake.



Proposed Site Number: p012

Park Unit: CONG

Stream Name: Cedar Creek

Date: 11.2.2017

Time: 1:25 p.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: No

Recommend for Monitoring: No

Best Point of Access/Parking: Cedar Creek canoe access.

Directions from Parking to Site: Kayak to point.

Management Issues Noted: Hogs present.

Safety Concerns: Deep water.

Site Summary—Cedar Creek 8 (fifth order stream) is black water muck bottom stream. Wetted width was estimated to be approximately 14.5 meters (47.6 ft) and bankfull width around 20 meters (65.6 ft). Water depth was estimated to be approximately 1.3 meters (4.3 ft). The banks were higher on river right (1.5 meters [4.9 ft] versus ~0.6 meter [2 ft]). Banks on river right are sandy, steep, and unvegetated. River left bank slopes gently up to bankfull. The left bank is hog rooted and stripped of all understory vegetation. A well-developed floodplain is present on river left. Floodplain vegetation is mostly Cypress on river left (with some River Cane) and floodplain forest on river right. Cypress knees are present at the water line of both banks. Large woody debris is prevalent.

Monitoring Recommendation—This site is not recommended for monitoring (Figure A-11) because the water is deep and the mucky bottom adds to the effective depth of the water. Additionally, the site can only be accessed by kayak or canoe and the boats need to be portaged more than 25 times.

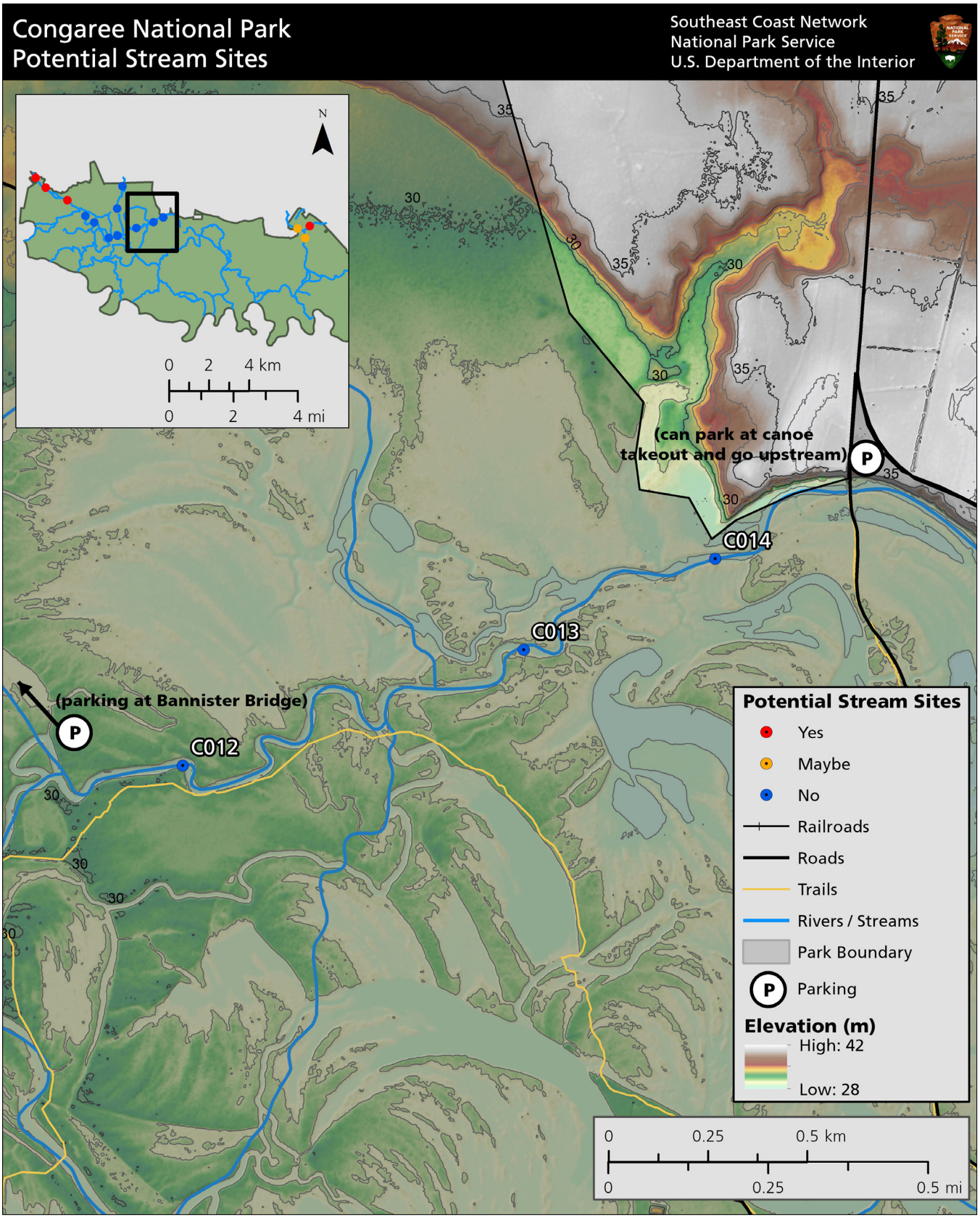


Figure A-11. Map of three sites on Cedar Creek (c012, c013, and c014). Cedar Creek 8 (c012) is downstream of the outlet of Weston Lake and upstream from the South Cedar Creek takeout.



Proposed Site Number: c013

Park Unit: CONG

Stream Name: Cedar Creek

Date: 11.2.2017

Time: 2:00 p.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: No

Recommend for Monitoring: No

Best Point of Access/Parking: Cedar Creek canoe access.

Directions from Parking to Site: Kayak to point.

Management Issues Noted: Hogs present.

Safety Concerns: Deep water.

Site Summary—Cedar Creek 9 (fifth order stream) is black water muck bottom stream. Wetted width was estimated to be approximately 13.5 meters (44.3 ft) and bankfull width around 16.5 meters (54,1 ft). Water depth was estimated to be approximately 0.9 meter (3 ft). The banks were higher on river left (1.5 meters [4.9 ft] versus 1 meter [3.3 ft]). Banks on river left are sandy, steep, and unvegetated. River right bank is mucky sand and slopes gently up to bankfull. A well-developed floodplain is present on river right and there is a slightly higher surface on river left. Floodplain vegetation is floodplain forest on both sides of the stream and Saw Palmetto is prevalent. Large woody debris is prevalent.

Monitoring Recommendation—This site is not recommended for monitoring (Figure A-12) because the water is deep and the mucky bottom adds to the effective depth of the water. Additionally, the site can only be accessed by kayak or canoe and the boats need to be portaged more than 30 times.

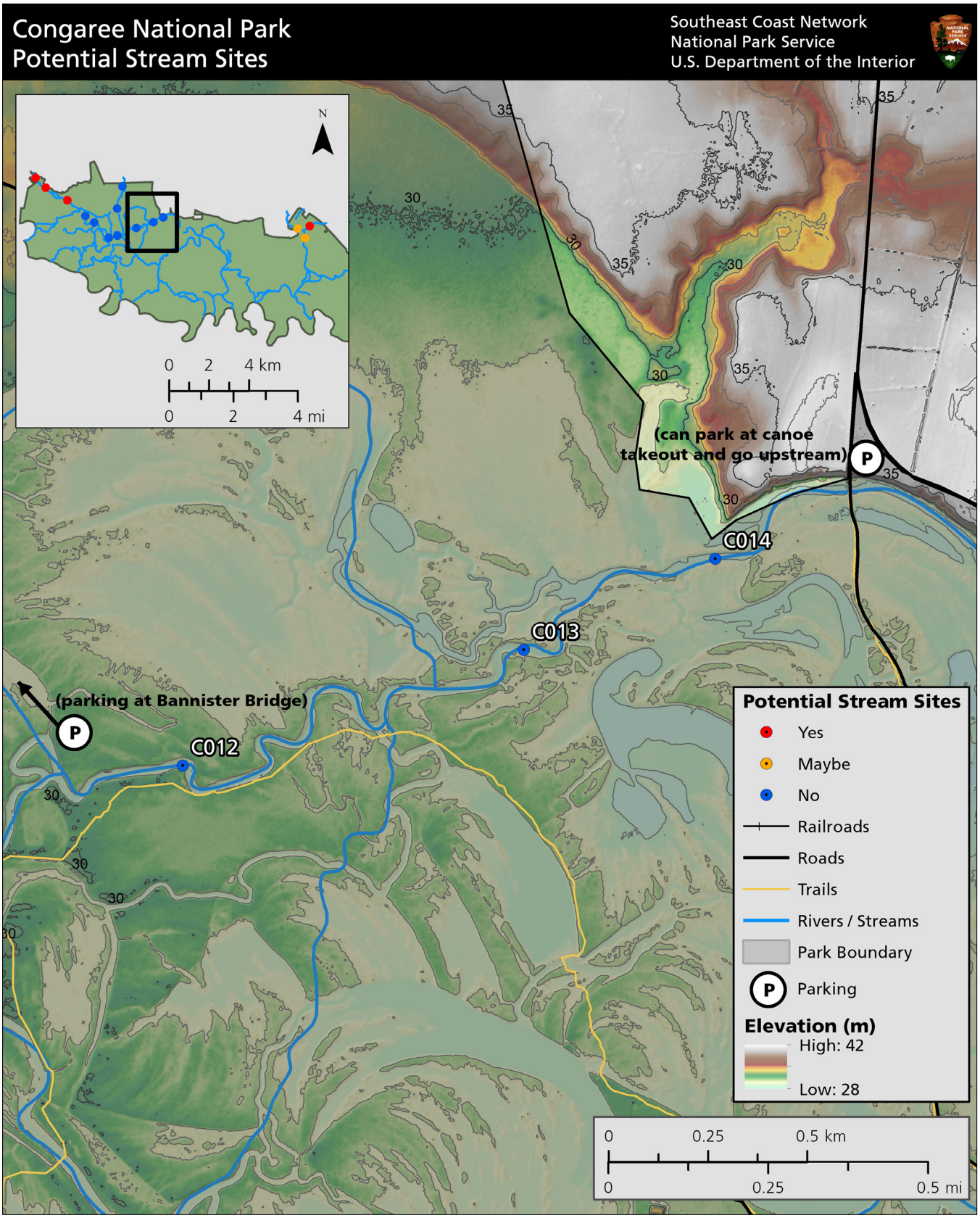


Figure A-12. Map of three sites on Cedar Creek (c012, Cc013, and c014). Cedar Creek 9 (c013) is downstream of the outlet of an unnamed paleomeander and upstream of the South Cedar Creek takeout.



Proposed Site Number: c014

Park Unit: CONG

Stream Name: Cedar Creek

Date: 11.2.2017

Time: 2:25 p.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: No

Recommend for Monitoring: No

Best Point of Access/Parking: Cedar Creek canoe access.

Directions from Parking to Site: Kayak to site

Management Issues Noted: Hogs on river left.

Safety Concerns: Deep water.

Site Summary—Cedar Creek 10 (fifth order stream) is black water muck bottom stream. Wetted width was estimated to be approximately 17.5 meters (57.4 ft) and bankfull width around 24.5 meters (80.3 ft). Water depth was estimated to be approximately 0.7 meter. The banks were uniform in height (approximately 1.25 meters [4.1 ft]). Both banks are mucky sand and the only difference was that the river left bank had a more gradual slope. A well-developed floodplain is present on both sides of the stream. Floodplain vegetation is floodplain forest on both sides of the stream and Cypress knees are present on river left water's edge. Large woody debris is prevalent.

Monitoring Recommendation—This site is not recommended for monitoring (Figure A-13) because the water is deep and the mucky bottom adds to the effective depth of the water. Additionally, the site can only be accessed by kayak or canoe and the boats need to be portaged more than 40 times.

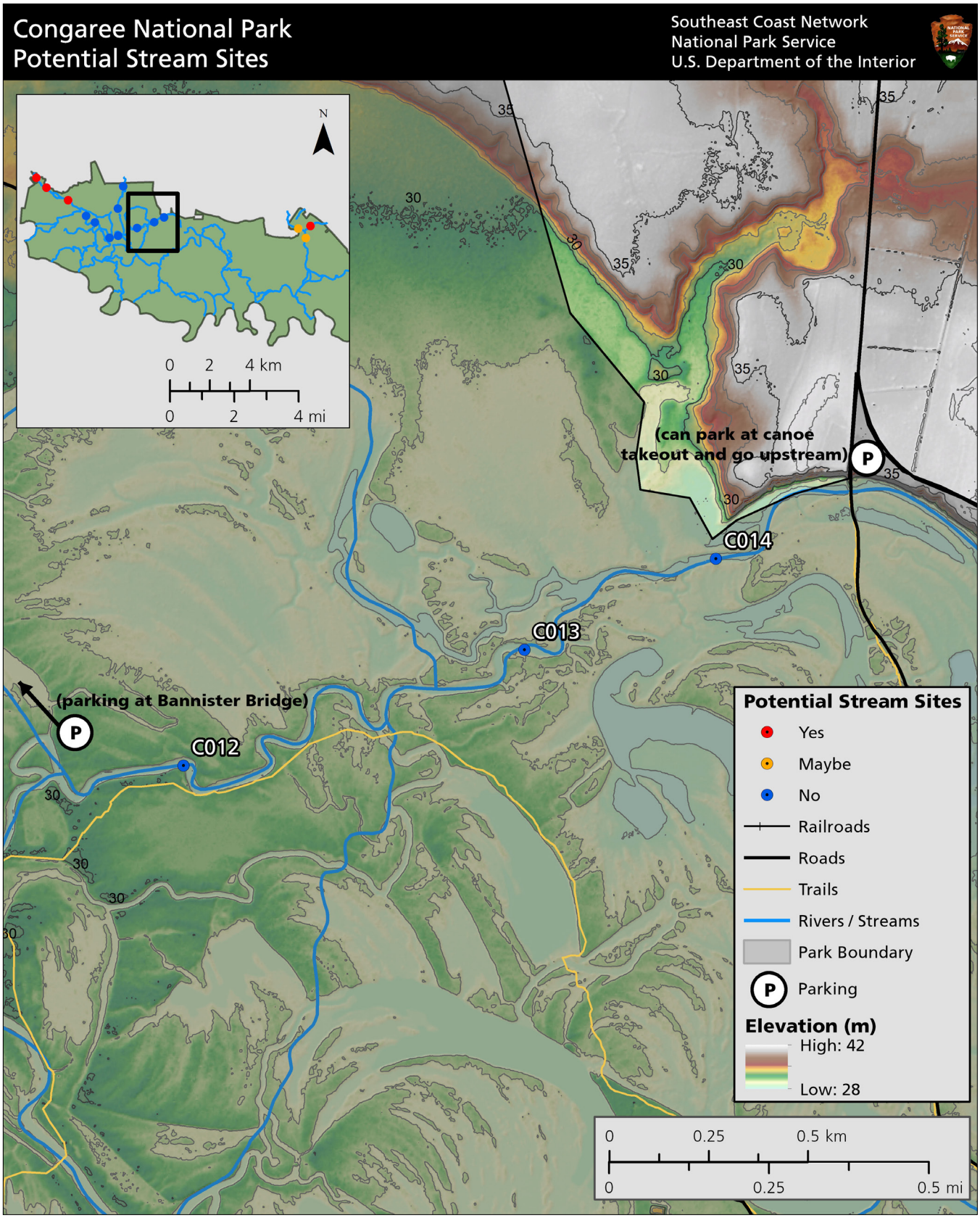


Figure A-13. Map of three sites on Cedar Creek (c012, c013, and c014). Cedar Creek 10 (c014) is upstream of the South Cedar Creek takeout.



Proposed Site Number: c015

Park Unit: CONG

Stream Name: Dry Branch

Date: 11.3.2017

Time: 8:40 p.m.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: Yes

Recommend for Monitoring: No

Best Point of Access/Parking: Congaree Learning Center.

Directions from Parking to Site: Walk from learning center to firebreak between park and private land, then follow downslope to site.

Management Issues Noted: Hogs present, influence of dam and recent clear-cut.

Safety Concerns: Crossing on private property (hunting club).

Site Summary—Dry Branch upstream (fourth order stream) is sandy bottom multi-thread stream. Wetted width was estimated to be approximately 3.5 meters (11.5 ft) and bankfull width around 4.5 meters (14.8 ft). Water depth was estimated to be approximately 0.5 meter (1.6 ft). The banks were uniform in height (approximately 0.4 meter [1.3 ft]). Both banks are mucky sand. A well-developed floodplain is present on both sides of the stream. Floodplain vegetation is dominated by grasses and pines. Large woody debris is prevalent. The water is very turbid and there is lots of iron flocs in the water. This site is downstream from the private hunt club dam (that was recently repaired). Hog damage was also noted around the stream.

Monitoring Recommendation—This site is not recommended for monitoring (Figure A-14) because of the multi-thread nature of the stream channel.

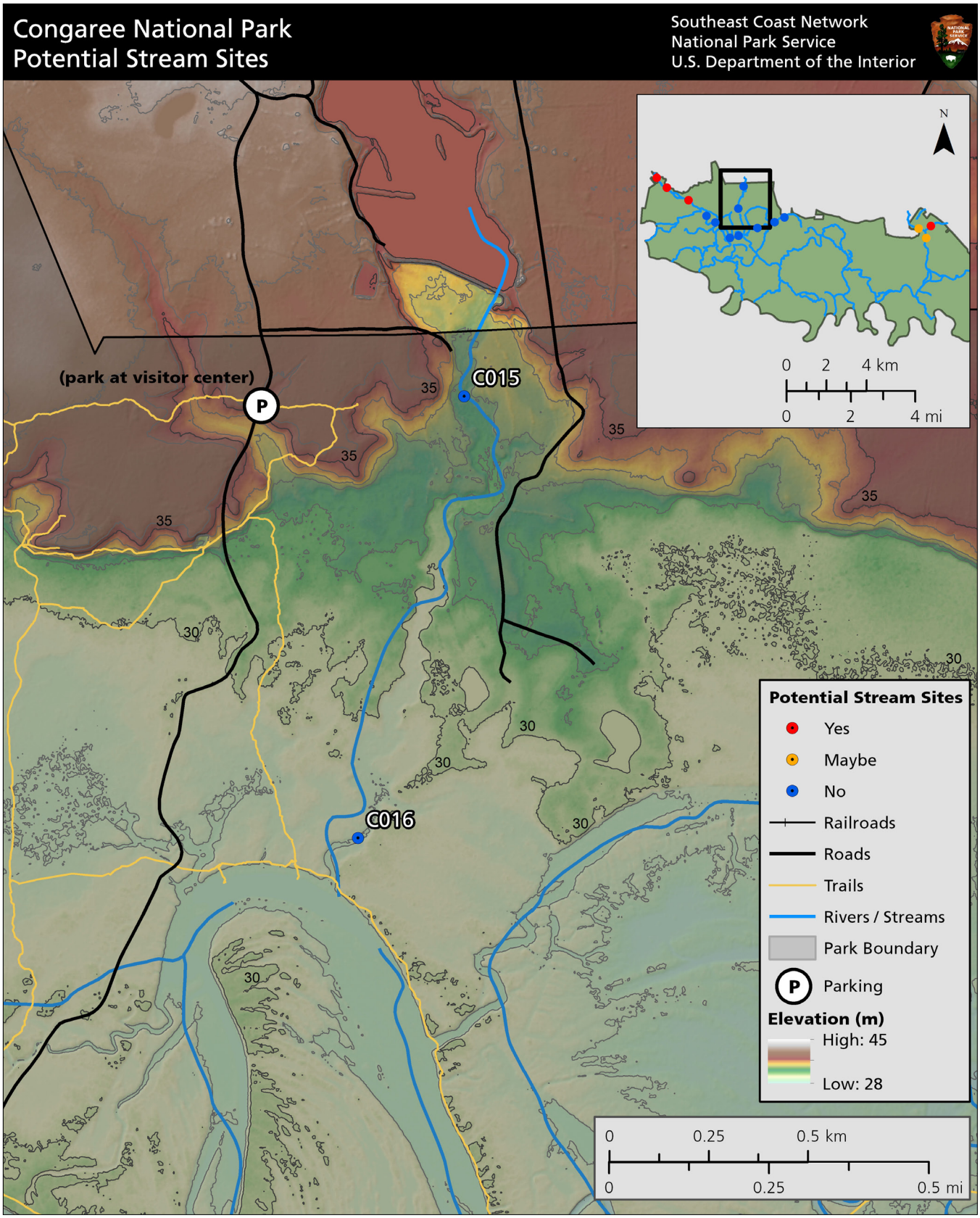


Figure A-14. Map of two sites on Dry Branch (c015 and c016). Dry Branch upstream (c015) is immediately downstream of a privately owned earthen dam.



Proposed Site Number: c016

Park Unit: CONG

Stream Name: Dry Branch

Date: 11.3.2017

Time: 10:26 am.

Assessed by: JMM, ENS

Accessible: Yes

Gate Key Required: No

Wadeable: Yes

Recommend for Monitoring: No

Best Point of Access/Parking: Congaree Learning Center.

Directions from Parking to Site: Walk to the boardwalk to Westan Lake, leave boardwalk and go to site.

Management Issues Noted: Hogs present.

Safety Concerns: Deep mud.

Site Summary—Dry Branch downstream (fourth order stream) is a small muck-bottomed stream. Wetted width was estimated to be approximately 4.75 meters and bankfull width around 10.25 meters. Water depth was estimated to be approximately 0.1 meter. The banks were uniform in height (approximately 0.4 meter). Both banks are mucky and full of tree roots. A well-developed floodplain is present on both sides of the stream. A slightly higher surface is present on river right (approximately 15 meters from the stream). Floodplain vegetation is floodplain forest with an abundance of Cypress knees. Large woody debris is prevalent. We scared some hogs away on our approach to the site and their rooting and vegetation damage is obvious.

Monitoring Recommendation—This site is not recommended for monitoring (Figure A-15) because the stream does not fit within the objectives of the wadeable stream monitoring protocol.

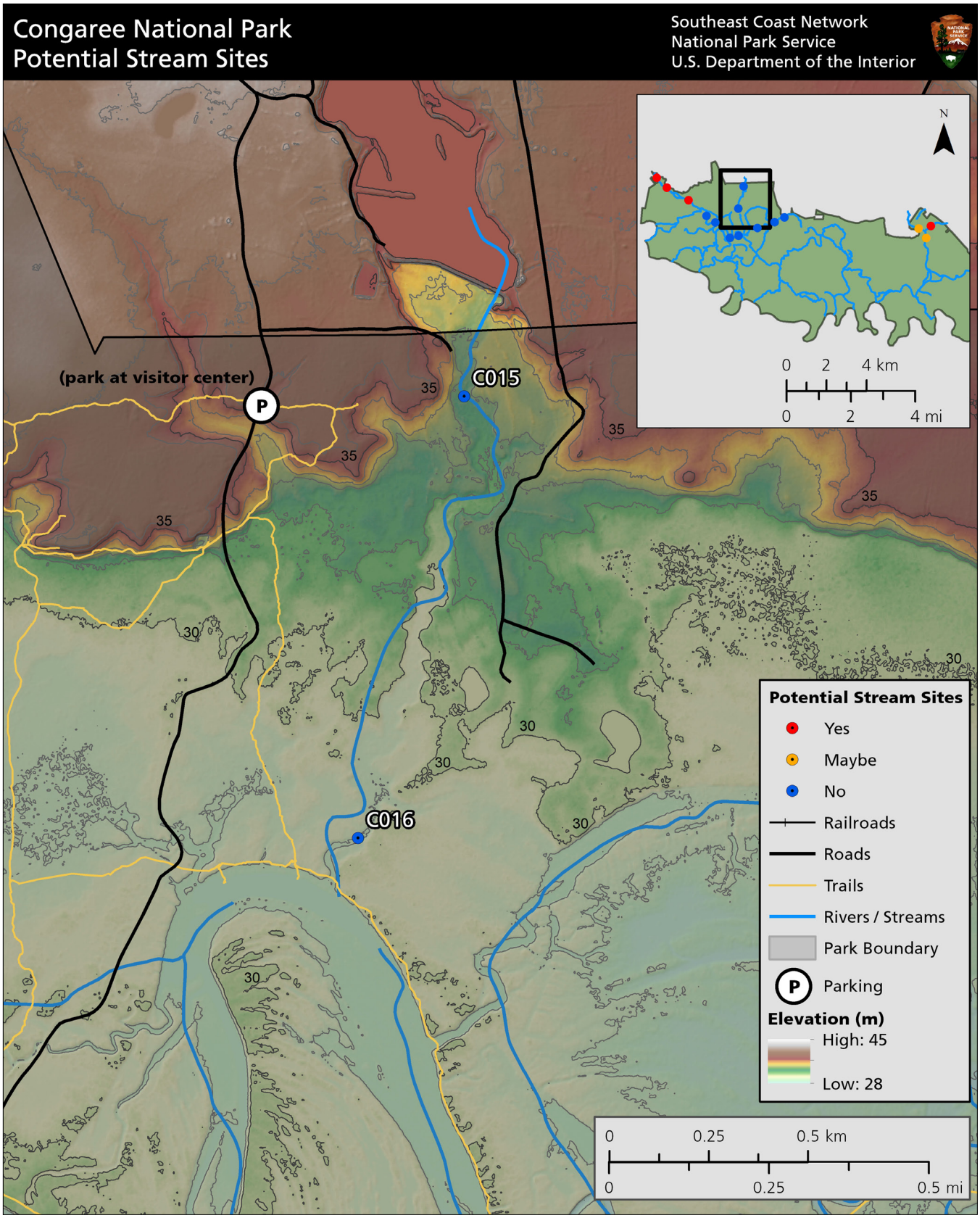


Figure A-15. Map of two sites on Dry Branch (c015 and c016). Dry Branch downstream (c016) is immediately upstream of the confluence of Dry Branch and Weston Lake.

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NPS 178/148988, October 2018

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
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