MONITORING YEAR 7 ANNUAL/CLOSEOUT REPORT

FINAL

OWL'S DEN MITIGATION SITE
Lincoln County, NC
DEQ Contract 005150
DMS Project Number 95808
DWR No. 14-0153
USACE Action ID No. SAW-2013-00717
Catawba River Basin
HUC 03050102

Data Collection Period: March - November 2022
Submitted: January, 2023

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

PREPARED BY:

WILDLANDS
ENGINEERING

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Charlotte, NC 28203

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January 9, 2023

Mr. Paul Wiesner
Western Regional Supervisor
NCDEQ – Division of Mitigation Services
Asheville Regional Office
2090 U.S. 70 Highway
Swannanoa, NC 28778-8211

RE: Owl's Den Mitigation Site - Monitoring Year 7 / Closeout Report
Final Submittal for DMS
Catawba River Basin – CU# 03050102 – Lincoln County, NC
Providing mitigation for CU# 03050103 (Catawba ESA)
DMS Project ID No. 95808
Contract # 005150

Dear Mr. Wiesner:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments and observations from the Owl's Den Mitigation Site Monitoring Year 7/ Closeout Report Draft, received on January 5, 2023. The report text has been revised for the final submittal to reflect the most current condition of the site. Your comments and observations from the report are noted below in **Bold**. Wildlands' response to those comments are noted in *Italics*.

DMS' Comment: General/ Report Text and Table 1: Please continue to maintain Table 1 and do not remove the potential "at risk" wetland credits from the table. DMS has entered the 0.103 potential "at risk" WMUs into our internal accounting system (CRM) for tracking purposes. The IRT closeout site visit for Owls Den has been scheduled for Thursday March 2, 2023 at 9:00am. Once reviewed and approved by the IRT, the potential "at risk" wetland credits can be removed from the project's final credit ledger for IRT signature and project closeout.

Wildlands' Response: We acknowledge DMS' request and the "at risk" acreage and WMUs will not be removed from Table 1.

DMS' Comment: General: As noted in the report text, beaver and beaver dams should be removed from the site through project closeout. Invasives species should also be treated through project closeout.

Wildlands' Response: Wildlands will continue monitoring for beaver activity and invasive species and will treat invasive species and remove re-established and/or newly established dams until closeout.

DMS' Comment: Section 1.2.4 Wetland Assessment: In the report text, please also briefly discuss the gage 14 malfunction reported in the groundwater gage plots.

Wildlands' Response: A discussion of the malfunctioning gage has been included in the report text.

DMS' Comment: Table 9C - Planted and Total Stems (Species by Plot with Annual Means): In the table, MY0 (1/2016) shows "0" for the Stems per ACRE. Please review and update accordingly.

Wildlands' Response: Wildlands conducted a review of the MY0 vegetation data and found the correct stems per acre to be 647. Table 9c has been updated accordingly.

DMS' Comment: Table 11 - Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section): Please review the BHR reported for XS 8 in MY5 (2020) and the BHR reported in MY7 (2022). The surveyed channel geometry looks similar in both years but in MY5 (2020) the BHR was 1.7 and in MY7 (2022) 1.1. Please review and update as necessary.

Wildlands' Response: Wildlands conducted a review of the MY7 XS8 data and found the correct BHR to be 2.0. Table 11 has been updated accordingly.

Enclosed please find two (2) hard copies of the Year 7 Final Monitoring Report and one (1) USB with all the final corrected electronic files for DMS distribution. Please contact me at 704-332-7754 x101 if you have any questions.

Sincerely,

Kristi Suggs
ksuggs@wildlandseng.com

EXECUTIVE SUMMARY

Wildlands Engineering Inc. (Wildlands) implemented a full delivery project at the Owl's Den Mitigation Site (Site) for the North Carolina Division of Mitigation Services (DMS) to restore 2,453 linear feet (LF) of perennial streams, rehabilitate 2.82 acres of existing wetlands, and re-establish 6.77 acres of wetlands in Lincoln County, NC. The Site is expected to generate 2,453.000 stream mitigation units (SMUs) and 8.835 riparian wetland mitigation units (WMUs) (Table 1). A wetland area "at risk" was defined in the wetland re-establishment area during Monitoring Year 6 and is expected to result is a loss of 0.103 acres of wetlands and 0.103 WMUs. The "at risk" acreage has not been deducted in Table 1.

The Site is located near the City of Lincolnton in Lincoln County, NC within the DMS targeted watershed for the Catawba River Basin Hydrologic Unit Code (HUC) 03050102040040 and NCDWR Subbasin 03-08-35 (Figure 1) and is being submitted for mitigation credit in the Catawba River Basin HUC 03050103 within the expanded service area of this HUC. The project streams consist of two unnamed tributaries to Howards Creek, HC1 and HC2 (Figure 2). Howards Creek eventually flows into the South Fork Catawba River near the City of Lincolnton in Lincoln County. The adjacent land to the streams and wetlands is maintained for agricultural purposes.

The Site is located in the Howards Creek watershed and is within a Targeted Local Watershed (TLW) identified in NCDMS 2007 Catawba River Basin Restoration Priority Plan (RBRP). The Site is also identified in the Indian Creek and Howards Creek Local Watershed Plan (LWP) Project Atlas (DMS, 2010). The Indian and Howards Creek LWP identified stream channelization and dredging, incised channels and unstable stream banks, deforested riparian buffers, drained and cleared wetlands, and nutrient inputs to streams and wetlands as major stressors within this watershed. The LWP Project Atlas identified the Owl's Den Mitigation Site as a restoration opportunity with the potential to improve water quality, habitat, and hydrology within the Howards Creek watershed.

The project goals established in the mitigation plan (Wildlands, 2014) were completed with careful consideration of goals and objectives that were described in the RBRP and to address stressors identified in the LWP. The following project goals established include:

- Correct hydrologic modifications to streams including stream incision and dredging, bank erosion, lowering of the local water table, sedimentation, and loss of riparian buffer and floodplain functions.
- Improve hydrology and function of previously drained and cleared wetlands.
- Re-establish riparian buffer and wetland vegetation communities.
- Reduce excess sediment to downstream waters by stabilizing streams and revegetating site.
- Reduce nutrient loads to downstream waters by improving wetlands and buffers to treat runoff.

Secondary project goals include:

- Improve instream habitat by diversifying the stream bedform and introducing habitat structures and wood debris.
- Reduce agricultural pollution from pesticides and herbicides used on adjacent fields by improving wetland and buffers to treat runoff.

The Site construction and as-built surveys were completed between May 2015 and August 2015. A conservation easement is in place on 12.87 acres of the riparian corridors to protect them in perpetuity. Monitoring Year (MY) seven (7) assessments and Site visits were completed between March and November 2022 to assess the condition of the project. Detailed monitoring and analysis of vegetation and channel cross-sectional dimensions, visual observation data, hydrology data, and management practices are included in this report.

This is the seventh and final monitoring year (MY7) as established in the Mitigation Plan (Wildlands, 2014). The Site will be presented to the Interagency Review Team (IRT) for regulatory closeout in 2023. Overall, the Site has met the required vegetation, stream, and hydrology success criteria for MY7. The planted stem density for the Site is 479 stems per acre with all vegetation plots individually exceeding the final density success criteria of 210 stems per acre. The average stem height for the Site is 16.4 feet with eleven of thirteen plots individually meeting the final height success criteria of 10 feet. The Site met the bankfull success criteria in MY2, and multiple bankfull events were recorded in MY7. Cross-section surveys confirm that stream channels have remained morphologically stable with only minimal adjustment when compared to as-built. All wetland gages, except for GWG1, met the wetland hydrology success criteria during MY7. Throughout the post-construction monitoring period, apart from GWG1, all wetland gages have individually met wetland hydrology success criteria for a majority of the monitoring years. In MY6, Wildlands concluded that GWG1 was installed on the edge of a localized high area within the proposed wetland re-establishment boundary and 0.103 acres was determined to be “at risk.” Wildlands is no longer seeking credit for this area. The MY7 visual assessments revealed minor areas of concern which included pockets of invasive plant species, beaver activity, and isolated aggradation and bank scour. These areas will continue to be monitored and adaptive management will be performed as needed through closeout.

OWL'S DEN MITIGATION SITE

Monitoring Year 7 Annual/Closeout Report

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APPENDICES

Section 1: PROJECT OVERVIEW

The Site is located in central Lincoln County within the Catawba River Basin (USGS Hydrologic Unit 03050102) and is located off of Owl's Den Road northwest of Lincolnton, North Carolina. The Site is located in the Inner Piedmont Belt of the Piedmont Physiographic Province (USGS, 1998). The project watershed is dominated by agricultural and forested land. The drainage area for the Site is 152 acres. (0.24 square miles).

The project streams include unnamed tributaries to Howards Creek (HC1 and HC2). Stream restoration reaches included HC1 (Reach 1 and 2) and HC2 comprising 2,453 linear feet (LF) of perennial stream channel. The riparian areas were planted with native vegetation to improve habitat and protect water quality. Wetland components included rehabilitating 2.82 acres of existing wetlands and re-establishing 6.67 acres of wetlands.

Construction activities were completed by Land Mechanic Designs, Inc. in July 2015. Planting and seeding activities were completed by Bruton Natural Systems, Inc. in January 2016. A conservation easement has been recorded and is in place on 12.87 acres (Deed Book 2455, Page Number 864) within a tract owned by Owl's Den Farm, LLC. The project is expected to generate 2,453.000 stream mitigation units (SMU's) and 8.835 wetland mitigation units (WMUs). Wildlands identified 0.103 wetland credits "at risk" and expects that only 8.835 credits will be released. The credit loss of 0.103 WMUs has not been deducted from the Project Components and Mitigation Credits table in Appendix 1. This is the seventh and final monitoring year (MY7) as established in the Mitigation Plan (Wildlands, 2014). The site will be presented to the Interagency Review Team (IRT) for regulatory closeout in 2023. Appendix 1 provides more detailed project activity, history, contact information, and watershed/site background information for this project.

Directions and a map of the Site are provided in Figure 1 and project components are illustrated for the Site in Figure 2.

1.1 Project Goals and Objectives

Prior to construction activities, the streams on the Site had been straightened, widened, and deepened to provide drainage for surrounding cropland. The adjacent floodplain areas had been cleared and maintained to support agricultural activities. Table 10a and b in Appendix 4 present the pre-restoration conditions in detail.

The Site will help address stressors identified in the LWP and provide numerous ecological benefits within the Catawba River Basin. While many of these benefits are limited to the Owl's Den project area, others, such as pollutant removal, reduced sediment loading, and improved aquatic and terrestrial habitat, many goals have effects extending well beyond the watershed. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals established were completed with careful consideration of goals and objectives in the RBRP and address stressors identified in the LWP while also meeting the DMS mitigation needs.

The primary objectives of the Owl's Den Mitigation Site address stressors identified in the LWP and included the following:

- **Correct hydrologic modifications to streams including stream incision and dredging, bank erosion, lowering of the local water table, sedimentation, and loss of riparian buffer and floodplain functions.** The project re-connected streams with a stable floodplain using Priority 1 restoration techniques. The Priority 1 restoration eliminated vertically incised channels on site.

Stream banks were stabilized with grading, in-stream structures, and planting. By stabilizing stream banks on site, sediment loading should be reduced in the receiving watershed.

- **Improve hydrology and function of previously drained and cleared wetlands.** The project restored hydrologic connections to existing wetlands using Priority 1 stream restoration to raise the local water table and increase overbank flooding. The project extended existing wetland zones into adjacent areas and established wetland vegetation throughout the site.
- **Re-establish wetland hydrology and function in relic wetland areas.** Removal of historic overburden uncovered relic hydric soils and bringing local water table elevations closer to the ground surface. Disking and roughening of wetland re-establishment areas should increase retention times and improve natural infiltrative processes.
- **Re-establish riparian buffer and wetland vegetation communities.** A native vegetation community was planted on the site to revegetate the riparian buffers and wetlands and return the functions associated with these wooded areas.
- **Reduce excess sediment to downstream waters by stabilizing streams and revegetating site.** Stream banks were stabilized on all project reaches. The site was also revegetated with a native forest community to prevent erosion and sedimentation from overland runoff of agricultural lands and filter runoff from adjacent fields.
- **Reduce nutrient and agricultural pollutant inputs to streams and wetlands.** Increased retention times along with reestablished vegetation in restored wetland areas will reduce fertilizers used in blackberry and soybean agricultural production before runoff enters the streams.

Secondary project goal include:

- **Improve instream habitat by diversifying the stream bedform and introducing habitat structures and woody debris.** Large woody debris, brush toe meander bends, other woody structures, and native stream bank vegetation were installed to improve both instream and terrestrial habitat value throughout the riparian corridor.
- **Reduce agricultural pollution from pesticides and herbicides used on adjacent fields by improving wetlands and buffers to treat runoff.** Restored wetland areas will provide treatment for agricultural runoff from blackberry and soybean fields that are sprayed with pesticides and herbicides.

1.2 Monitoring Year 7 Data Assessment

Annual monitoring and quarterly site visits were conducted during MY7 to assess the condition of the project. The stream, vegetation, and hydrologic success criteria for the Site follows the approved success criteria presented in the Owl's Den Mitigation Plan (Wildlands, 2014). The following sections provide detailed monitoring and analysis of vegetation and channel cross-sectional dimensions, visual observation data, hydrology data, and management practices observed during MY7.

1.2.1 Stream Assessment

Morphological surveys were conducted in May 2022. Throughout the Site, the cross-section (XS) survey results indicate that channel dimensions are stable and continuing to perform as expected with minimal adjustments when compared to as-built. A reduction in cross-sectional area is present on XS5 along HC1 Reach (R) 2 due to the development of a point bar and sediment storage in the pool. It is anticipated that pool depth will return to depths similar to those at as-built as the channel continues to transport the sediment load downstream. As discussed in previous monitoring years, XS8 on the downstream end of HC1 R2 has experienced a rise in bank height, narrowing of the channel, and an increase in cross-sectional area due to fine sediment deposition from the backwater effects of Howard's Creek. This

floodplain deposition has increased bank height by approximately three feet over the original, MY0, bank heights in some areas. Though the bank height has adjusted, the channel bed has remained at nearly the same elevation as recorded in MY0 and does not appear to be vertically or laterally unstable.

Overall, both HC1 R1 and R2 have remained stable throughout the seven years of monitoring. The channels have maintained a stable pool-riffle sequence and continue to function as designed. Refer to Appendix 2 for the visual stability assessment tables (5a-5c), the Current Condition Plan View (CCPV) maps, and reference photographs and Appendix 4 for cross-section plots and Tables 11 and 12a-12c for cross-section dimensions.

1.2.2 Stream Areas of Concern and Management Activity

The streams on Site are functioning as designed. MY7 visual stream assessments revealed minimal areas of concern including instances of scour on HC1 Reach 2 and localized aggradation on HC2. Silky willow (*Salix sericea*) and black willow (*Salix nigra*) live stakes were added along the banks of HC1 Reach 2 near the confluence of Howard Creek to help stabilize channel banks in areas experiencing scour. While grade control and bank protection structures are still in place, additional bank scour was observed in MY7 at stations 116+15 and 116+40. Currently, these areas have no negative impact on overall stream function or stability.

Beaver dams on project streams and downstream of the project area on Howard's Creek have caused floodplain inundation and sediment deposition on Site. To help control beaver activity within the Site, Animal and Plant Inspection Service (APHIS) and Wildlands have been actively monitoring the Site throughout the seven years of monitoring. During MY7, on March 8th, 2022, APHIS removed two beaver dams on HC1 Reach 2, above and below the culvert. During a Site visit on April 21st, 2022, APHIS trapped a male and female beaver, and removed another dam on HC1 Reach 2. During a Site visit on August 3rd, 2022, Wildlands noted that beavers were still active on the Site, as dams above and below the crossing had been re-established. These dams were removed by Wildlands on August 4th, 2022, and APHIS was notified of the beaver activity. On September 13th, 2022, APHIS removed 2 more dams and set traps, but no beavers were caught in the following weeks. During the final Site visit on November 14th, several on-site beaver dams were removed; additionally, a large dam directly downstream of the project area was observed on Howard's Creek. Removed beaver dams and current stream areas of concern are depicted on the CCPV Figures in Appendix 2, along with the visual stability assessment tables.

1.2.3 Stream Hydrologic Assessment

The stream hydrology success criteria were met within the first two years of monitoring on HC1 and HC2 with reaches experiencing 28 and 29 events throughout the first six monitoring years, respectively. In MY7, both streams recorded at least four bankfull events. HC1 Reach 2 exhibited prolonged floodplain inundation from August 1st to September 10th due to beaver dams. There is a corresponding drop in water level on the stream hydrographs associated with dam removal. Refer to Appendix 5 for hydrologic summary data and plots.

In May of 2022, the barotroll malfunctioned and could not be downloaded for the remainder of monitoring year seven. The cause of the malfunction is likely due to ants, which laid eggs inside the hardware of the data logger. Data for the rest of the year were calibrated from the Wyant Lands Mitigation Site, which is in Lincoln County approximately 3.5 miles north of the Owl's Den Mitigation Site. Data from both barotrolls were plotted over time and confirmed that both Sites recorded similar atmospheric pressure readings throughout the year.

1.2.4 Wetland Assessment

Following construction, groundwater gages (GWGs) were distributed so that the data collected would provide a reasonable indication of groundwater levels throughout the wetland components on the Site. A gage was established in MY0 in an adjacent reference wetland and is being utilized to compare its hydrologic response with the on-site restored wetland areas. Rainfall data was collected from an existing NC CRONOS station, Lincolnton 2 NW, NC (2022). All monitoring gages were downloaded quarterly and maintained on an as-needed basis.

As discussed in previous monitoring years, an additional gage (GWG15) was added in December 2018 to define the wetland re-establishment area near GWG1. A soil temperature probe was also installed during December 2018. The soil probe was installed to verify the dates of the growing season, March 28th to November 5th (223 days in 2022). The final performance standard established for wetland hydrology is free groundwater surface within 12 inches of the ground surface for 18 consecutive days (8.1%) of the defined growing season under typical precipitation conditions.

In MY7, 14 out of 15 (93%) GWGs met the hydrologic wetland success criteria defined for Lincoln County. Gages with measurements meeting the minimum requirement of consecutive days ranged from 13% to 100% of the growing season. GWG1 was the only gage that failed to meet the minimum requirement in MY7, as well as 6 out of 7 years of annual monitoring. In August of 2022, the probe battery at GWG14 died, and did not record data for the remainder of monitoring year seven. GWG14 met the hydrologic wetland success criteria (128 consecutive days) before the probe battery died; therefore, the missing interval of data did not affect the overall result for GWG14. Individual results over the seven years of monitoring can be found in Table 14 in Appendix 5.

Due to the lack of hydrologic success for GWG1, in MY6, Wildlands took several soil borings to assess the extent of the wetland re-establishment area represented by the gage. Results showed that there were no hydrologic or hydric soil indicators that would support wetland re-establishment in this area, and it was likely that GWG1 was installed on the edge of a localized high area within the proposed wetland re-establishment boundary. Wildlands is no longer seeking wetland re-establishment credit for the localized high area totaling 0.103 acres that is considered to be “at risk.” The project will still provide 8.835 riparian wetland mitigation units (WMUs), which exceeds the contract amount of 8 WMUs; therefore, removing this “at risk” area from the wetland re-establishment credit request will not affect Wildland’s delivery of the required WMU credits for this project. The “at risk” acreage has not been deducted from Table 1.

Refer to the CCPVs in Appendix 2 for the groundwater gage locations, and Appendix 5 for groundwater hydrology data and plots.

1.2.5 Vegetation Assessment

The planted stem density for the Site for MY7 is 479 stems per acre with all 13 vegetation plots individually meeting the MY7 success criteria of 210 stems per acre. The average stem height for the Site was 16.4 feet with eleven of thirteen plots individually meeting the final height success criteria of 10 feet. 94% of monitored stems had a vigor of 3 or greater, indicating that planted stems within the project limits are healthy and thriving. The individual stem density per plot data is available in Appendix 3.

1.2.6 Vegetation Areas of Concern and Management Activity

The vegetation areas of concern were monitored and treated in MY7. Herbaceous cover has become well-established throughout the Site. The previously reported area of low stem vigor along the right

floodplain of HC1 Reach 1 and Reach 2 has continued to improve and has lessened in size and severity well below the 0.1-acre mapping threshold; therefore, it is no longer shown on the CCPV maps.

In total, over 98% of the Site is free of invasive and undesirable species. In April 2022, invasive species including Japanese honeysuckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), and Chinese privet (*Ligustrum sinsense*) were treated by cut-stump chemical application. Cattails (*Typha latifolia*) and in-stream marsh dewflower (*Murdannia keisak*) found growing near the confluence of HC1 R1 and HC2 were treated in September 2022. While native to North Carolina, climbing hempvine (*Mikania scadens*) caused vine strangulation and reduced stem height in vegetation plots 1 and 3. The hempvine was hand-pulled in June and July 2022. Treatment of invasive species on Site will continue until closeout, which is projected for 2023.

DMS conducted an easement inspection of the Owls Den Site on September 14th, 2022. DMS provided an inspection report and made several requests to preserve the integrity of the conservation easement. They are as follows:

- Upgrade marking at three mowed areas with supplemental posts and horse tape, notify landowner of new posts.
- Repair damaged corner marker and sign at Mowed Area 1 and add tall PVC for visibility in this high traffic area.
- Trim vegetation blocking view of marker posts.
- Add missing signs to in-line markers (optional but recommended for consistency).

Wildlands successfully completed all action items on November 14th, 2022. Refer to Appendix 6 for the easement inspection report, as well reference maps and photographs of the resolved boundary areas of concern.

1.3 Monitoring Year 7 Summary

This is the seventh and final monitoring year (MY7) as established in the Mitigation Plan (Wildlands, 2014). The Site will be presented to the Interagency Review Team (IRT) for regulatory closeout in 2023. Overall, the Site has met the required vegetation, stream, and hydrology success criteria for MY7. The planted stem density for the Site is 479 stems per acre with all vegetation plots individually exceeding the final density success criteria of 210 stems per acre. The average stem height for the Site is 16.4 feet with eleven of thirteen plots individually meeting the final height success criteria of 10 feet. The Site met the bankfull success criteria in MY2, and multiple bankfull events were recorded in MY7. Cross-section surveys confirm that stream channels have remained morphologically stable with only minimal adjustment when compared to as-built. All wetland gages, except for GWG1, met the wetland hydrology success criteria during MY7. Throughout the post-construction monitoring period, apart from GWG1, all wetland gages have individually met wetland hydrology success criteria for a majority of the monitoring years. In MY6, Wildlands concluded that GWG1 was installed on the edge of a localized high area within the proposed wetland re-establishment boundary and 0.103 acres was determined to be "at risk." Wildlands is no longer seeking credit for this area. The MY7 visual assessments revealed minor areas of concern which included pockets of invasive plant species, beaver activity, and isolated aggradation and bank scour. These areas will continue to be monitored and adaptive management will be performed as needed through closeout.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information can be found in the Mitigation Plan (Wildlands, 2014) document available on DMS website.

Section 2: METHODOLOGY

All Integrated Current Condition Mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. Stream gages to detect bankfull events were installed in surveyed riffle cross-sections and monitored quarterly. Hydrologic monitoring instrument installation are in accordance with the United States Army Corps of Engineers (USACE, 2005) standards, and monitoring with IRT's Stream and Wetland Mitigation Update (2016). Vegetation monitoring protocols followed the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008).

Section 3: REFERENCES

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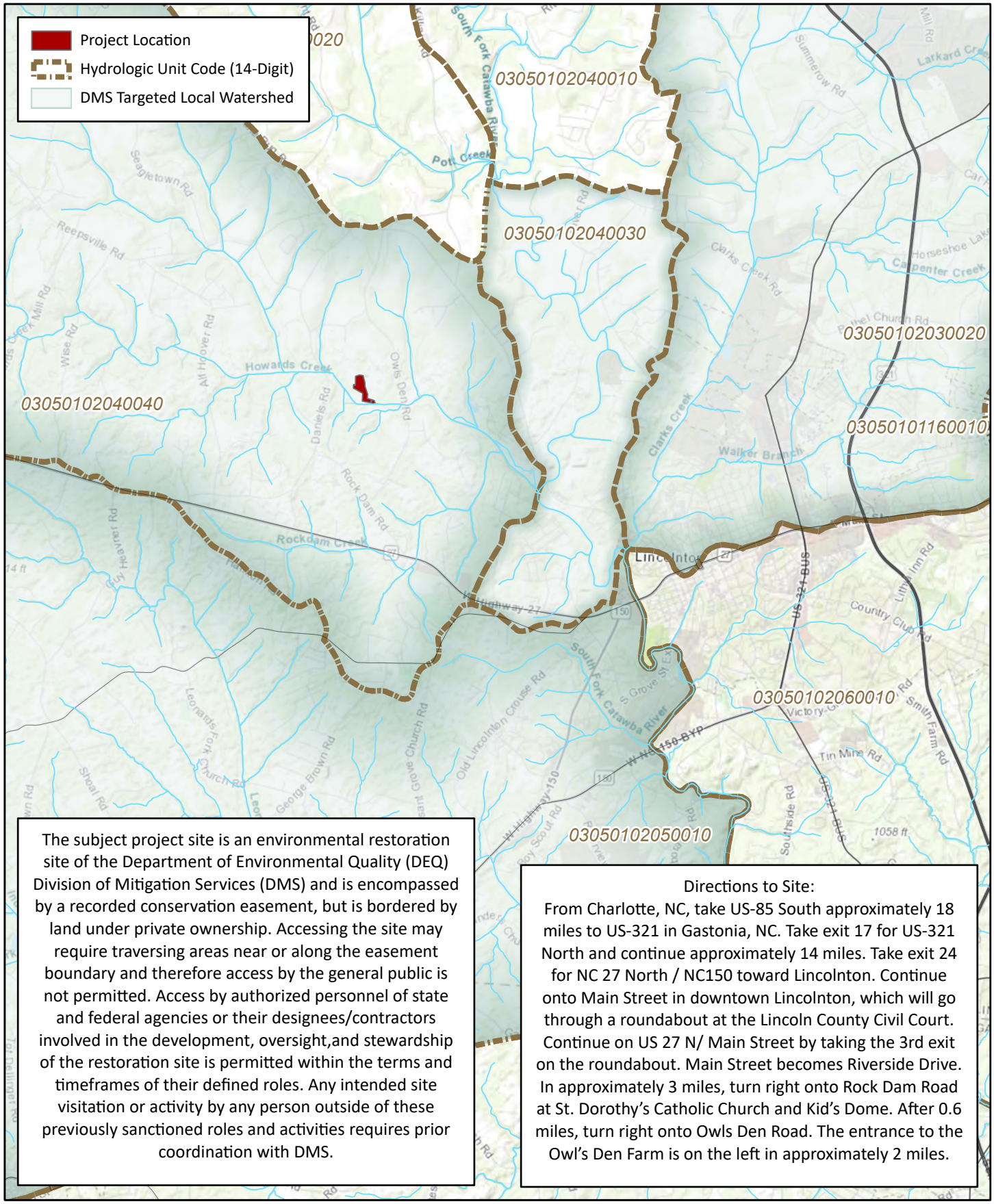
APPENDIX 1. General Figures and Tables



The subject project site is an environmental restoration site of the Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight,and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with DMS.

Directions to Site:

From Charlotte, NC, take US-85 South approximately 18 miles to US-321 in Gastonia, NC. Take exit 17 for US-321 North and continue approximately 14 miles. Take exit 24 for NC 27 North / NC150 toward Lincolnton. Continue onto Main Street in downtown Lincolnton, which will go through a roundabout at the Lincoln County Civil Court. Continue on US 27 N/ Main Street by taking the 3rd exit on the roundabout. Main Street becomes Riverside Drive. In approximately 3 miles, turn right onto Rock Dam Road at St. Dorothy's Catholic Church and Kid's Dome. After 0.6 miles, turn right onto Owls Den Road. The entrance to the Owl's Den Farm is on the left in approximately 2 miles.

WILDLANDS ENGINEERING

0 2 Miles

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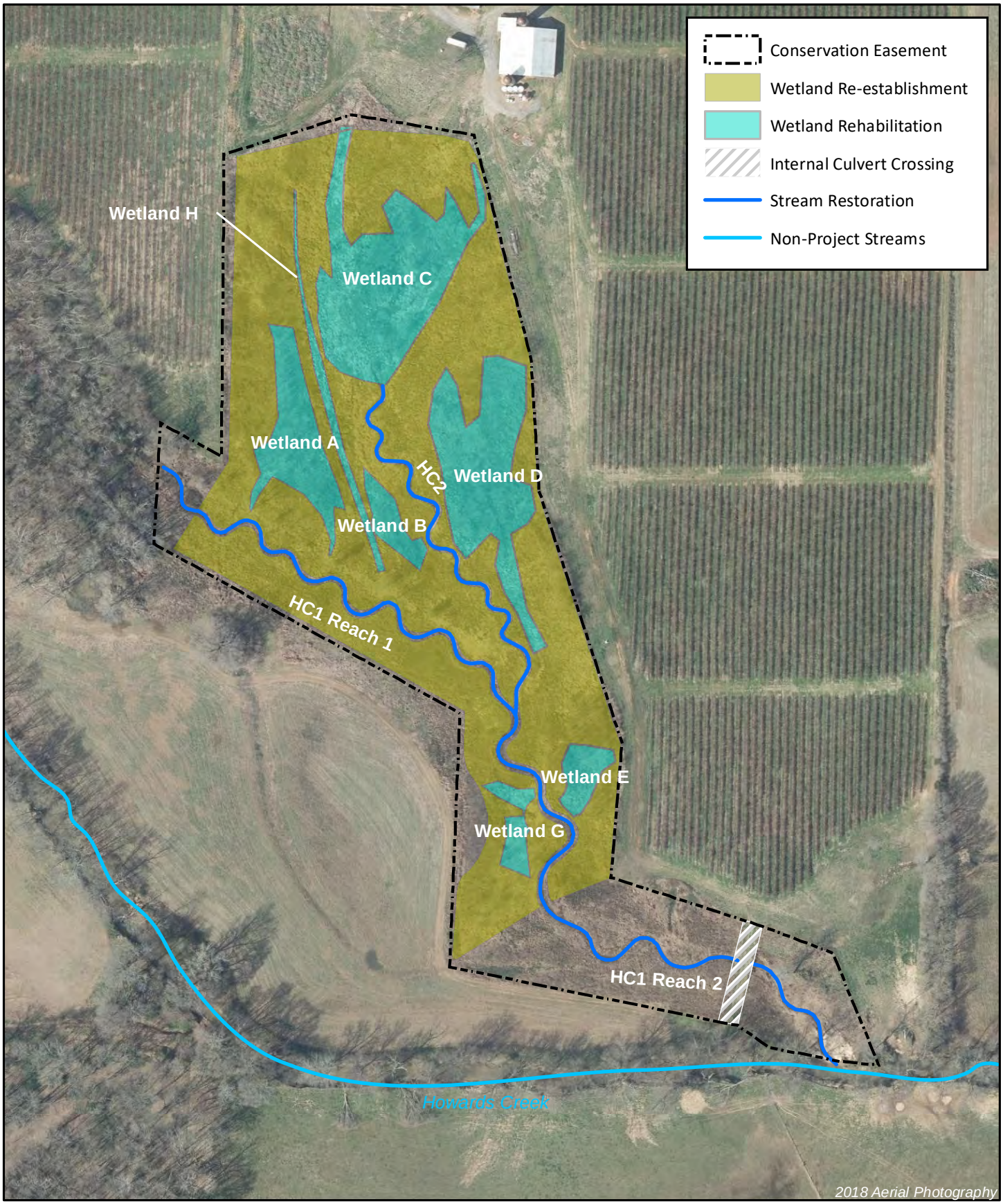
Figure 1 Vicinity Map
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Lincoln County, NC



WILDLANDS ENGINEERING

0 100 200 Feet

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Figure 2 Project Component/Asset Map
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
Lincoln County, NC

Table 1. Project Components and Mitigation Credits
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	2,453.000	N/A	8.938	N/A	N/A	N/A	N/A	N/A	N/A

Project Components							
Reach ID	As-Built Stationing / Location[1]	Existing Footage / Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage / Acreage[1]	Mitigation Ratio	Credits[1] (SMU / WMU)
STREAMS							
HC1 Reach 1	99+94 - 108+09	609	P1	Restoration	815	1:1	815.000
HC1 Reach 2	108+09 - 115+35	994	P1	Restoration	726	1:1	726.000
	115+65 - 117+79		P1	Restoration	214	1:1	214.000
HC2	200+00 - 206+98	444	P1	Restoration	698	1:1	698.000
WETLANDS							
Wetland A	N/A	0.44	Significant improvement to wetland functions	Rehabilitation	0.44	1.3:1	0.338
Wetland B	N/A	0.13	Significant improvement to wetland functions	Rehabilitation	0.13	1.3:1	0.100
Wetland C	N/A	1.03	Significant improvement to wetland functions	Rehabilitation	1.03	1.3:1	0.792
Wetland D	N/A	0.81	Significant improvement to wetland functions	Rehabilitation	0.81	1.3:1	0.623
Wetland E	N/A	0.13	Significant improvement to wetland functions	Rehabilitation	0.13	1.3:1	0.100
Wetland G	N/A	0.13	Significant improvement to wetland functions	Rehabilitation	0.13	1.3:1	0.100
Wetland H	N/A	0.15	Significant improvement to wetland functions	Rehabilitation	0.15	1.3:1	0.115
Wetland Re-Establishment Area[2,3]	N/A	n/a	Planting, hydrologic improvement	Re-Establishment	6.77	1:1	6.770

Component Summation						
Restoration Level	Stream (LF)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	2,453	-	-	-	-	-
Enhancement		-	-	-	-	-
Enhancement I	-					
Enhancement II	-					
Wetland Re-Establishment		6.77	-	-		
Wetland Rehabilitation	-	18.53	-	-		-

The 30 linear feet associated with the stream crossing on HC1 Reach 2 were excluded from the computations.
[1]Stream Mitigation Credits were adjusted in MY2 to reflect credits proposed in the mitigation plan using centerline alignment.
[2]Wetland Re-Establilishment credits were revised during the as-built as a result of an easement adjustment after mitigation plan was approved.

Table 2. Project Activity and Reporting History
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Activity or Report		Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan		July 2013	April 2014
Final Design - Construction Plans		March 2015	April 2015
Construction		May 2015 - July 2015	July 2015
Temporary S&E mix applied to entire project area[1]		May 2015 - July 2015	July 2015
Permanent seed mix applied to reach/segments		June 2015	July 2015
Bare root and live stake plantings for reach/segments		January 2016	January 2016
Baseline Monitoring Document (Year 0)	Stream Survey	June 2015	February 2016
	Vegetation Survey	January 2016	
Year 1 Monitoring	Stream Survey	April 2016	November 2016
	Vegetation Survey	September 2016	
Year 2 Monitoring	Stream Survey	March 2017	December 2017
	Vegetation Survey	July 2017	
Year 3 Monitoring	Stream Survey	April 2018	December 2018
	Vegetation Survey	September 2018	
Year 4 Monitoring	Supplemental Planting	March 2019	December 2019
	Stream Survey	N/A	
	Vegetation Survey	N/A	
	Beaver/Dam Removal	N/A	December 2019
Year 5 Monitoring	Stream Survey	March 2020	December 2020
	Vegetation Survey	July 2020	
	Invasive Species Treatment	March 2020	
	Beaver/Dam Removal	October 2020	
Year 6 Monitoring	Stream Survey	N/A	December 2021
	Vegetation Survey	N/A	
	Live Stake Installation	June 2021	
	Invasive Species Treatment	June 2021 - September 2021	
	Beaver/Dam Removal	November 2021	
Year 7 Monitoring	Stream Survey	May 2022	December 2022
	Vegetation Survey	August 2022	
	Invasive Species Treatment	June 2022 - September 2022	
	Beaver/Dam Removal	April, August - November 2022	

[1]Seed and mulch is added as each section of construction is completed.

Table 3. Project Contact Table
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Designer Emily Reinicker, PE	**Wildlands Engineering, Inc.** 1430 South Mint Street, Suite 104 Charlotte, NC 28203 704.332.7754, ext. 106
Construction Contractor	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers **Bare Roots** **Live Stakes**	**Bruton Natural Systems, Inc**
Monitoring Performers Monitoring, POC	**Wildlands Engineering, Inc.** Kristi Suggs 704.332.7754, ext. 110

Table 4. Project Information and Attributes

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Project Information			
Project Name	Owl's Den Mitigation Site		
County	Lincoln County		
Project Area (acres)	12.87		
Project Coordinates (latitude and longitude)	35°29'33.22" N, 81° 18'45.95" W		
Project Watershed Summary Information			
Physiographic Province	Inner Piedmont Belt of the Piedmont Physiographic Province		
River Basin	Catawba		
USGS Hydrologic Unit 8-digit	03050102		
USGS Hydrologic Unit 14-digit	03050102040040		
DWR Sub-basin	03-08-35		
Project Drainage Area (acres)	152		
Project Drainage Area Percentage of Impervious Area	<1%		
CGIA Land Use Classification	93% – Agriculture/Managed Herbaceous; 7% – Forested/Scrubland		
Reach Summary Information			
Parameters	**HC1 Reach 1**	**HC1 Reach 2**	**HC2**
Length of reach (linear feet) - Post-Restoration	815	940	698
Drainage area (acres)	62	152	27
NCDWR stream identification score	31.5	37.5	31.5
NCDWR Water Quality Classification	C		
Morphological Desription (stream type)	P	P	P
Evolutionary trend (Simon's Model) - Pre- Restoration	IV	IV	IV
Underlying mapped soils	Chewacla Loam, Helena sandy loam, Riverview loam, Worsham fine sandy loam		
Drainage class	---	---	---
Soil hydric status	---	---	---
Slope	0.0061	0.0075	0.0059
FEMA classification	AE*		
Native vegetation community	Piedmont Bottomland Forest		
Percent composition exotic invasive vegetation -Post-Restoration	0%		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	X	X	USACE Nationwide Permit No.27 (Action ID# SAW-2013-00717) and DWQ 401 Water Quality Certification No. 3885.
Waters of the United States - Section 401	X	X	
Division of Land Quality (Dam Safety)	N/A	N/A	N/A
Endangered Species Act	X	X	Owl's Den Mitigation Plan; Wildlands determined "no effect" on Lincoln County listed endangered species. May 18, 2015 email correspondence from USFWS indicating no effect on the northern long-eared bat.
Historic Preservation Act	X	X	No historic resources were found to be impacted (letter from SHPO dated 4/30/2013).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	X	X	Floodplain development permit issued by Lincoln County.
Essential Fisheries Habitat	No	N/A	N/A

*The project site reaches do not have regulated floodplain mapping, but are located within the Howards Creek floodplain.

APPENDIX 2. Visual Assessment Data

Conservation Easement
Wetland Re-establishment
Wetland Rehabilitation
Wetland Area at Risk - 0.103 ac.
Internal Culvert Crossing
Stream Restoration
Non-Project Streams
Bankfull
Structure
Cross - Sections
Reach Breaks
Stream Gage (SG)
Barotroll
Reference Gage
Soil Temperature Probe

Groundwater Gages (GWG) - MY7

Criteria Met - Yes
Criteria Met - No
Vegetation Plot - Criteria Met

Vegetation Areas of Concern - MY7

Climbing Hempvine
Honeysuckle

Stream Areas of Concern - MY7

Scour

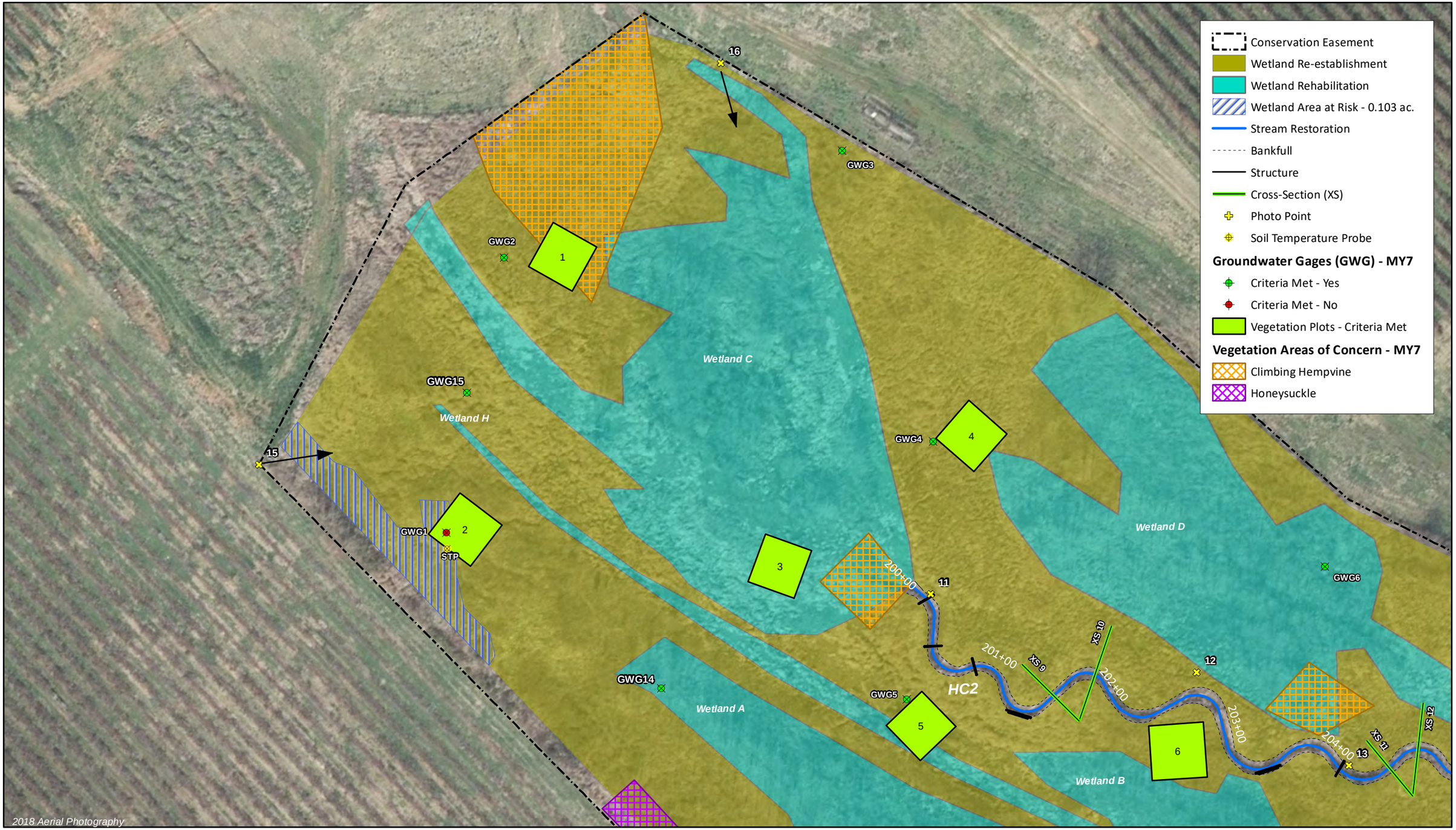
Sheet 1
Sheet 2
Sheet 3
GWG1
GWG2
GWG3
GWG4
GWG5
GWG6
GWG7
GWG8
GWG9
GWG10
GWG11
GWG12
GWG13
GWG14
GWG 15
STP
SG #1
SG #2
Reference Gage
Wetland A
Wetland B
Wetland C
Wetland D
Wetland E
Wetland G
Wetland H
HC1 Reach 1
HC1 Reach 2
HC2
XS 1
XS 2
XS 3
XS 4
XS 5
XS 6
XS 7
XS 8
XS 9
XS 10
XS 11
XS 12
XS 13
Howards Creek

2018 Aerial Photography

0 125 250 Feet

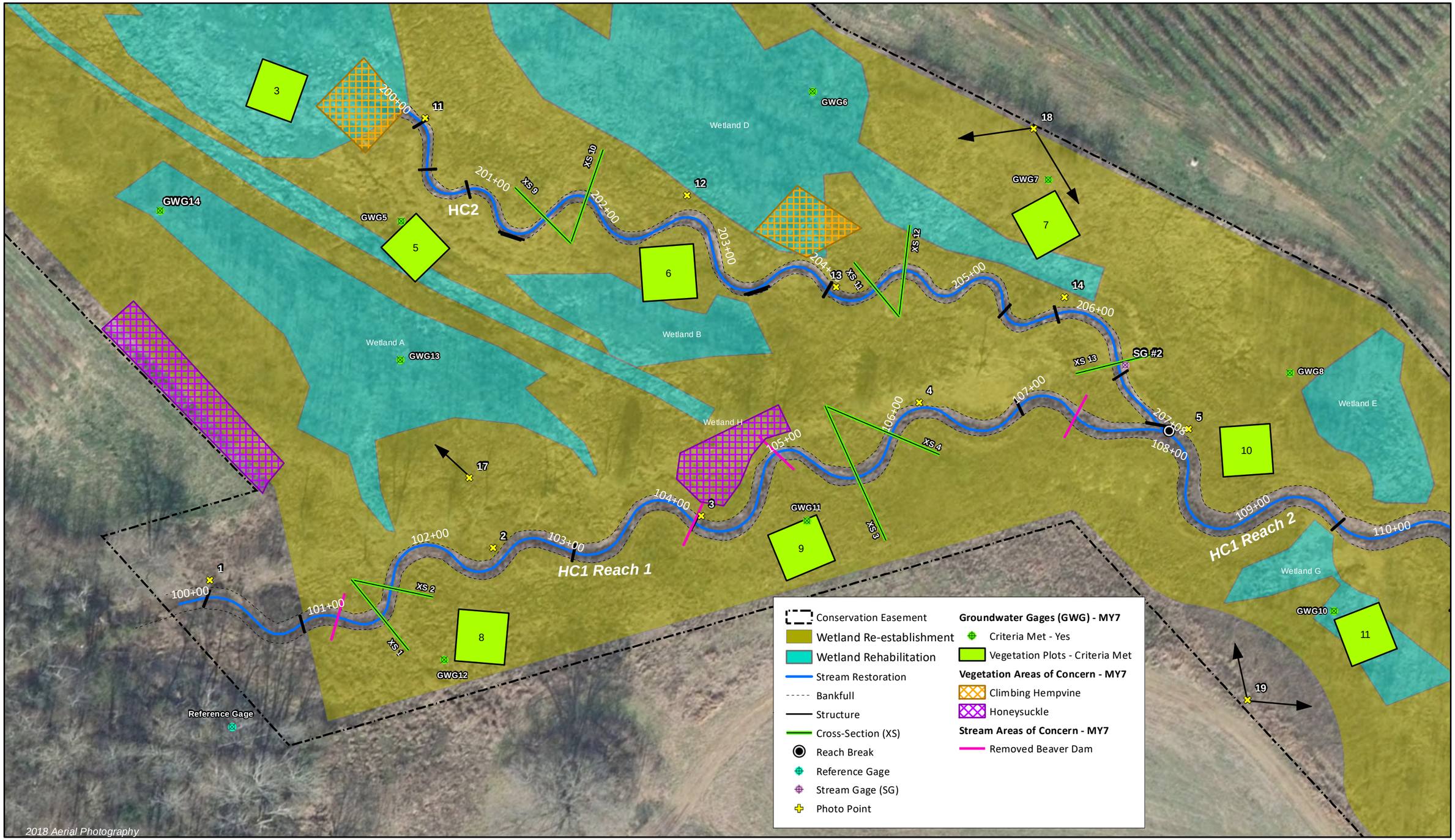
Figure 3.0 Integrated Current Condition Plan View (Key)
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Lincoln County, NC



0 30 60 Feet

Figure 3.1 Integrated Current Condition Plan View (Sheet 1 of 3)
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
Lincoln County, NC

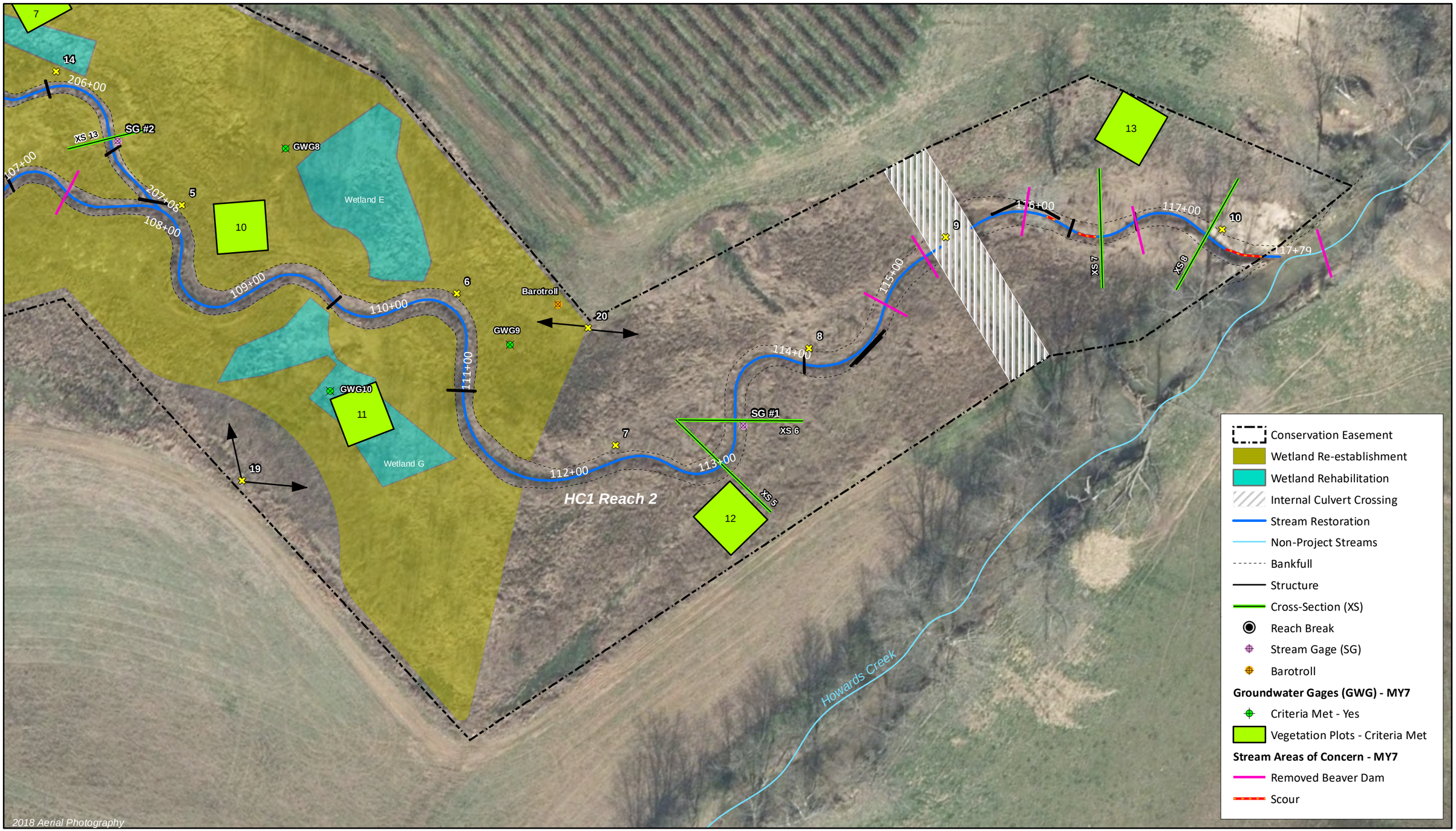


WILDLANDS ENGINEERING

0 30 60 Feet

Figure 3.2 Integrated Current Condition Plan View (Sheet 2 of 3)
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Lincoln County, NC



WILDLANDS ENGINEERING

0 30 60 Feet

Figure 3.3 Integrated Current Condition Plan View (Sheet 3 of 3)
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
Lincoln County, NC

Table 5a. Visual Stream Morphology Stability Assessment Table
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Reach: HC1 Reach 1										
Assessed Length	**820 LF**	**Date of Last Assessment: 11/14/2022**								
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Shallow and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Shallow Condition	Texture/Substrate	17	17			100%			
	3. Meander Pool Condition	Depth Sufficient	16	16			100%			
		Length Appropriate	16	16			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	16	16			100%			
		Thalweg centering at downstream of meander bend (Glide)	16	16			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	9	9			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	9	9			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	4	4			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%			

[1]Excludes constructed shallows since they are evaluated in channel category.

Table 5b. Visual Stream Morphology Stability Assessment Table
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Reach: HC1 Reach 2										
Assessed Length:	**940 LF**	**Date of Last Assessment: 11/14/2022**								
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Shallow and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Shallow Condition	Texture/Substrate	14	14			100%			
	3. Meander Pool Condition	Depth Sufficient	15	15			100%			
		Length Appropriate	15	15			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	15	15			100%			
		Thalweg centering at downstream of meander bend (Glide)	15	15			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			3	42	98%	Yes	42	No
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	3	42	98%	Yes	42	No
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	11	11			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	5	5			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	6	6			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%			

[1]Excludes constructed shallows since they are evaluated in channel category.

Table 5c. Visual Stream Morphology Stability Assessment Table
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Reach: HC2										
Assessed Length	**708LF**	**Date of Last Assessment: 11/14/2022**								
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Shallow and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Shallow Condition	Texture/Substrate	17	17			100%			
	3. Meander Pool Condition	Depth Sufficient	16	16			100%			
		Length Appropriate	16	16			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	16	16			100%			
		Thalweg centering at downstream of meander bend (Glide)	16	16			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	13	13			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	5	5			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed shallows since they are evaluated in channel category.

Table 6. Vegetation Condition Assessment Table

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Planted Acreage:	**13**	**Date of Last Assessment: 11/14/2022**			
Vegetation Category	**Definitions**	**Mapping Threshold (Ac)**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
Bare Areas	Very limited cover of both woody and herbaceous material.	0.1	0	0.0	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	0	0.00	0.0%
Areas of Low Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 Ac	0	0.0	0%
		Cumulative Total	**0**	**0.00**	**0.0%**

Easement Acreage	**35**	**Date of Last Assessment: 11/14/2022**			
Vegetation Category	**Definitions**	**Mapping Threshold (SF)**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1,000	5	0.48	1.4%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	None	0	0	0%

Stream Photographs

Monitoring Year 7

	
Photo Point 1 – HC1 Reach 1 view upstream (4/5/2022)	Photo Point 1 – HC1 Reach 1 view downstream (4/5/2022)
	
Photo Point 2 – HC1 Reach 1 view upstream (4/5/2022)	Photo Point 2 – HC1 Reach 1 view downstream (4/5/2022)
	
Photo Point 3 – HC1 Reach 1 view upstream (4/5/2022)	Photo Point 3 – HC1 Reach 1 view downstream (4/5/2022)

Photo Point 4 – HC1 Reach 1 view upstream (4/5/2022)

Photo Point 4 – HC1 Reach 1 view downstream (4/5/2022)

Photo Point 5 – HC1 Reach 1 & HC2 view upstream (4/5/2022)

Photo Point 5 – HC2 view upstream (4/5/2022)

Photo Point 5 – HC1 Reach 1 view downstream (4/5/2022)

	
Photo Point 6 – HC1 Reach 2 view upstream (4/5/2022)	Photo Point 6 – HC1 Reach 2 view downstream (4/5/2022)
	
Photo Point 7 – HC1 Reach 2 view upstream (4/5/2022)	Photo Point 7 – HC1 Reach 2 view downstream (4/5/2022)
	
Photo Point 8 – HC1 Reach 2 view upstream (4/5/2022)	Photo Point 8 – HC1 Reach 2 view downstream (4/5/2022)

	
Photo Point 9 – HC1 Reach 2 view upstream (4/5/2022)	Photo Point 9 – HC1 Reach 2 view downstream (4/5/2022)
	
Photo Point 10 – HC1 Reach 2 view upstream (4/5/2022)	Photo Point 10 – HC1 Reach 2 view downstream (4/5/2022)
	
Photo Point 11 – HC2 view upstream (4/5/2022)	Photo Point 11 – HC2 view downstream (4/5/2022)

	
Photo Point 12 – HC2 view upstream (4/5/2022)	Photo Point 12 – HC2 view downstream (4/5/2022)
	
Photo Point 13 – HC2 view upstream (4/5/2022)	Photo Point 13 – HC2 view downstream (4/5/2022)
	
Photo Point 14 – HC2 view upstream (4/5/2022)	Photo Point 14 – HC2 view downstream (4/5/2022)

Wetland Photographs

Monitoring Year 7

Photo Point 15 – looking southeast (4/5/2022)

Photo Point 16 – looking southwest (4/5/2022)

Photo Point 17 – looking north (4/5/2022)

Photo Point 18 – looking northwest (4/5/2022)

Photo Point 18 – looking southwest (4/5/2022)

	
Photo Point 19 – looking northeast (4/5/2022)	Photo Point 19 – looking southeast (4/5/2022)
	
Photo Point 20 – looking northwest (4/5/2022)	Photo Point 20 – looking southeast (4/5/2022)

Areas of Concern Photographs

Monitoring Year 7

HC1 Reach 2, station 116+15 – Bank scour *(11/8/2022)*

HC1 Reach 2, station 116+40 – Bank scour *(11/8/2022)*

HC1 Reach 2, station 117+50 to 117+79 – Bank scour *(11/8/2022)*

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Plot	MY7 Density Criteria Met (Y/N)	Tract Mean
1	Y	100%
2	Y	
3	Y	
4	Y	
5	Y	
6	Y	
7	Y	
8	Y	
9	Y	
10	Y	
11	Y	
12	Y	
13	Y	

Table 8. CVS Vegetation Plot Metadata
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Report Prepared By	Sara Thompson
Date Prepared	9/8/2022
Database Name	Owls Den MY7 cvs-eep-entrytool-v2.3.1.mdb
Database Location	\\192.168.3.7\projects\ActiveProjects\005-02140 Owls Den\Monitoring\Monitoring Year 7 (2022)\Vegetation Assessment
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and Spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	95808
project Name	Owls Den Mitigation Site
Description	50585.71
Required Plots (calculated)	13
Sampled Plots	13

Table 9a. Planted and Total Stems (Species by Plot with Annual Means)

Owl's Den Mitigation Site

DMS Project No. 95808

Monitoring Year 7 - 2022

Current Plot Data (MY7 2022)																			
Scientific Name	**Common Name**	**Species Type**	**Vegetation Plot 1**			**Vegetation Plot 2**			**Vegetation Plot 3**			**Vegetation Plot 4**			**Vegetation Plot 5**			**Vegetation Plot 6**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Boxelder	Tree																	130
Acer rubrum	Red maple	Tree	1	1	1	1	1	1	2	2	6						5			
Alnus serrulata	Hazel alder	Shrub									6									
Betula nigra	River birch	Tree	1	1	1	1	1	1	2	2	3	4	4	4				1	1	1
Diospyros virginiana	Common persimmon	Tree							1	1	3	2	2	2	1	1	1			
Fraxinus pennsylvanica	Green ash	Tree	4	4	4	3	3	5	2	2	2	2	2	2	4	5	5	5	5	5
Lindera benzoin	northern spicebush	Shrub						1												
Platanus occidentalis	American sycamore	Tree	3	3	3	2	2	2	3	3	3	1	1	1	2	2	2	5	5	5
Quercus michauxii	Swamp chestnut oak	Tree				3	3	3	1	1	1							1	1	1
Quercus nigra	Water oak	Tree																		
Quercus phellos	Willow oak	Tree				2	2	2	1	1	1	4	4	4						
Rhus	Sumac	Shrub																		
Robinia pseudoacacia	Black locust	Tree																		
Salix nigra	Black willow	Tree																		
Sambucus canadensis	Common Elderberry	Shrub																		
Sambucus nigra	European black elderberry	Shrub																		
Ulmus americana	American elm	Tree																		
		Stem count	9	9	9	12	12	15	12	12	25	13	13	13	7	8	13	12	12	142
		Size (ares)		1			1			1			1			1			1	
		Size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02	
		Species count	4	4	4	6	6	7	7	7	8	5	5	5	3	3	4	4	4	5
		Stems per ACRE	364	364	364	486	486	607	486	486	1012	526	526	526	283	324	526	486	486	5747

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Volunteers included

PnoLS: Number of planted stems excluding live stakes

P-All: Number of planted stems including live stakes

T: Total stems

Table 9b. Planted and Total Stems (Species by Plot with Annual Means)

Owl's Den Mitigation Site

DMS Project No. 95808

Monitoring Year 7 - 2022

Current Plot Data (MY7 2022)																							
Scientific Name	**Common Name**	**Species Type**	**Vegetation Plot 7**			**Vegetation Plot 8**			**Vegetation Plot 9**			**Vegetation Plot 10**			**Vegetation Plot 11**			**Vegetation Plot 12**			**Vegetation Plot 13**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Boxelder	Tree												6									24
Acer rubrum	Red maple	Tree			19				2	2	12				2	2	3			7			
Alnus serrulata	Hazel alder	Shrub																		1			
Betula nigra	River birch	Tree	3	3	3	3	3	10	4	4	14	2	2	2	1	1	2	2	2	13	2	2	2
Diospyros virginiana	Common persimmon	Tree	2	2	2	1	1	1				2	2	6				2	2	2	1	1	1
Fraxinus pennsylvanica	Green ash	Tree	2	2	5	5	5	15	4	4	44	3	3	3	5	5	20	5	5	20	4	4	19
Lindera benzoin	northern spicebush	Shrub																					
Platanus occidentalis	American sycamore	Tree	1	1	1	3	3	3	4	4	4	1	1	1	3	3	3	1	1	1	1	1	1
Quercus michauxii	Swamp chestnut oak	Tree							1	1	1							1	1	1			
Quercus nigra	Water oak	Tree										1	1	1									
Quercus phellos	Willow oak	Tree	1	1	1	1	1	1				1	1	1	2	2	2	4	4	4	6	6	6
Rhus	Sumac	Shrub																					
Robinia pseudoacacia	Black locust	Tree																					
Salix nigra	Black willow	Tree																					
Sambucus canadensis	Common Elderberry	Shrub																					
Sambucus nigra	European black elderberry	Shrub																					
Ulmus americana	American elm	Tree									4												
		Stem count	9	9	31	13	13	30	15	15	79	10	10	20	13	13	30	15	15	49	14	14	53
		Size (ares)		1			1			1			1			1			1			1	
		Size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02	
		Species count	5	5	6	5	5	5	5	5	6	6	6	7	5	5	5	6	6	8	5	5	6
		Stems per ACRE	364	364	1255	526	526	1214	607	607	3197	405	405	809	526	526	1214	607	607	1983	567	567	2145

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Volunteers included

PnoLS: Number of planted stems excluding live stakes

P-All: Number of planted stems including live stakes

T: Total stems

Table 9c. Planted and Total Stems (Species by Plot with Annual Means)

Owl's Den Mitigation Site

DMS Project No. 95808

Monitoring Year 7 - 2022

Annual Means																				
Scientific Name	**Common Name**	**Species Type**	**MY7 (7/2022)**			**MY5 (7/2020)**			**MY3 (9/2018)**			**MY2 (7/2017)**			**MY1 (9/2016)**			**MY0 (1/2016)**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Boxelder	Tree			160			27			30			16						
Acer rubrum	Red maple	Tree	8	8	54	8	8	34	8	8	29	7	7	20	8	8	16	9	9	10
Alnus serrulata	Hazel alder	Shrub			7						4			3						
Betula nigra	River birch	Tree	26	26	56	27	27	31	25	25	38	27	27	27	27	27	27	33	33	33
Diospyros virginiana	Common persimmon	Tree	12	12	18	12	12	13	11	11	19	14	14	19	16	16	18	21	21	21
Fraxinus pennsylvanica	Green ash	Tree	48	49	149	51	51	243	42	42	124	49	49	69	51	51	59	50	50	55
Lindera benzoin	northern spicebush	Shrub			1													45	45	45
Platanus occidentalis	American sycamore	Tree	30	30	30	32	32	40	29	29	48	30	30	33	33	33	35	17	17	17
Quercus michauxii	Swamp chestnut oak	Tree	7	7	7	7	7	7	6	6	6	7	7	7	13	13	13			
Quercus nigra	Water oak	Tree	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Quercus phellos	Willow oak	Tree	22	22	22	22	22	22	22	22	22	27	27	27	31	31	31	33	33	33
Rhus	Sumac	Shrub									9			1						
Robinia pseudoacacia	Black locust	Tree						1												
Salix nigra	Black willow	Tree						5			1			1			1			
Sambucus canadensis	Common Elderberry	Shrub									4			15			4			2
Sambucus nigra	European black elderberry	Shrub						25												
Ulmus americana	American elm	Tree			4															
		Stem count	154	155	509	160	160	449	144	144	335	162	162	239	180	180	205	208	208	216
		Size (ares)		13			13			13			13			13			13	
		Size (ACRES)		0.32			0.32			0.32			0.32			0.32			0.32	
		Species count	8	8	12	8	8	12	8	8	13	8	8	13	8	8	10	7	7	8
		Stems per ACRE	479	479	1584	498	498	1398	448	448	1043	504	504	744	560	560	638	647	647	672

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Volunteers included

PnoLS: Number of planted stems excluding live stakes

P-All: Number of planted stems including live stakes

T: Total stems

Table 9d. Planted Stem Average Heights Across All Years
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Average Stem Height (ft) by Plot						
	MY0	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Permanent Plot 1	2.0	2.1	2.3	3.7	4.7	6.2
Permanent Plot 2	1.9	2.2	2.5	4.8	9.3	18.4
Permanent Plot 3	1.9	1.9	2.8	5.1	10.0	19.6
Permanent Plot 4	2.0	1.8	2.1	5.1	11.8	20.9
Permanent Plot 5	1.8	1.4	1.9	4.4	4.5	7.3
Permanent Plot 6	1.5	2.2	4.0	5.4	13.0	23.4
Permanent Plot 7	1.8	1.9	2.0	3.2	6.9	10.7
Permanent Plot 8	1.5	1.7	2.2	4.4	9.4	14.7
Permanent Plot 9	1.7	1.7	2.1	4.0	8.3	15.2
Permanent Plot 10	1.9	2.0	2.6	4.5	7.1	16.2
Permanent Plot 11	1.8	1.8	2.3	6.1	9.6	19.7
Permanent Plot 12	1.7	2.4	2.8	5.2	10.7	13.2
Permanent Plot 13	1.8	2.4	3.5	7.9	17.0	22.0
Permanent Plot Site Average	**1.8**	**2.0**	**2.5**	**4.9**	**9.4**	**15.9**

Table 9e. Stems Per Plot Across All Years
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Plot	MY7 (2022)			MY5 (2020)			MY3 (2018)			MY2 (2017)			MY1 (2016)			MY0 (2016)		
	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac	Planted Stems	Total Stems	Total Stems/Ac
Permanent Plot 1	9	9	364	10	10	405	10	10	405	11	11	445	14	14	567	16	16	648
Permanent Plot 2	12	15	607	12	15	607	10	10	405	12	12	486	12	12	486	16	16	648
Permanent Plot 3	12	24	971	13	20	809	13	25	1,012	13	21	850	15	18	728	17	17	688
Permanent Plot 4	13	13	526	13	13	526	12	12	486	14	14	567	16	16	648	16	16	648
Permanent Plot 5	8	13	526	9	9	364	3	3	121	10	10	405	13	13	526	16	16	648
Permanent Plot 6	14	142	5,747	12	16	648	10	14	567	10	13	526	11	12	486	16	16	648
Permanent Plot 7	9	31	1,255	8	27	1,093	10	18	728	15	31	1,255	16	24	971	15	16	648
Permanent Plot 8	14	31	1,255	15	43	1,740	15	31	1,255	15	17	688	15	16	648	16	16	648
Permanent Plot 9	15	79	3,197	15	170	6,880	15	110	4,452	15	29	1,174	15	46	1,862	16	16	648
Permanent Plot 10	10	20	809	11	13	526	9	12	486	9	9	364	9	9	364	17	17	688
Permanent Plot 11	13	30	1,214	14	17	688	6	8	324	7	14	567	13	22	890	16	21	850
Permanent Plot 12	15	49	1,983	14	32	1,295	15	35	1,416	15	20	809	15	15	607	16	16	648
Permanent Plot 13	14	53	2,145	14	64	2,590	16	47	1,902	16	38	1,538	16	19	769	16	18	728

APPENDIX 4. Morphological Summary Data and Plots

Table 10b. Baseline Stream Data Summary
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Owl's Den-HC2

		Pre-Restoration		Reference Reach Data	Design		As-Built/Baseline	
Parameter	**Gage**	**HC2**		**See Table 10a.**	**HC2**		**HC2**	
		Min	**Max**		**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle								
Bankfull Width (ft)		5.4	8.9		6.5		6.8	8.8
Floodprone Width (ft)		9	14		35	110	200+	
Bankfull Mean Depth		0.4	0.5		0.5		0.3	0.5
Bankfull Max Depth		0.8	0.9		0.8		0.8	1.0
Bankfull Cross-sectional Area (ft^2)	N/A	2.9	3.5	See Table 10a.	3.3		2.1	3.8
Width/Depth Ratio		10.0	22.3		13.2		16.1	21.5
Entrenchment Ratio		1.6			5.4	16.9	23+	30+
Bank Height Ratio		3.3	4.1		1.0		1.0	
D50 (mm)		0.047						
Profile								
Shallow Length (ft)					---		8.5	26.7
Shallow Slope (ft/ft)		0.0046	0.0120		0.0053	0.0160	0.0044	0.0294
Pool Length (ft)	N/A			See Table 10a.	---		10.6	48.7
Pool Max Depth (ft)		N/A			0.7	1.0	1.0	2.0
Pool Spacing (ft)		90	148		10	65	29	72
Pool Volume (ft^3)								
Pattern								
Channel Beltwidth (ft)		N/A			12	27	16	41
Radius of Curvature (ft)		N/A			12	29	11	26
Rc:Bankfull Width (ft/ft)	N/A	N/A		See Table 10a.	1.8	4.5	1.3	3.8
Meander Length (ft)		N/A			27	48	46	80
Meander Width Ratio		N/A			1.8	4.2	1.8	6.0
Substrate, Bed and Transport Parameters								
Ri%/Ru%/P%/G%/S%								
SC%/Sa%/G%/C%/B%/Be%								
d16/d35/d50/d84/d95/d100	N/A	0.002/0.012/0.05/0.26/0.43/5		See Table 10a.			N/A	
Reach Shear Stress (Competency) lb/ft^2		---			---		0.11	0.15
Max part size (mm) mobilized at bankfull								
Stream Power (Capacity) W/m^2					3.6		3.6	
Additional Reach Parameters								
Drainage Area (SM)		0.04			0.04		0.04	
Watershed Impervious Cover Estimate (%)		<1%			<1%		<1%	
Rosgen Classification		Modified G6c			C/E		C5	
Bankfull Velocity (fps)		1.4	1.7		1.6		1.3	2.4
Bankfull Discharge (cfs)		5			5		5	
Q-NFF regression (2-yr)		20						
Q-USGS extrapolation (1.2-yr)	N/A	2		See Table 10a.				
Q-Mannings		---						
Valley Length (ft)		---			---		574	
Channel Thalweg Length (ft)		444			698		708	
Sinuosity		1.0			1.1	1.3	1.2	
Water Surface Slope $(ft/ft)^2$		---			0.0043	0.0098	0.0061	
Bankfull Slope (ft/ft)		---			0.0043	0.0098	0.0059	0.0062

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable
N/A4: No pool Cross-Section taken on HC2

Table 11. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

	Cross-Section 1, HC1 Reach 1 (Pool)								Cross-Section 2, HC1 Reach 1 (Riffle)								Cross-Section 3, HC1 Reach 1 (Pool)								Cross-Section 4, HC1 Reach 1 (Riffle)							
Dimension and Substrate[1,2,3,4]	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	765.9	765.9	765.9	766.1		766.0		766.0	765.9	765.9	765.9	765.9		765.9		765.9	765.5	765.5	765.5	765.5		765.5		765.6	765.0	765.0	765.0	765.1		765.2		765.2
Low Bank Elevation (ft)	765.9	765.9	765.9	765.9		766.0		766.0	765.9	765.9	765.9	765.9		766.0		766.0	765.5	765.5	765.5	765.5		765.5		765.6	765.0	765.0	765.0	765.1		765.0		765.3
Bankfull Width (ft)	15.5	13.9	13.4	12.6		10.2		16.5	10.7	9.7	10.4	11.4		11.9		14.2	16.4	15.4	14.6	15.4		14.2		16.7	8.9	8.5	9.4	12.6		8.6		9.0
Floodprone Width (ft)	---	---	---	---		---		---	200+	200+	200+	50.3		53.0		53.6	---	---	---	---		---		---	200+	200+	200+	79.8		80.7		80.7
Bankfull Mean Depth (ft)	0.8	0.7	0.8	0.9		1.0		0.8	0.6	0.5	0.6	0.6		0.6		0.5	0.9	0.9	1.0	1.0		0.9		0.8	0.7	0.6	0.6	0.5		0.5		0.8
Bankfull Max Depth (ft)	1.9	1.6	1.7	1.9		1.8		2.0	1.2	1.0	1.2	1.3		1.3		1.1	2.4	2.3	2.5	2.6		2.4		2.3	1.3	1.1	1.1	1.3		1.3		1.5
Bankfull Cross-Sectional Area (ft^2)	11.6	9.6	11.1	11.6		10.2		13.6	6.1	4.7	6.5	6.6		7.2		6.5	14.8	13.7	14.6	14.8		12.7		13.7	6.1	4.7	5.5	6.3		4.6		6.8
Bankfull Width/Depth Ratio	20.6	20.2	16.3	13.8		10.2		20.0	19.0	20.0	16.6	19.7		19.5		30.9	18.2	17.2	14.7	15.9		15.7		20.4	17.9	15.5	15.8	25.1		16.2		11.8
Bankfull Entrenchment Ratio	---	---	---	---		---		---	19+	20+	19+	4.4+		4.5		3.8	---	---	---	---		---		---	19+	24+	21+	6.3+		9.4		9.0
Bankfull Bank Height Ratio	---	---	---	---		---		---	1.0	1.0	1.0	1.0		1.1		1.0	---	---	---	---		---		---	1.0	1.0	1.0	0.9		0.9		1.1

	Cross-Section 5, HC1 Reach 2 (Pool)								Cross-Section 6, HC1 Reach 2 (Riffle)								Cross-Section 7, HC1 Reach 2 (Pool)								Cross-Section 8, HC1 Reach 2 (Riffle)							
Dimension and Substrate[1,2,3,4]	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**[1]	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**[1]	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	763.7	763.7	763.7	763.8		763.7		763.7	763.6	763.6	763.6	763.7		763.9		764.0	762.4	762.6	762.6	763.1		762.9		763	762.1	762.3	762.3	763.1		763.4		763.1
Low Bank Elevation (ft)	763.7	763.7	763.7	763.7		763.7		763.7	763.6	763.6	763.6	763.7		763.8		764.0	762.4	762.6	762.6	762.4		762.9		763	762.1	762.3	762.3	763.1		765.1		765.4
Bankfull Width (ft)	16.5	16.0	16.5	16.4		15.6		17.6	11.8	11.1	11.1	12.6		11.8		12.2	14.7	10.5	10.6	8.7		12.8		10.6	13.9	12.5	12.8	14.0		11.7		12.7
Floodprone Width (ft)	---	---	---	---		---		---	200+	200+	200+	79.9		81.0		81.0	---	---	---	---		---		---	61	47	44	73.0		79.6		61.0
Bankfull Mean Depth (ft)	1.5	1.5	1.5	1.5		1.0		0.7	0.9	0.8	0.8	0.7		0.7		0.8	0.9	1.1	1.1	1.6		0.6		1.4	0.8	0.8	0.7	0.8		2.1		2.4
Bankfull Max Depth (ft)	2.6	2.5	2.5	2.7		1.9		1.6	1.6	1.3	1.4	1.5		1.5		1.7	2.2	2.4	2.1	2.9		1.2		2.4	1.3	1.4	1.4	2.2		4.2		4.5
Bankfull Cross-Sectional Area (ft^2)	24.9	23.5	24.0	24.9		15.0		13.1	10.3	8.8	8.4	9.2		8.7		10.1	13.9	12.1	11.1	13.9		8.1		14.9	10.5	9.7	9.0	11.6		24.3		30.2
Bankfull Width/Depth Ratio	10.9	10.8	11.4	10.8		16.3		23.5	13.4	14.1	14.7	16.2		15.9		14.8	15.6	9.2	10.0	5.5		20.2		7.6	18.5	16.1	18.0	16.9		5.7		5.4
Bankfull Entrenchment Ratio	---	---	---	---		---		---	17+	18+	18+	6+		6.9		6.6	---	---	---	---		---		---	4.4	3.7	3.4	5.2		6.8		4.8
Bankfull Bank Height Ratio	---	---	---	---		---		---	1.0	1.0	1.0	1.0		0.9		1.0	---	---	---	---		---		---	1.0	1.1	1.1	1.0		1.7		2.0

	Cross-Section 9, HC2 (Riffle)								Cross-Section 10, HC2 (Pool)								Cross-Section 11, HC2 (Riffle)							
Dimension and Substrate[1,2,3,4]	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	767.8	767.8	767.8	767.7		767.8		767.8	767.5	767.5	767.5	767.6		767.5		767.5	766.6	766.6	766.6	766.6		766.6		766.6
Low Bank Elevation (ft)	767.8	767.8	767.8	767.7		767.7		767.7	767.5	767.5	767.5	767.5		767.5		767.5	766.6	766.6	766.6	766.6		766.6		766.6
Bankfull Width (ft)	6.8	6.1	5.9	4.6		4.0		6.5	12.2	11.1	11.3	11.2		8.5		11.6	7.5	7.7	7.7	7.9		9.0		9.2
Floodprone Width (ft)	200+	200+	200+	51.1		51.1		50.9	---	---	---	---		---		---	200+	200+	200+	45.3		45.7		45.7
Bankfull Mean Depth (ft)	0.3	0.3	0.3	0.4		0.3		0.3	0.6	0.5	0.5	0.6		0.5		0.4	0.5	0.4	0.4	0.4		0.4		0.4
Bankfull Max Depth (ft)	0.8	0.8	0.8	0.8		0.7		0.8	1.6	1.3	1.4	1.5		1.2		1.3	1.0	0.9	0.9	1.1		1.0		1.0
Bankfull Cross-Sectional Area (ft^2)	2.1	1.9	1.7	1.9		1.3		1.8	7.0	5.9	5.3	7.0		4.1		5.2	3.4	3.1	3.2	3.5		3.4		3.8
Bankfull Width/Depth Ratio	21.5	19.9	20.0	10.9		12.4		23.9	21.0	20.8	24.1	17.8		17.5		25.9	16.1	19.2	18.8	17.7		24.1		22.3
Bankfull Entrenchment Ratio	30+	33+	34+	11+		12.7		7.8	---	---	---	---		---		---	27+	26+	26+	6+		5.1		5.0
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0		1.0		1.0	---	---	---	---		---		---	1.0	1.0	1.1	1.0		1.0		1.0

	Cross-Section 12, HC2 (Pool)								Cross-Section 13, HC2 (Riffle)							
Dimension and Substrate[1,2,3,4]	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation (ft)	766.7	766.7	766.7	766.8		766.6		766.7	765.1	765.1	765.1	765.1		765.2		765.1
Low Bank Elevation (ft)	766.7	766.7	766.7	766.7		766.6		766.8	765.1	765.1	765.1	765.1		765.1		765.2
Bankfull Width (ft)	12.1	12.2	11.5	12.4		9.4		10.5	8.8	9.3	9.1	10.6		8.1		7.4
Floodprone Width (ft)	---	---	---	---		---		---	200+	200+	200+	48+		49.3		43.7
Bankfull Mean Depth (ft)	0.7	0.7	0.7	0.7		0.6		0.6	0.4	0.3	0.4	0.3		0.5		0.5
Bankfull Max Depth (ft)	1.8	1.6	1.5	1.8		1.2		1.4	1.0	0.8	0.8	1.0		1.0		0.9
Bankfull Cross-Sectional Area (ft^2)	8.9	8.5	8.2	8.9		5.2		6.4	3.8	2.7	3.3	3.5		3.9		3.5
Bankfull Width/Depth Ratio	16.4	17.4	16.0	17.2		17.2		17.2	20.7	32.2	25.3	31.9		16.9		15.8
Bankfull Entrenchment Ratio	---	---	---	---		---		---	23+	21+	22+	5+		6.1		5.9
Bankfull Bank Height Ratio	---	---	---	---		---		---	1.0	1.0	1.0	1.0		1.0		1.0

[1]Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

[2]MY3 – MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018).
The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

[3]ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.

[4]MY1: The bankful elevation was adjusted +0.13 ft to componsate for the natural floodplain deposition associated with Howards Creek at the lower extent of HC1 Reach 2.

Table 12a. Monitoring Data - Stream Reach Data Summary

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Owl's Den-HC1 Reach 1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Shallow[1,2,3]																
Bankfull Width (ft)	8.9	10.7	8.5	9.7	9.4	10.4	11.4	12.6			8.6	11.9			9.0	14.2
Floodprone Width (ft)	200+		200+		200+		50.3	79.8			53.0	80.7			53.6	80.7
Bankfull Mean Depth	0.6	0.7	0.5	0.6	0.6		0.5	0.6			0.5	0.6			0.5	0.8
Bankfull Max Depth	1.2	1.3	1.0	1.1	1.1	1.2	1.3				1.3				1.1	1.5
Bankfull Cross-Sectional Area (ft2)	6.1		4.7		5.5	6.5	6.3	6.6			4.6	7.2			6.5	6.8
Width/Depth Ratio	13.0	19.0	15.5	21.0	15.8	16.6	19.7	25.1			16.2	19.5			11.8	30.9
Entrenchment Ratio	19+		20+	24+	19+	21+	4.4+	6.3+			4.5	9.4			3.8	9
Bank Height Ratio	1.0		1.0		1.0		0.9	1.0			0.9	1.1			1.0	1.1
D50 (mm)	N/A															
Profile																
Shallow Length (ft)	8	25														
Shallow Slope (ft/ft)	0.0004	0.0193														
Pool Length (ft)	19	62														
Pool Max Depth (ft)	1.2	2.2														
Pool Spacing (ft)	32	74														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	21	45														
Radius of Curvature (ft)	16	27														
Rc:Bankfull Width (ft/ft)	1.5	3.0														
Meander Wave Length (ft)	58	92														
Meander Width Ratio	1.9	5.1														
Additional Reach Parameters																
Rosgen Classification	C5															
Channel Thalweg Length (ft)	820															
Sinuosity (ft)	1.4															
Water Surface Slope (ft/ft)	0.0023															
Bankfull Slope (ft/ft)	0.0021	0.0026														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	N/A															
d16/d35/d50/d84/d95/d100	N/A															
% of Reach with Eroding Banks	0%		0%		0%		0%									

(---): Data was not provided

[1]Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

[2]MY3 – MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's bank height.

[3]ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.

Table 12b. Monitoring Data - Stream Reach Data Summary
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Owl's Den-HC1 Reach 2

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle[1,2,3]																
Bankfull Width (ft)	11.8	13.9	11.1	12.5	11.1	12.8	4.6	10.9			11.7	11.8			12.2	12.7
Floodprone Width (ft)	60	200+	47	200+	44	200+	45.3	51.1			79.6	81.0			61.0	81.0
Bankfull Mean Depth	0.8	0.9	0.8		0.7	0.8	0.3	0.4			0.7	2.1			0.8	2.4
Bankfull Max Depth	1.3	1.6	1.2	1.4	1.4		1.9	3.5			1.5	4.2			1.7	4.5
Bankfull Cross-Sectional Area (ft2)	10.3	10.5	7.6	9.7	8.4	9.0	9.2	11.6			8.7	24.3			10.1	30.2
Width/Depth Ratio	13.4	18.5	14.1	16.1	14.7	18.0	10.9	31.9			5.7	15.9			5.4	14.8
Entrenchment Ratio	4.4	17+	3.7	18+	3.4	18+	5.0	11+			6.8	6.9			4.8	6.6
Bank Height Ratio	1.0		1.0	1.1	1.0	1.1	1.0				0.9	1.7			1.0	
D50 (mm)	N/A															
Profile																
Shallow Length (ft)	8	33														
Shallow Slope (ft/ft)	0.0023	0.0227														
Pool Length (ft)	22	70														
Pool Max Depth (ft)	2.0	3.4														
Pool Spacing (ft)	36	91														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	17	62														
Radius of Curvature (ft)	22	50														
Rc:Bankfull Width (ft/ft)	1.6	4.2														
Meander Wave Length (ft)	82	155														
Meander Width Ratio	1.2	5.3														
Additional Reach Parameters																
Rosgen Classification	C5															
Channel Thalweg Length (ft)	940															
Sinuosity (ft)	1.2															
Water Surface Slope (ft/ft)	0.0031															
Bankfull Slope (ft/ft)	0.0026	0.0029														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	N/A															
d16/d35/d50/d84/d95/d100	N/A															
% of Reach with Eroding Banks	0%		0%		0%		0%									

(---): Data was not provided

[1]Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

[2]MY3 – MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's bank height.

[3]ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.

Table 12c. Monitoring Data - Stream Reach Data Summary

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Owl's Den-HC2

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle[1,2,3]																
Bankfull Width (ft)	6.8	8.8	6.1	9.3	5.9	9.1	5.7	11.2			4.0	9.0			6.5	9.2
Floodprone Width (ft)	200+		200+		200+		200+				45.7	51.1			43.7	50.9
Bankfull Mean Depth	0.3	0.5	0.3	0.4	0.3	0.4	0.3	0.4			0.3	0.5			0.3	0.5
Bankfull Max Depth	0.8	1.0	0.8	0.9	0.8	0.9	0.8	1.1			0.7	1.0			0.8	1.0
Bankfull Cross-Sectional Area (ft2)	2.1	3.8	1.9	3.1	1.7	3.3	2.1	3.8			1.3	3.9			1.8	3.8
Width/Depth Ratio	16.1	21.5	19.2	32.2	18.8	25.3	15.5	32.8			12.4	24.1			15.8	23.9
Entrenchment Ratio	23+	30+	21+	33+	22+	34+	17+	35+			5.1	12.7			5.0	7.8
Bank Height Ratio	1.0		1.0		1.0	1.1	1.0				1.0				1.0	
D50 (mm)	N/A															
Profile																
Shallow Length (ft)	9	27														
Shallow Slope (ft/ft)	0.0044	0.0294														
Pool Length (ft)	11	49														
Pool Max Depth (ft)	1.0	2.0														
Pool Spacing (ft)	29	72														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	16	41														
Radius of Curvature (ft)	11	26														
Rc:Bankfull Width (ft/ft)	1.3	3.8														
Meander Wave Length (ft)	46	80														
Meander Width Ratio	1.8	6.0														
Additional Reach Parameters																
Rosgen Classification	C5															
Channel Thalweg Length (ft)	708															
Sinuosity (ft)	1.2															
Water Surface Slope (ft/ft)	0.0061															
Bankfull Slope (ft/ft)	0.0059	0.0062														
Ri%/Ru%/P%/G%/S%	---															
SC%/Sa%/G%/C%/B%/Be%	N/A															
d16/d35/d50/d84/d95/d100	N/A															
% of Reach with Eroding Banks	0%		0%		0%		0%									

(---): Data was not provided

[1]Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

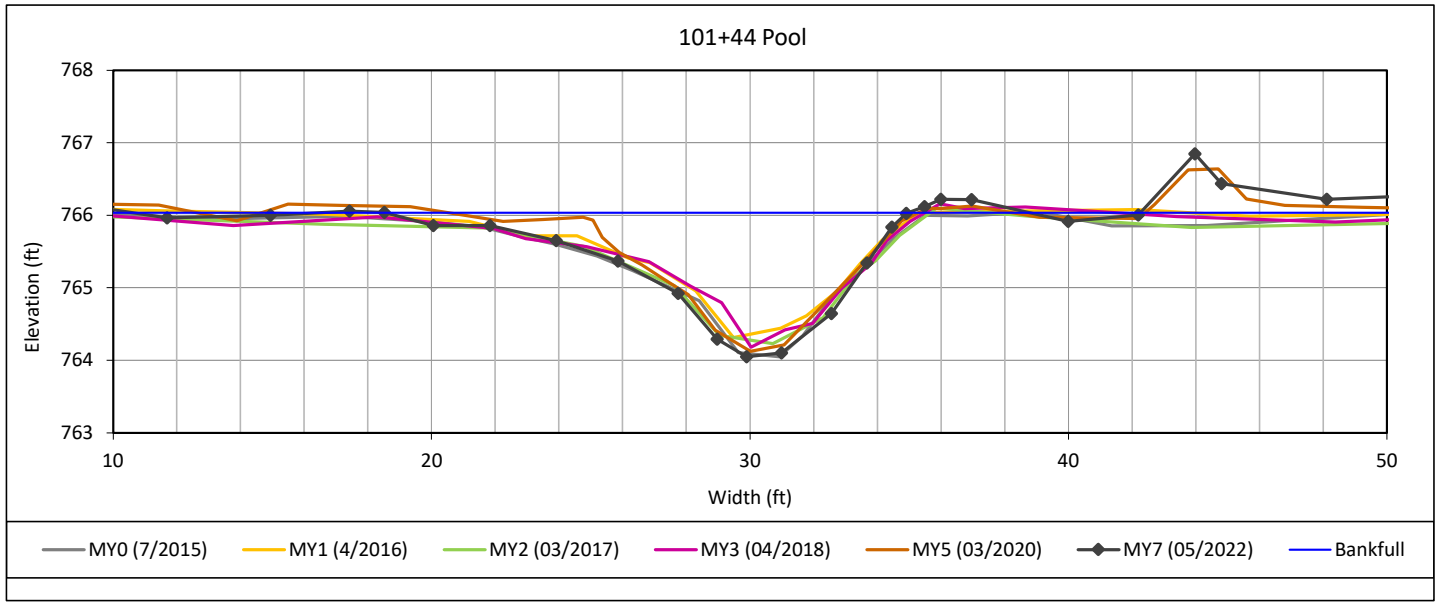
[2]MY3 – MY7 Bank Height Ratio was calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document profivded by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's bank height.

[3]ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 1, HC1 Reach 1



Bankfull Dimensions	
13.6	x-section area (ft.sq.)
16.5	width (ft)
0.8	mean depth (ft)
2.0	max depth (ft)
17.2	wetted parimeter (ft)
0.8	hyd radi (ft)
20.0	width-depth ratio

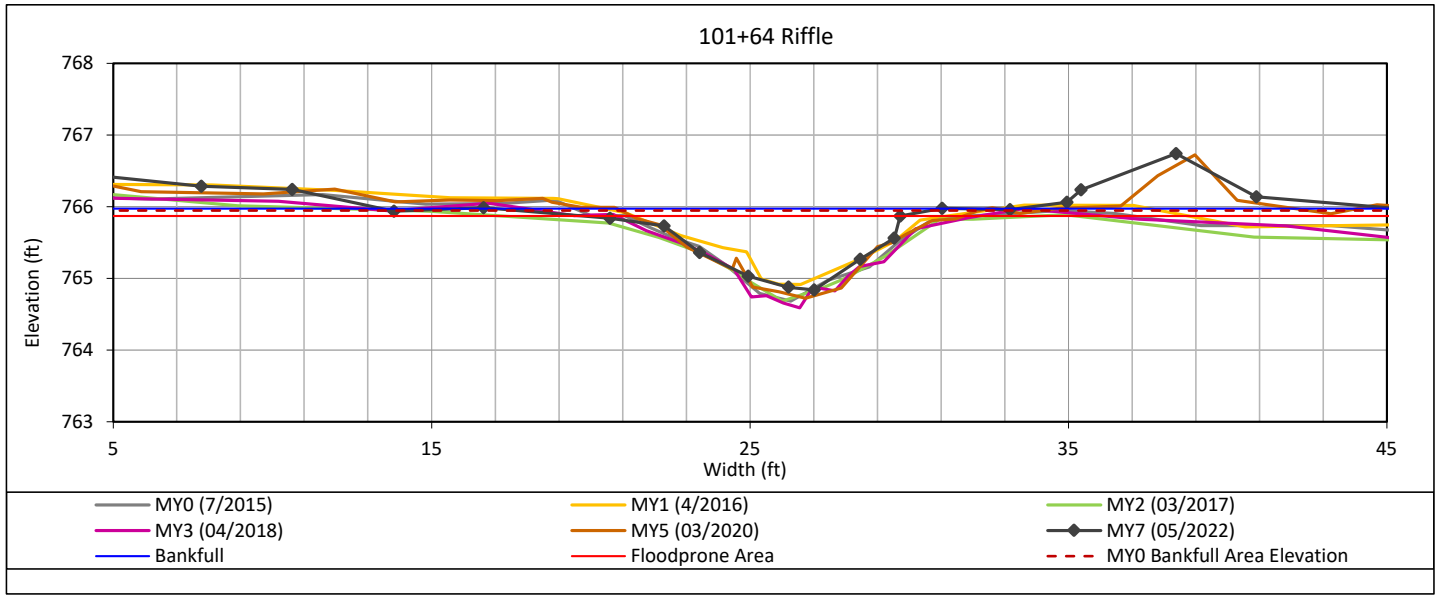
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 2, HC1 Reach 1



Bankfull Dimensions	
6.5	x-section area (ft.sq.)
14.2	width (ft)
0.5	mean depth (ft)
1.1	max depth (ft)
14.6	wetted parimeter (ft)
0.4	hyd radi (ft)
30.9	width-depth ratio
53.6	W flood prone area (ft)
3.8	entrenchment ratio
1.0	low bank height ratio

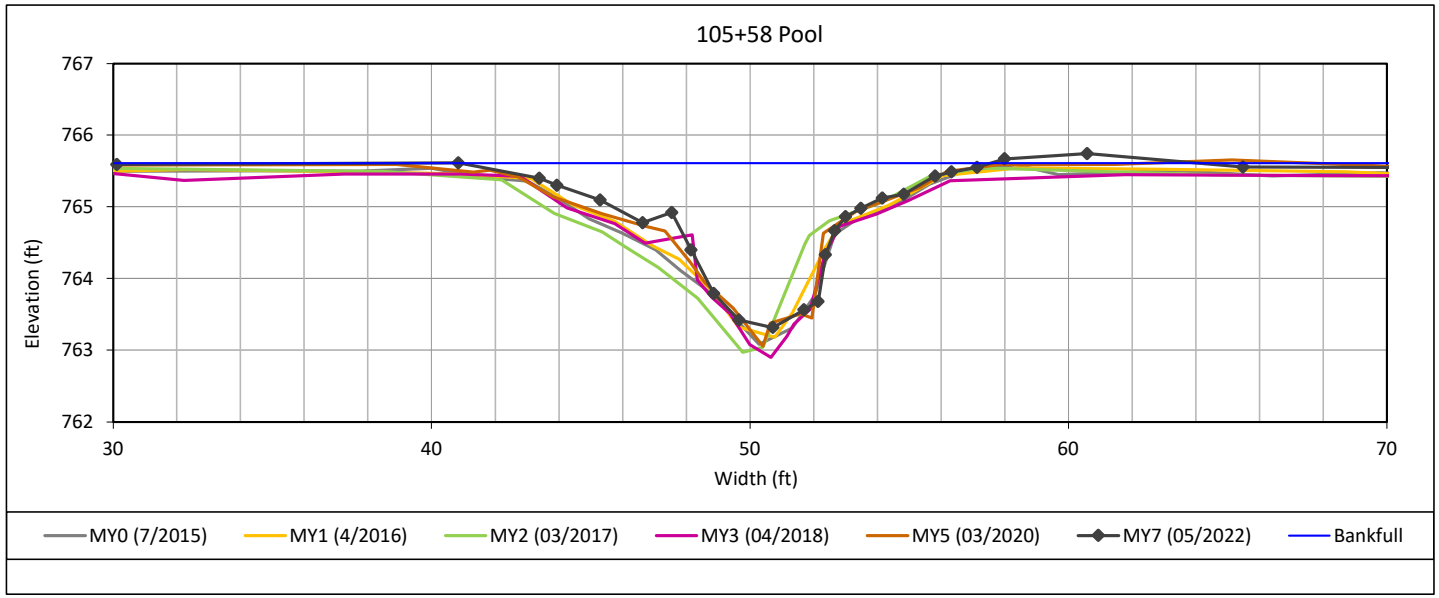
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 3, HC1 Reach 1



Bankfull Dimensions	
13.7	x-section area (ft.sq.)
16.7	width (ft)
0.8	mean depth (ft)
2.3	max depth (ft)
18.1	wetted parimeter (ft)
0.8	hyd radi (ft)
20.4	width-depth ratio

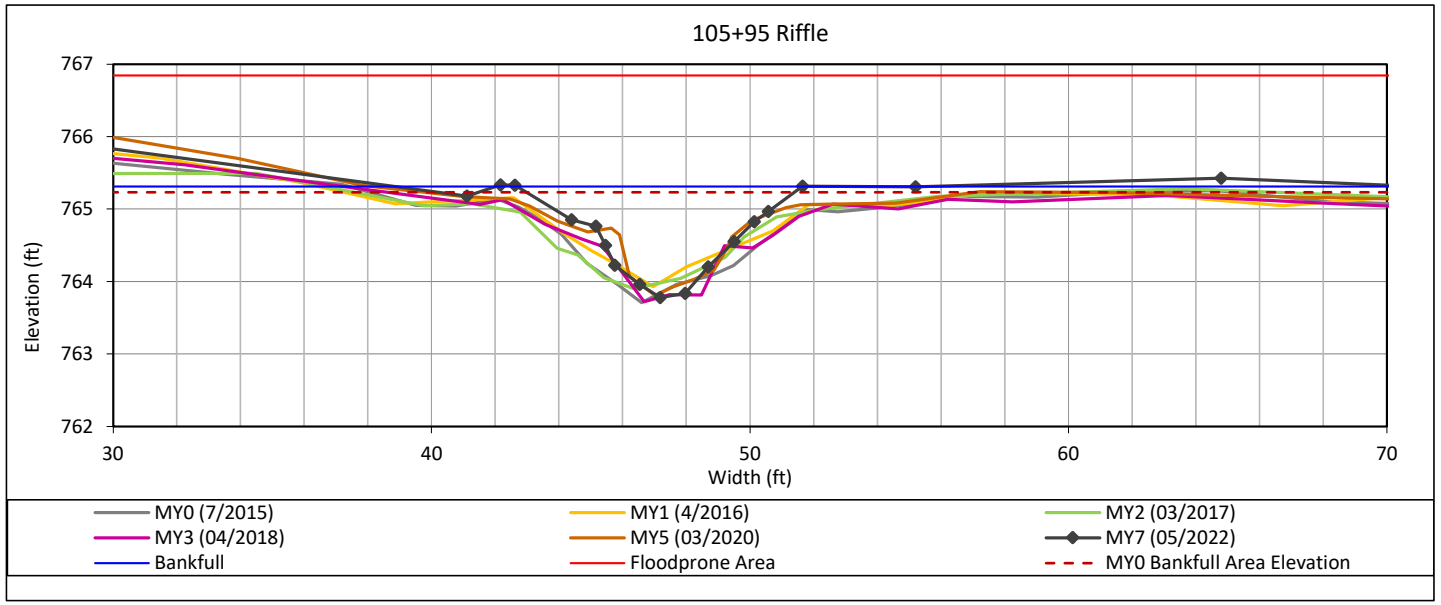
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 4, HC1 Reach 1



Bankfull Dimensions	
6.8	x-section area (ft.sq.)
9.0	width (ft)
0.8	mean depth (ft)
1.5	max depth (ft)
9.6	wetted parimeter (ft)
0.7	hyd radi (ft)
11.8	width-depth ratio
80.7	W flood prone area (ft)
9.0	entrenchment ratio
1.1	low bank height ratio

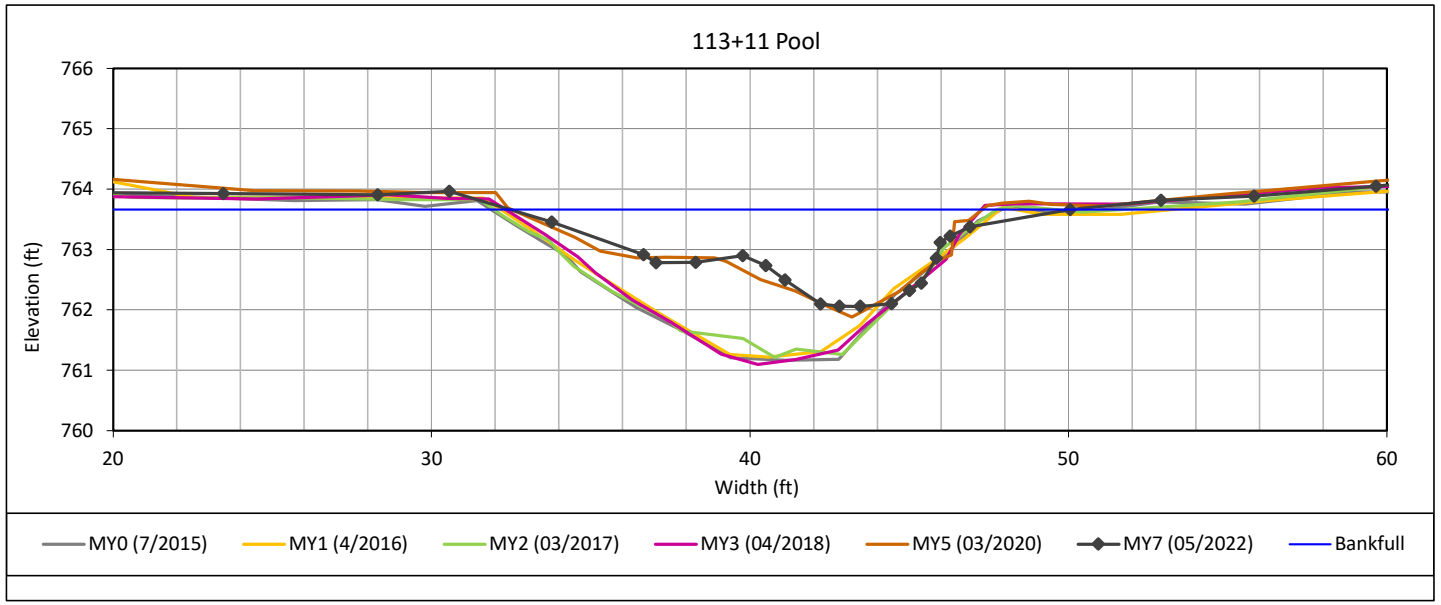
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 5, HC1 Reach 2



Bankfull Dimensions	
13.1	x-section area (ft.sq.)
17.6	width (ft)
0.7	mean depth (ft)
1.6	max depth (ft)
18.2	wetted parimeter (ft)
0.7	hyd radi (ft)
23.5	width-depth ratio

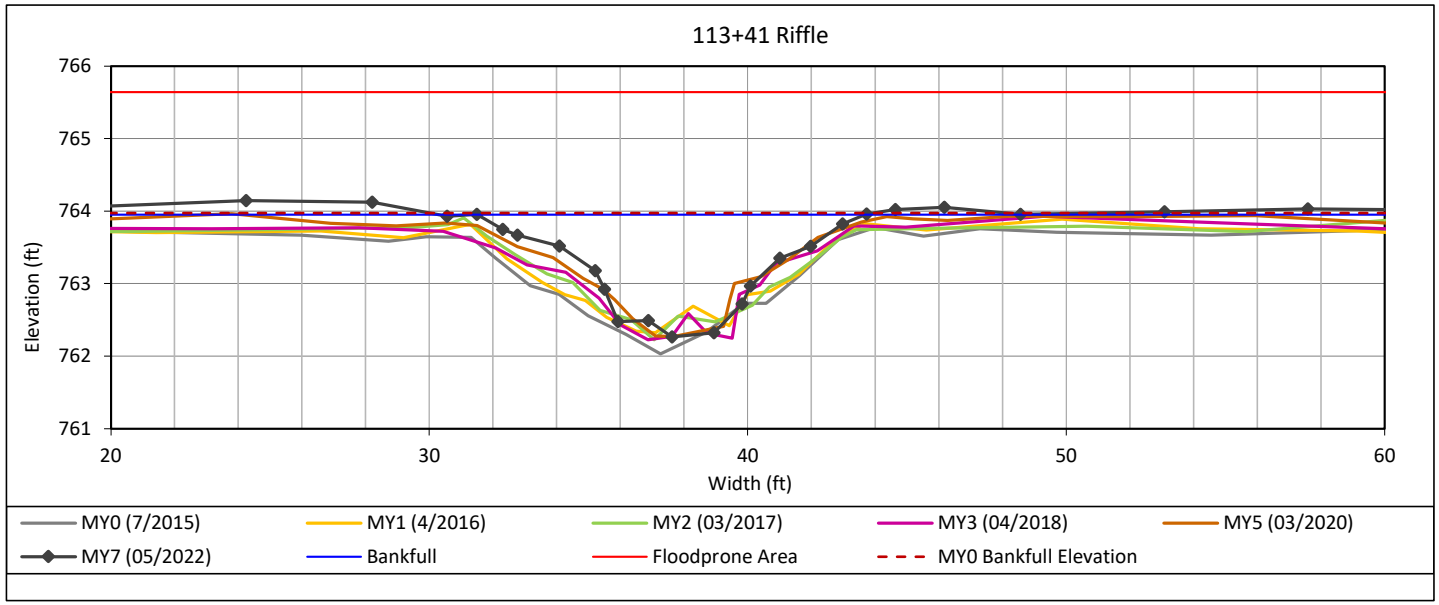
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 6, HC1 Reach 2



Bankfull Dimensions	
10.1	x-section area (ft.sq.)
12.2	width (ft)
0.8	mean depth (ft)
1.7	max depth (ft)
13.0	wetted parimeter (ft)
0.8	hyd radi (ft)
14.8	width-depth ratio
81.0	W flood prone area (ft)
6.6	entrenchment ratio
1.0	low bank height ratio

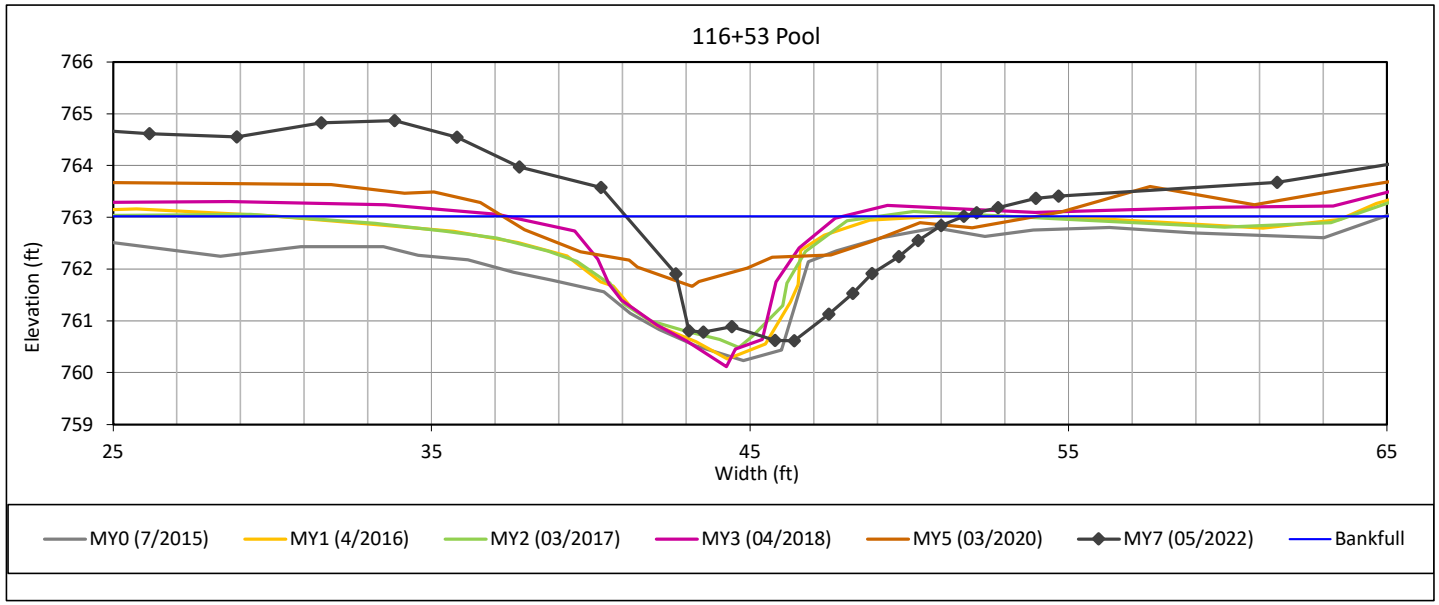
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 7, HC1 Reach 2



Bankfull Dimensions	
14.9	x-section area (ft.sq.)
10.6	width (ft)
1.4	mean depth (ft)
2.4	max depth (ft)
12.3	wetted parimeter (ft)
1.2	hyd radi (ft)
7.6	width-depth ratio

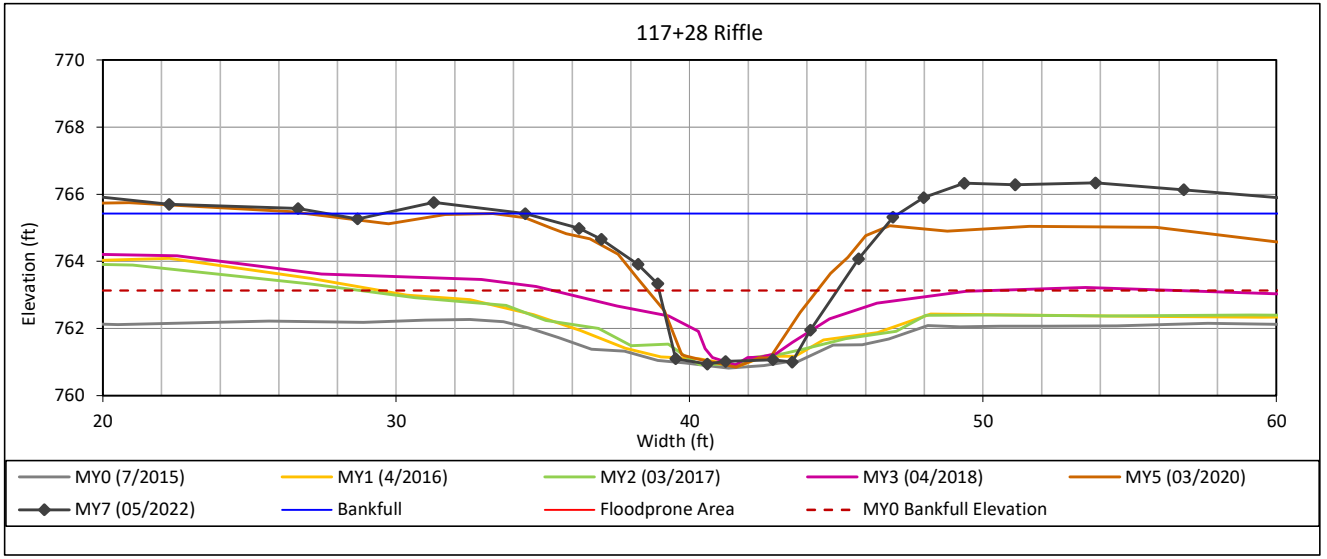
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 8, HC1 Reach 2



Bankfull Dimensions	
30.2	x-section area (ft.sq.)
12.7	width (ft)
2.4	mean depth (ft)
4.5	max depth (ft)
17.1	wetted parimeter (ft)
1.8	hyd radi (ft)
5.4	width-depth ratio
61.0	W flood prone area (ft)
4.8	entrenchment ratio
2.0	low bank height ratio

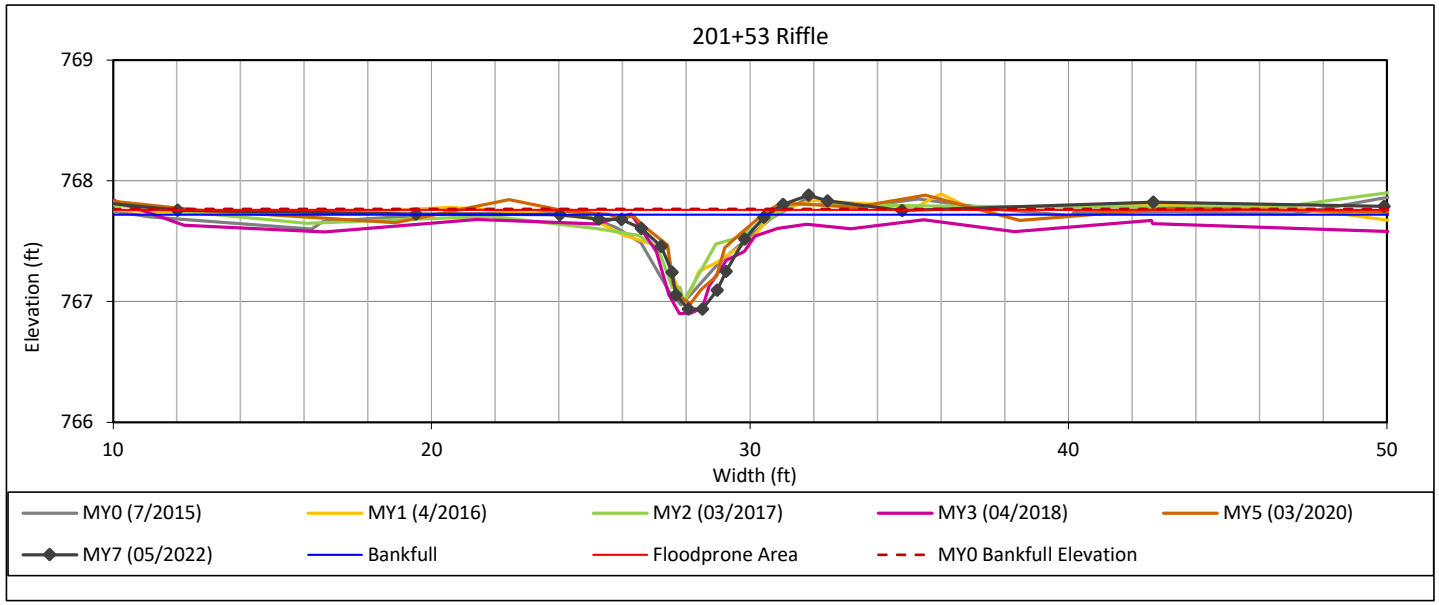
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 9, HC2



Bankfull Dimensions	
1.8	x-section area (ft.sq.)
6.5	width (ft)
0.3	mean depth (ft)
0.8	max depth (ft)
6.9	wetted parimeter (ft)
0.3	hyd radi (ft)
23.9	width-depth ratio
50.9	W flood prone area (ft)
7.8	entrenchment ratio
1.0	low bank height ratio

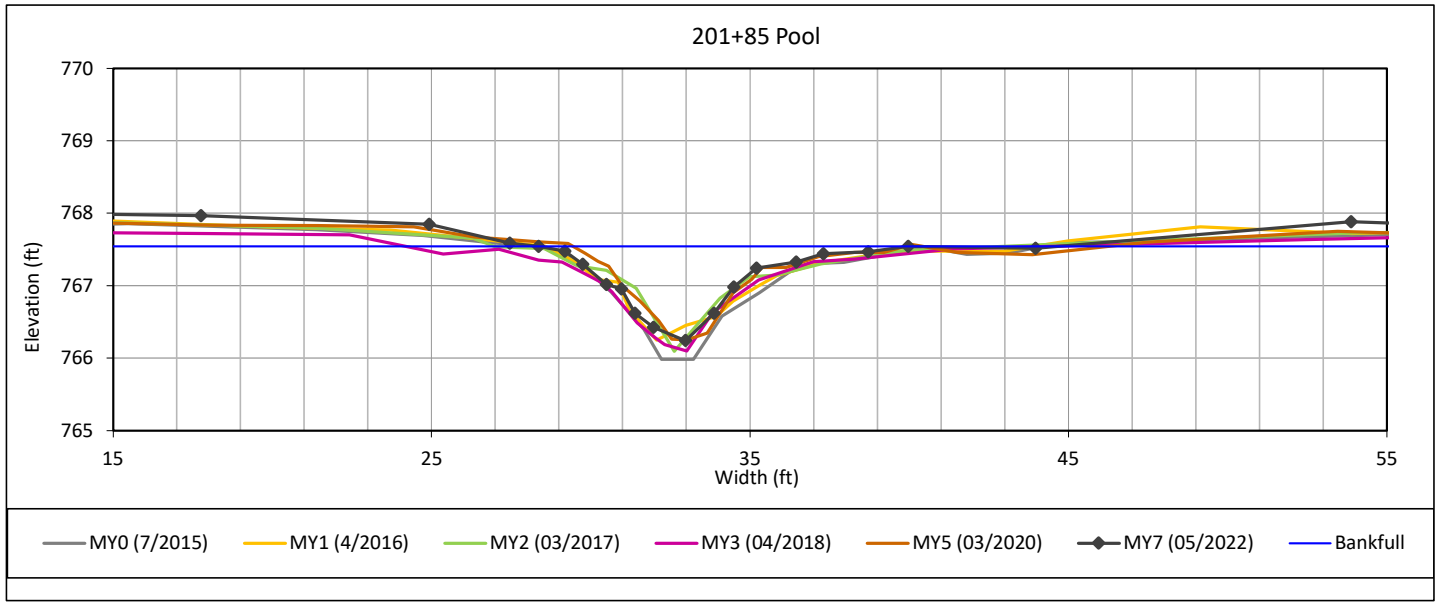
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 10, HC2



Bankfull Dimensions	
5.2	x-section area (ft.sq.)
11.6	width (ft)
0.4	mean depth (ft)
1.3	max depth (ft)
12.1	wetted parimeter (ft)
0.4	hyd radi (ft)
25.9	width-depth ratio

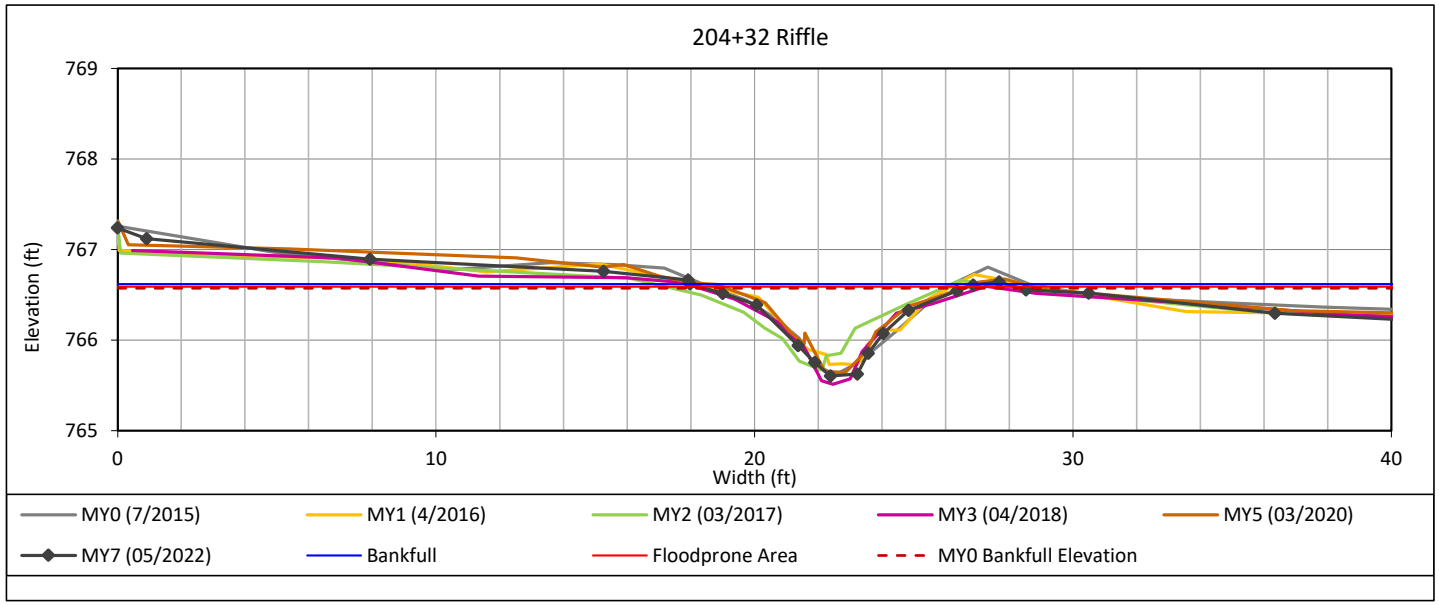
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 11, HC2



Bankfull Dimensions	
3.8	x-section area (ft.sq.)
9.2	width (ft)
0.4	mean depth (ft)
1.0	max depth (ft)
9.5	wetted parimeter (ft)
0.4	hyd radi (ft)
22.3	width-depth ratio
45.7	W flood prone area (ft)
5.0	entrenchment ratio
1.0	low bank height ratio

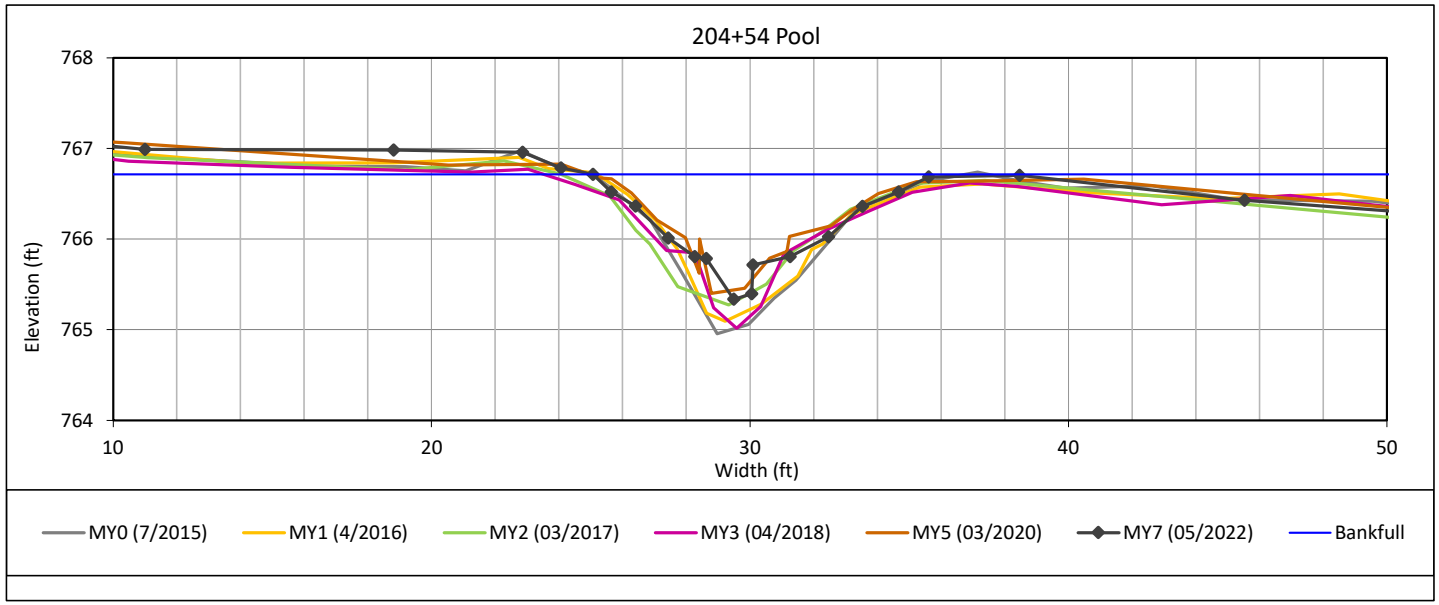
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 12, HC2



Bankfull Dimensions	
6.4	x-section area (ft.sq.)
10.5	width (ft)
0.6	mean depth (ft)
1.4	max depth (ft)
11.1	wetted parimeter (ft)
0.6	hyd radi (ft)
17.2	width-depth ratio

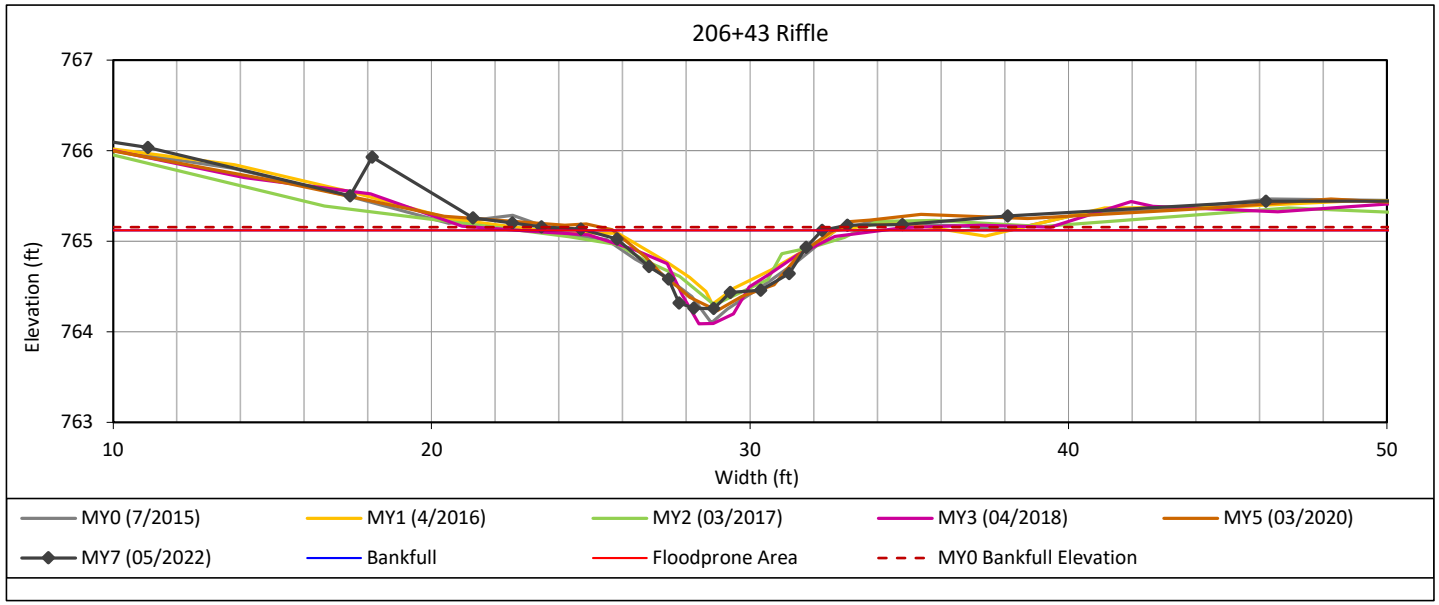
Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

Cross Section Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7

Cross Section 13, HC2



Bankfull Dimensions	
3.5	x-section area (ft.sq.)
7.4	width (ft)
0.5	mean depth (ft)
0.9	max depth (ft)
7.8	wetted parimeter (ft)
0.5	hyd radi (ft)
15.8	width-depth ratio
43.7	W flood prone area (ft)
5.9	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2022
Field Crew: Wildlands Engineering

View Downstream

APPENDIX 5. Hydrology Summary Data and Plots

Table 13. Verification of Bankfull Events
Owls Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Reach	MY	Date of Occurrence	Method
HC1	MY1	1/16/2016	Stream Gage
		2/3/2016	
		5/1/2016	
		5/3/2016	
		5/20/2016	
		7/4/2016	
HC1	MY2	5/21/2017	
		7/1/2017	
		9/5/2017	
		10/9/2017	
		10/23/2017	
HC1	MY3	2/3/2018	
		2/7/2018	
		4/24/2018	
		5/18/2018	
		5/30/2018	
		10/11/2018	
		10/26/2018	
HC1	MY4	2/18/2019	
		4/14/2019	
		6/8/2019	
		7/9/2019	
HC1	MY5	1/3/2020	
		1/24/2020	
		2/6/2020	
		2/11/2020	
		2/13/2020	
HC1	MY6	9/2/2021	
HC1	MY7	1/3/2022	
		5/24/2022	
		5/26/2022	
		7/31/2022	

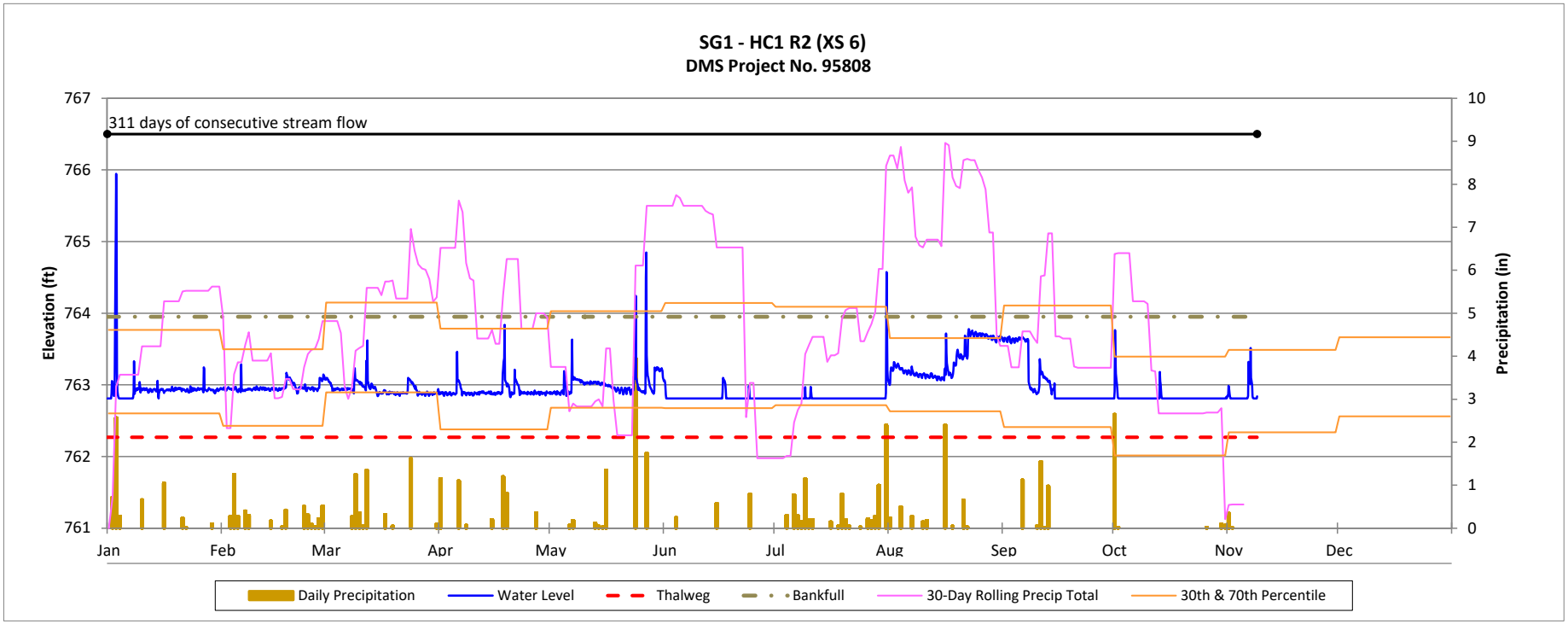
Reach	MY	Date of Occurrence	Method
HC2	MY1	1/16/2016	Stream Gage
		5/3/2016	
		7/4/2016	
HC2	MY2	1/23/2017	
		2/9/2017	
		2/26/2017	
		4/24/2017	
		5/21/2017	
		7/1/2017	
		9/5/2017	
		10/9/2017	
		10/23/2017	
		10/29/2017	
HC2	MY3	2/7/2018	
		4/24/2018	
		5/18/2018	
		10/11/2018	
		10/26/2018	
HC2	MY4	2/18/2019	
		4/14/2019	
		6/8/2019	
		7/9/2019	
HC2	MY5	4/30/2020	
		5/21/2020	
		6/1/2020	
		7/27/2020	
		8/13/2020	
HC2	MY6	6/12/2021	
		7/7/2021	
HC2	MY7	1/3/2022	
		5/26/2022	
		7/31/2022	
		8/16/2022	

Recorded Bankfull Events

Owls Den Mitigation Site

DMS Project No. 95808

Monitoring Year 7 - 2022



In May of 2022, the barotroll malfunctioned and could not be downloaded for the remainder of the year; therefore, pressure data from May to November was calibrated from the Wyant Lands Mitigation Site located approximately 3.5 miles north of the Owl's Den Mitigation.

Recorded Bankfull Events

Owls Den Mitigation Site

DMS Project No. 95808

Monitoring Year 7 - 2022

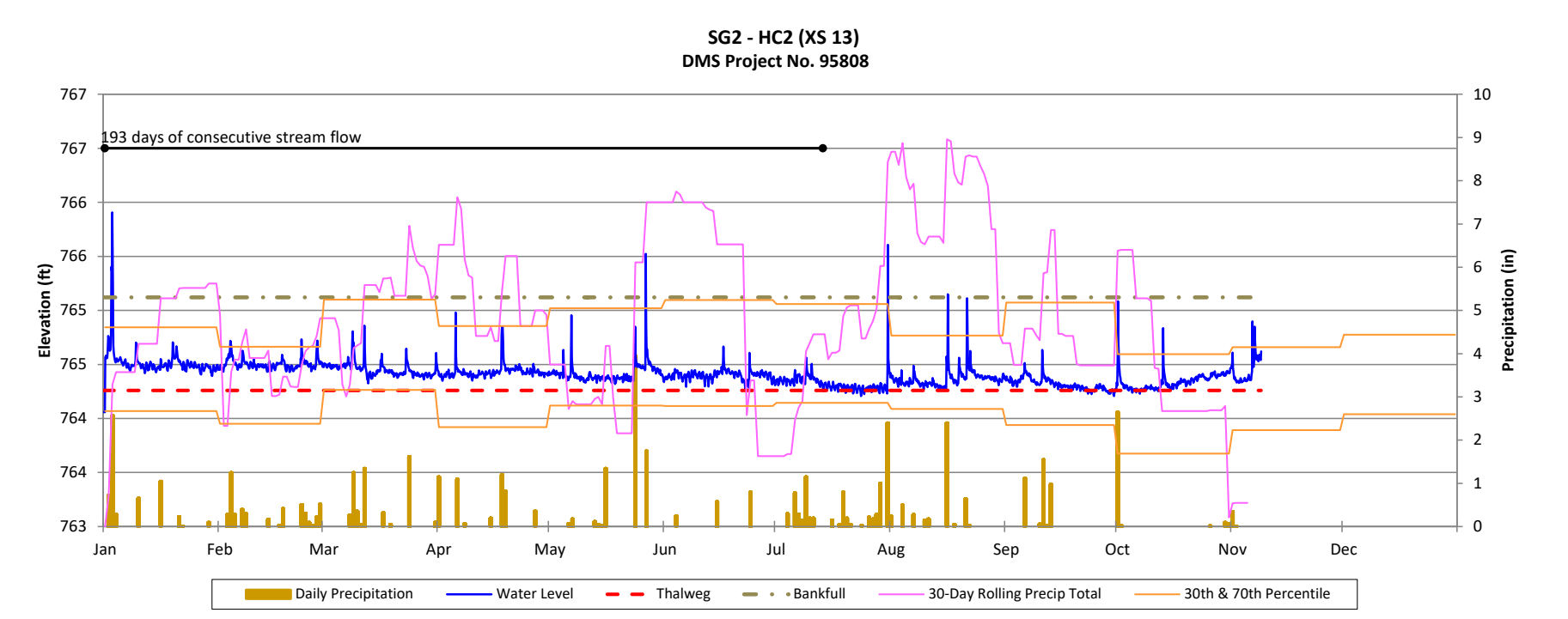


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Table 14. Wetland Gage Attainment Summary
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022

Summary of Groundwater Gage Results for Monitoring Years 1 through 7							
	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)[1]						
Gage	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)	Year 6 (2021)	Year 7 (2022)
1	No/4 Days (2%)	No/14 Days (6%)	No/16 Days (7%)	Yes/19 Days (9%)	No/15 Days (6.7%)	No/16 Days (7.2%)	No/7 Days (3.1%)
2	Yes/223 Days (100%)	Yes/223 Days (100%)	Yes/142 Days (64%)	Yes/113 Days (51%)	Yes/223 Days (100%)	Yes/204 Days (91.5%)	Yes/177 Days (79.4%)
3	Yes/223 Days (100%)	Yes/223 Days (100%)	Yes/218 Days (98%)	Yes/222 Days (100%)	Yes/223 Days (100%)	Yes/203 Days (91.0%)	Yes/223 Days (100%)
4	Yes/75 Days (34%)	Yes/94 Days (42%)	Yes/143 Days (64%)	Yes/49 Days (22%)	Yes/109 Days (48.9%)	Yes/60 Days (26.9%)	Yes/76 Days (34.1%)
5	Yes/223 Days (100%)	Yes/223 Days (100%)	Yes/176 Days (80%)	Yes/222 Days (100%)	Yes/223 Days (100%)	Yes/101 Days (45.3%)	Yes/223 Days (100%)
6	Yes/20 Days (9%)	Yes/53 Days (24%)	Yes/87 Days (39%)	Yes/61 Days (27%)	Yes/97 Days (43.5%)	Yes/57 Days (25.6%)	Yes/37 Days (16.6%)
7	Yes/39 Days (18%)	Yes/68 Days (31%)	Yes/96 Days (43%)	Yes/63 Days (28%)	Yes/97 Days (43.5%)	Yes/61 Days (27.4%)	Yes/52 Days (23.3%)
8	No/10 Days (5%)	Yes/49 Days (22%)	Yes/47 Days (21%)	Yes/34 Days (15%)	Yes/55 Days (24.7%)	Yes/34 Days (15.2%)	Yes/29 Days (13.0%)
9	Yes/30 Days (14%)	Yes/51 Days (23%)	Yes/83 Days (37%)	Yes/36 Days (16%)	Yes/106 Days (47.4%)	Yes/50 Days (22.4%)	Yes/34 Days (15.2%)
10	Yes/223 Days (100%)	Yes/223 Days (100%)	Yes/217 Days (98%)	Yes/223 Days (100%)	Yes/223 Days (100%)	Yes/113 Days (50.7%)	Yes/223 Days (100%)
11	Yes/89 Days (40%)	Yes/52 Days (23%)	Yes/96 Days (43%)	Yes/113 Days (51%)	Yes/100 Days (44.8%)	Yes/54 Days (24.2%)	Yes/52 Days (23.3%)
12	Yes/39 Days (40%)	Yes/53 Days (24%)	Yes/82 Days (37%)	Yes/58 Days (26%)	Yes/ 111 Days (49.8%)	Yes/53 Days (23.8%)	Yes/51 Days (22.9%)
13	Yes/223 Days (100%)	Yes/223 Days (100%)	Yes/217 Days (98%)	Yes/223 Days (100%)	Yes/97 Days (43.5%)	Yes/204 Days (91.5%)	Yes/223 Days (100%)
14	---	Yes/192 Days (87%)	Yes/218 Days (98%)	Yes/222 Days (100%)	Yes/223 Days (100%)	Yes/208 Days (93.4%)	Yes/128 Days (57.4%)[3]
15	---	---	---	Yes/54Days (24%)[2]	Yes/76 Days (34.1%)	Yes/54 Days (24.2%)	Yes/36 Days (16.1%)
Reference Gage	Yes/83 Days (37%)	Yes/124 Days (56%)	Yes/157 Days (71%)	Yes/223 Days (100%)	Yes/223 Days (100%)	Yes/100 Days (44.8%)	Yes/223 Days (100%)

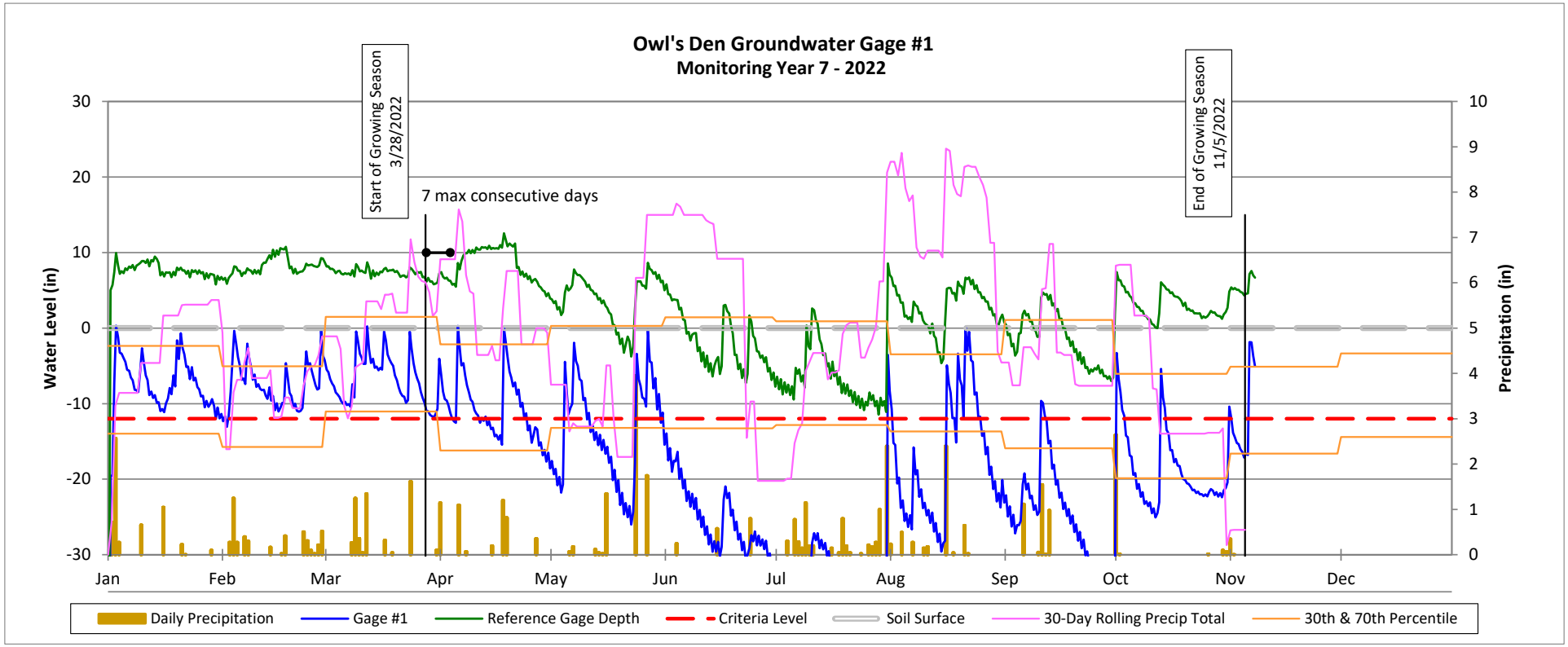
[1]Success Criteria: Water table within 12 inches of ground surface for 8.1% of growing season (3/28 - 11/5).

[2]GWG 15 installed December 2018.

[3]GWG 14 malfunctioned in MY7; therefore, no data was recorded from August to November 2022.

Groundwater Gage Plots

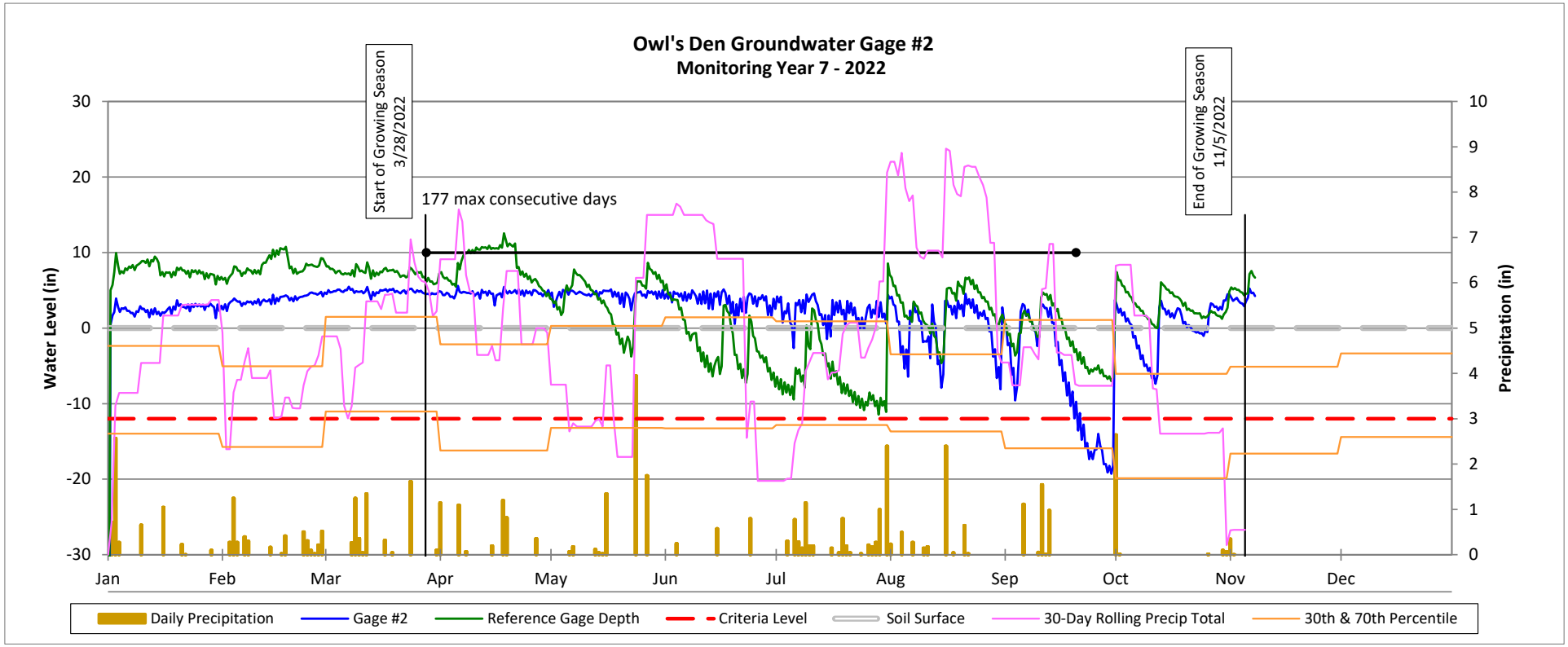
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
Wetland Re-establishment



In May of 2022, the barotroll malfunctioned and could not be downloaded for the remainder of the year; therefore, pressure data from May to November was calibrated from the Wyant Lands Mitigation Site located approximately 3.5 miles north of the Owl's Den Mitigation Site.

Groundwater Gage Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
Wetland Re-establishment



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DMS Project No. 95808
Monitoring Year 7 - 2022
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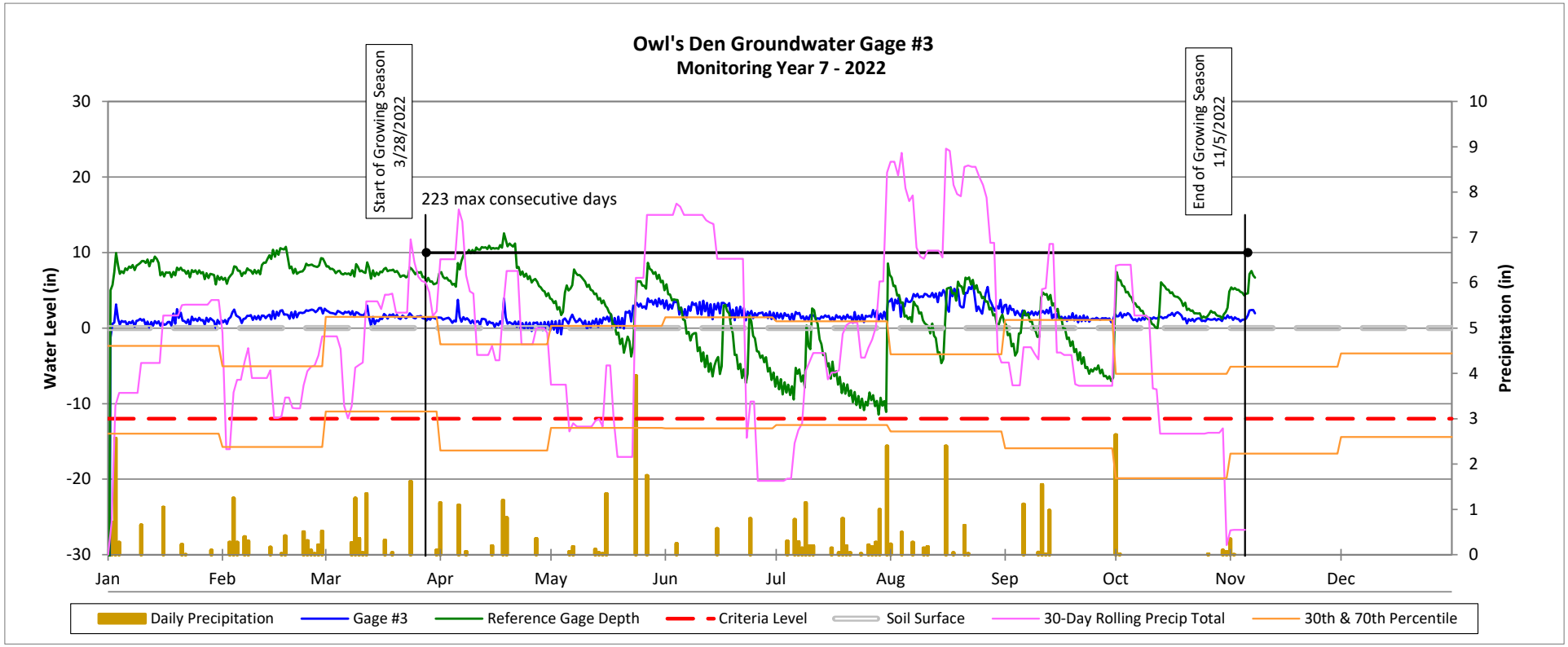

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DMS Project No. 95808
Monitoring Year 7 - 2022
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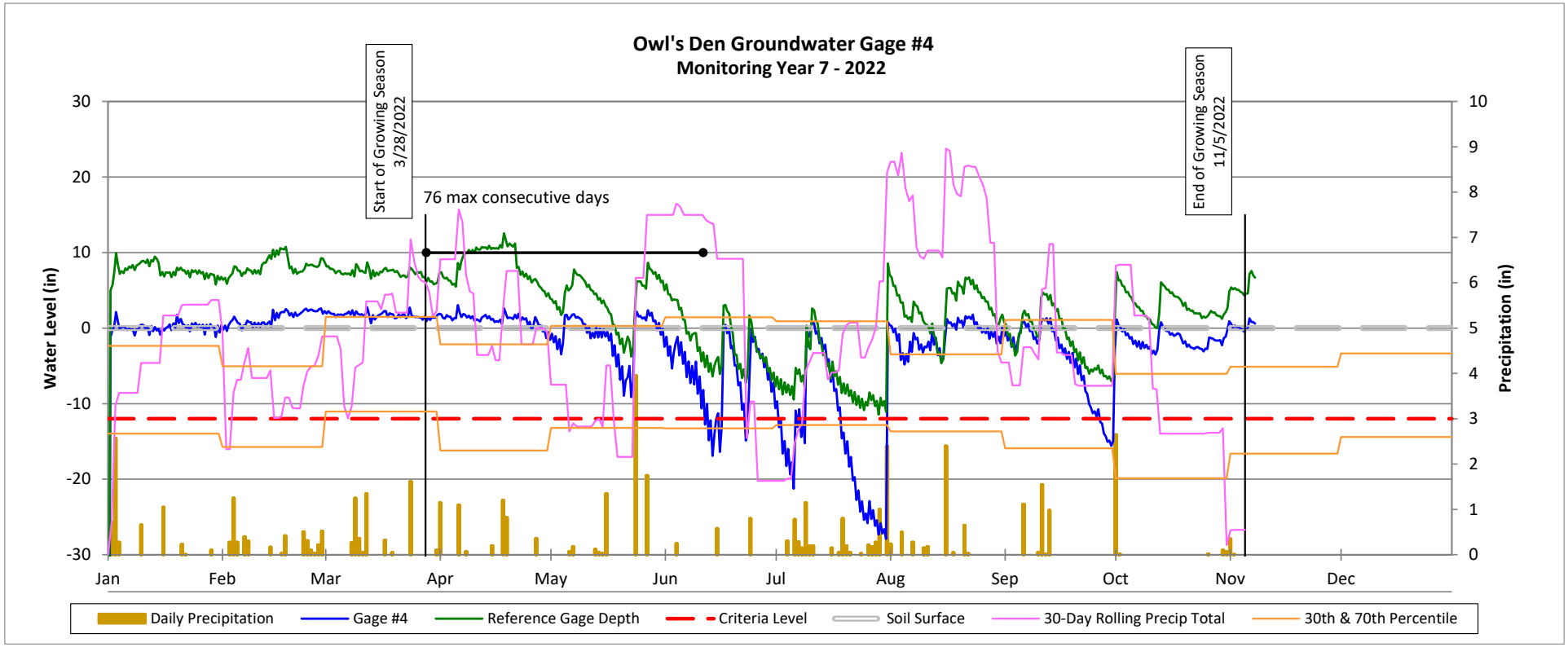

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Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
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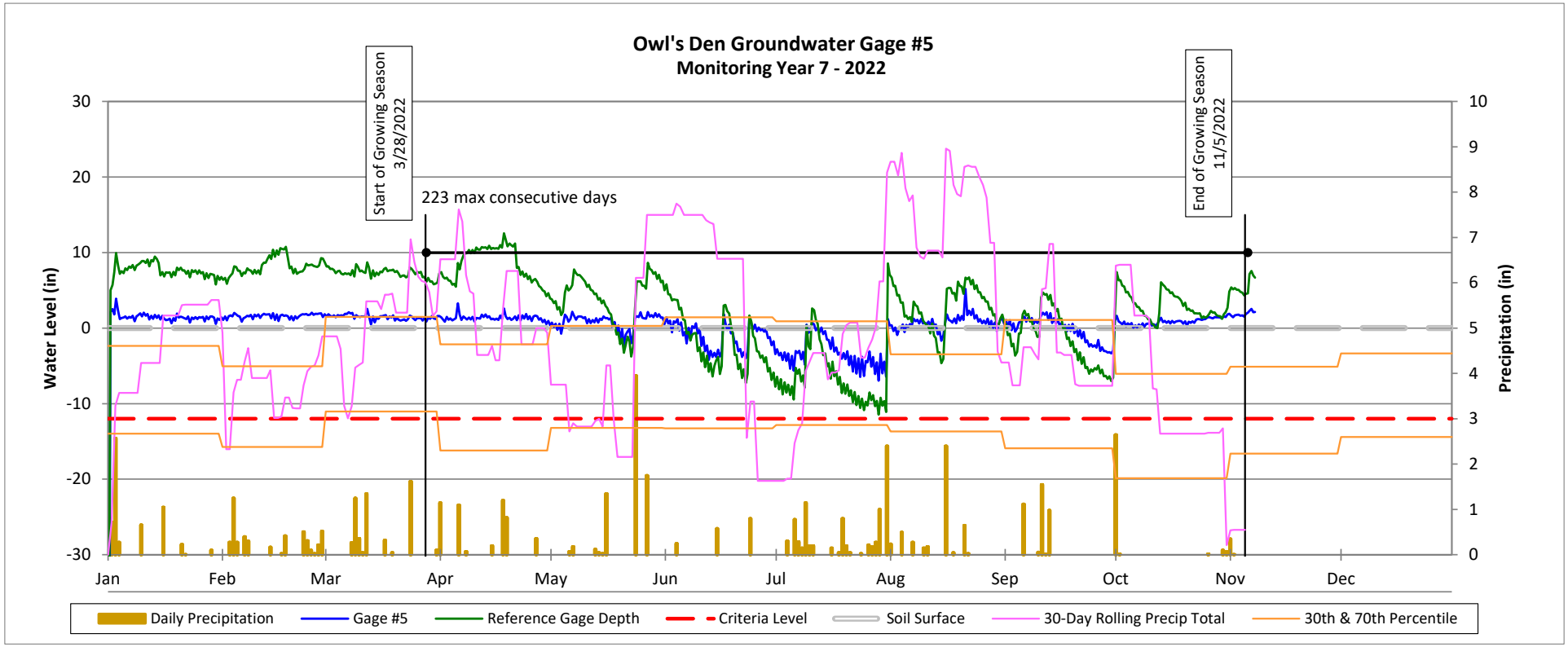

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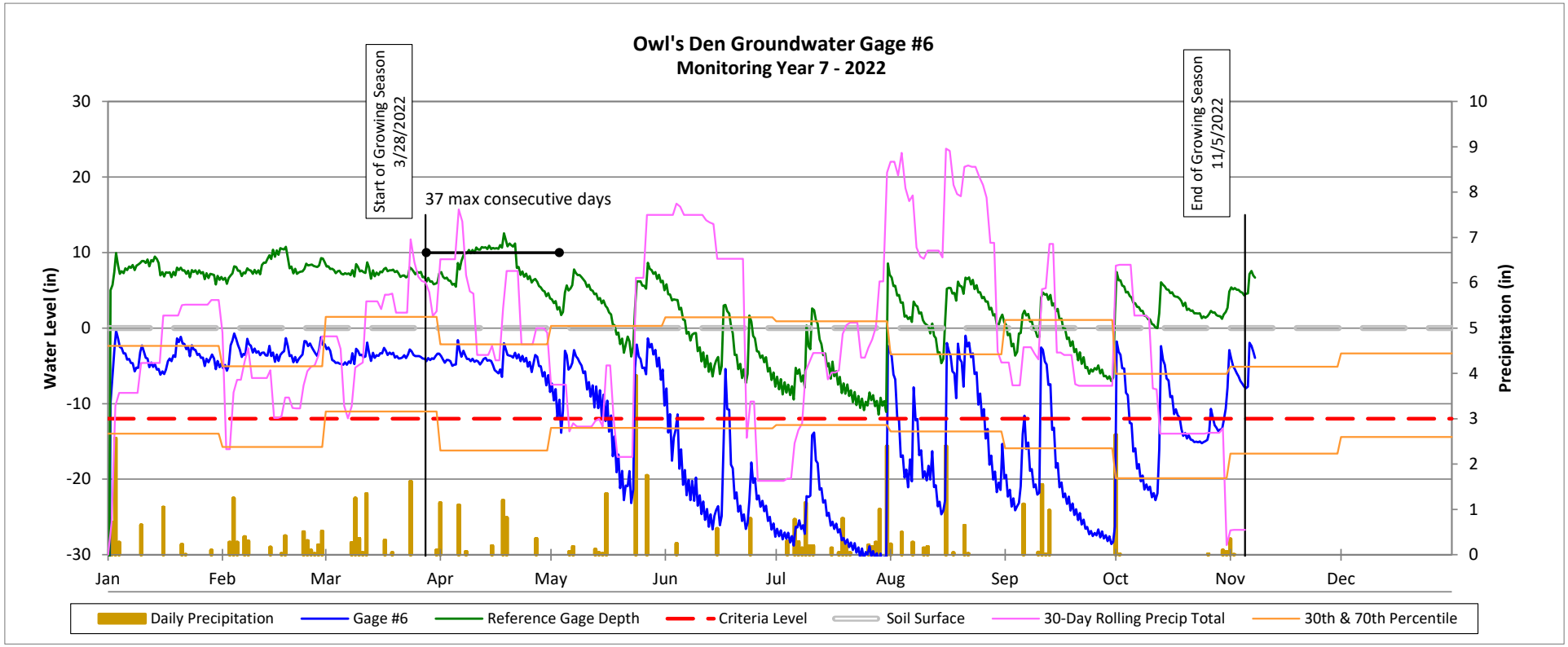
Groundwater Gage Plots

Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
Wetland Rehabilitation



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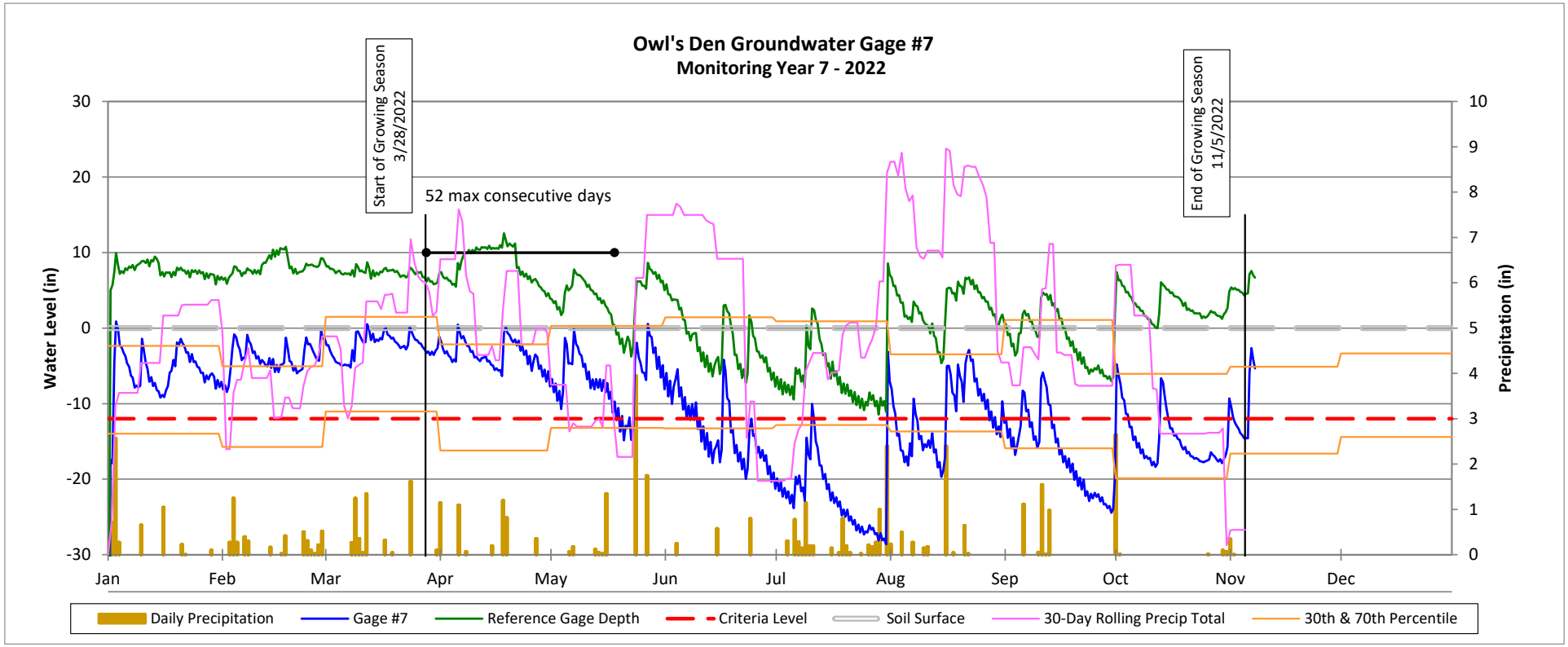

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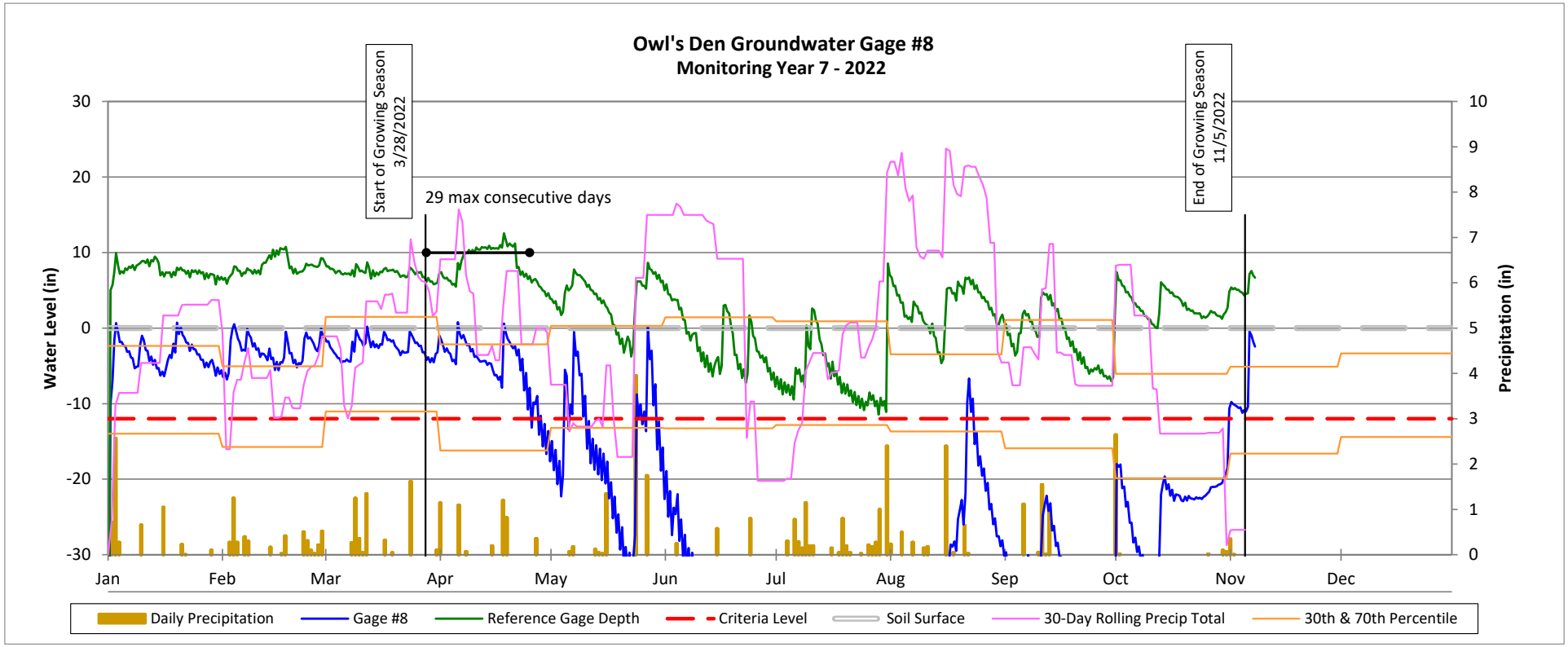

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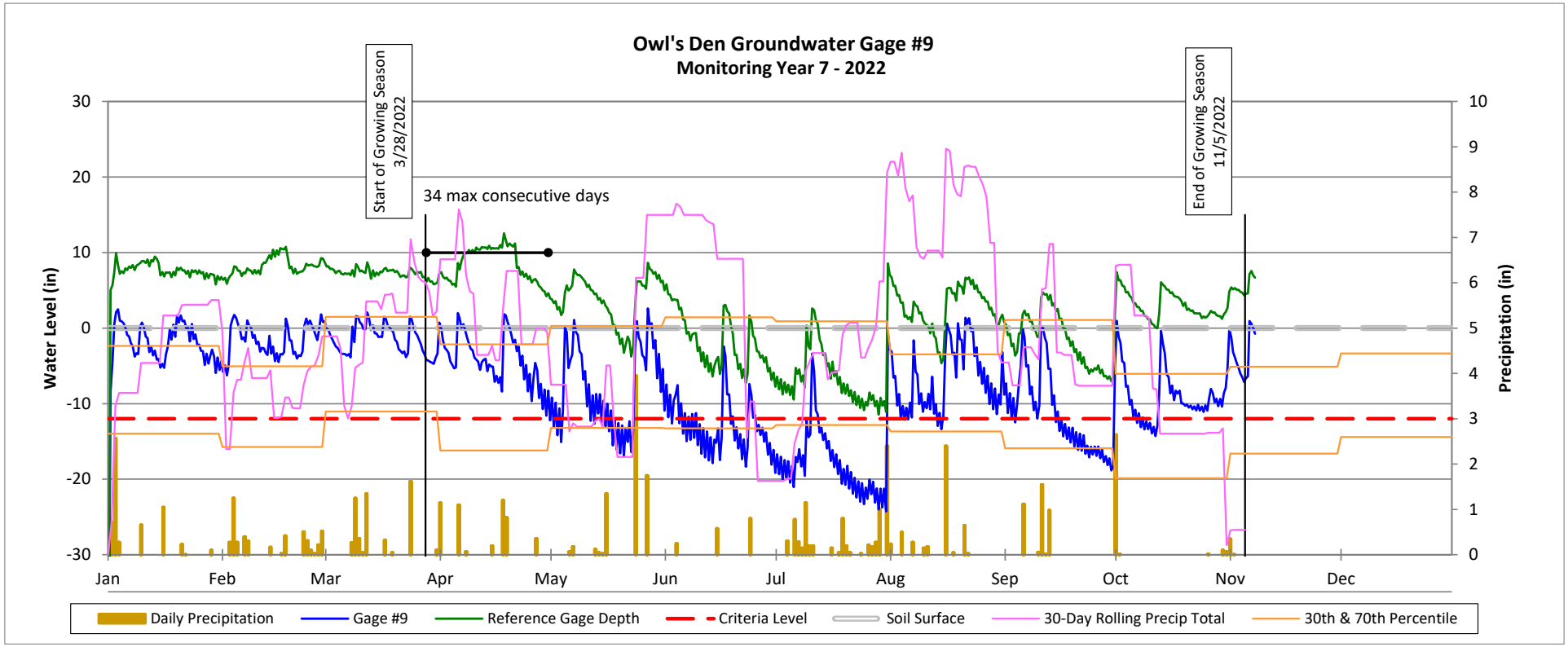

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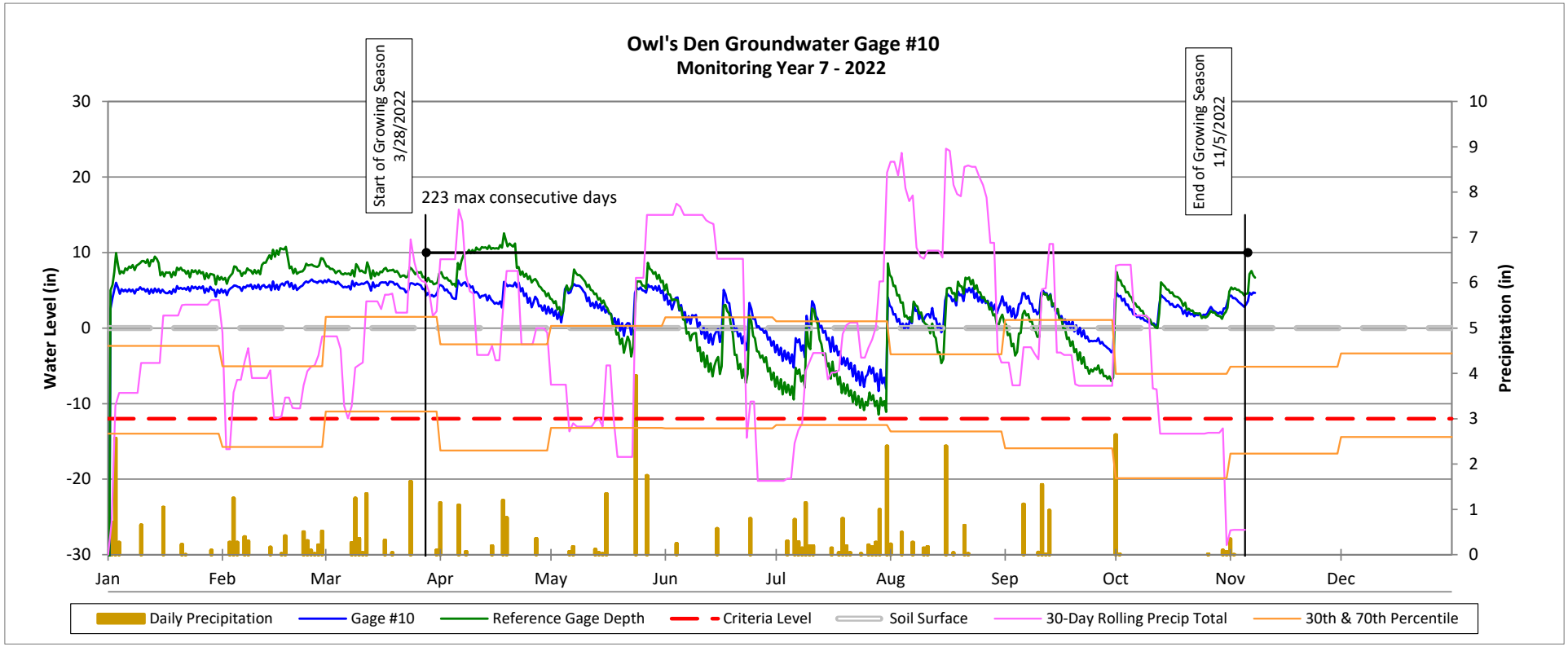
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
Wetland Rehabilitation



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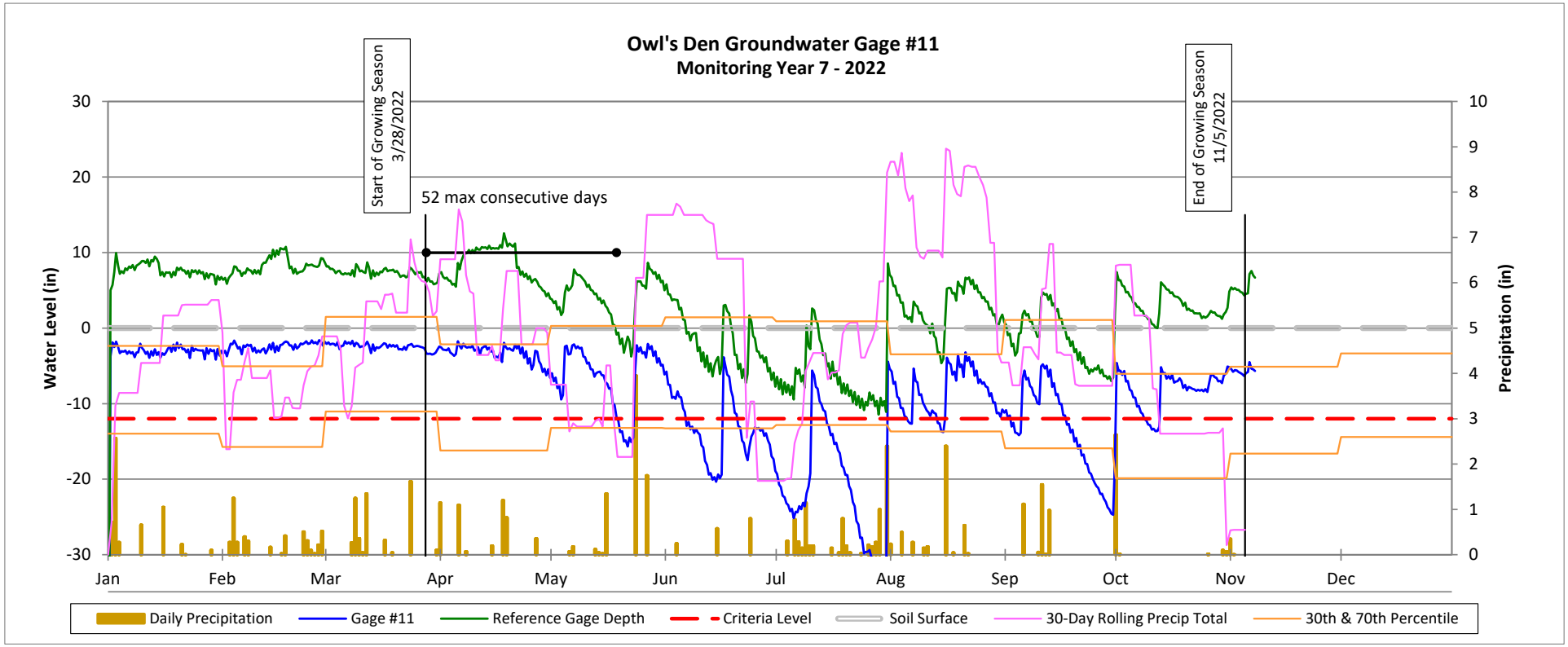

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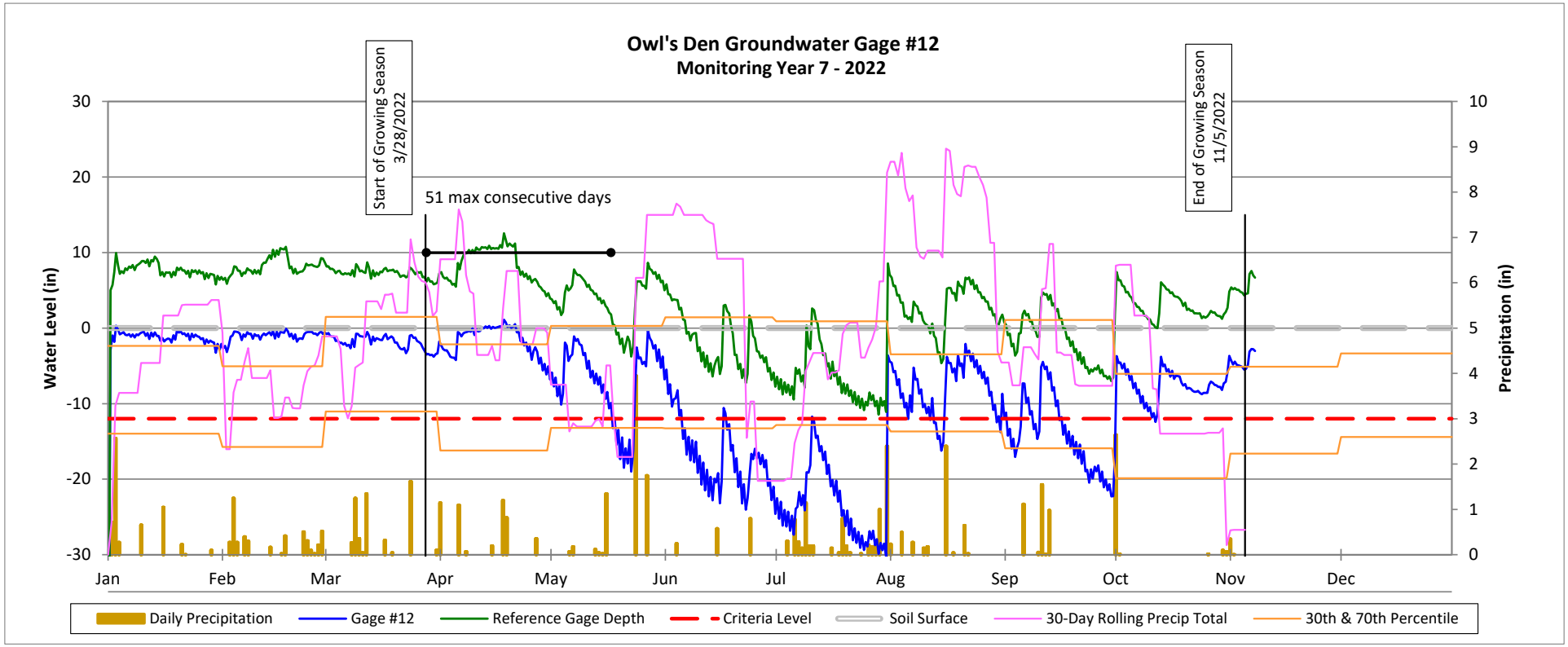

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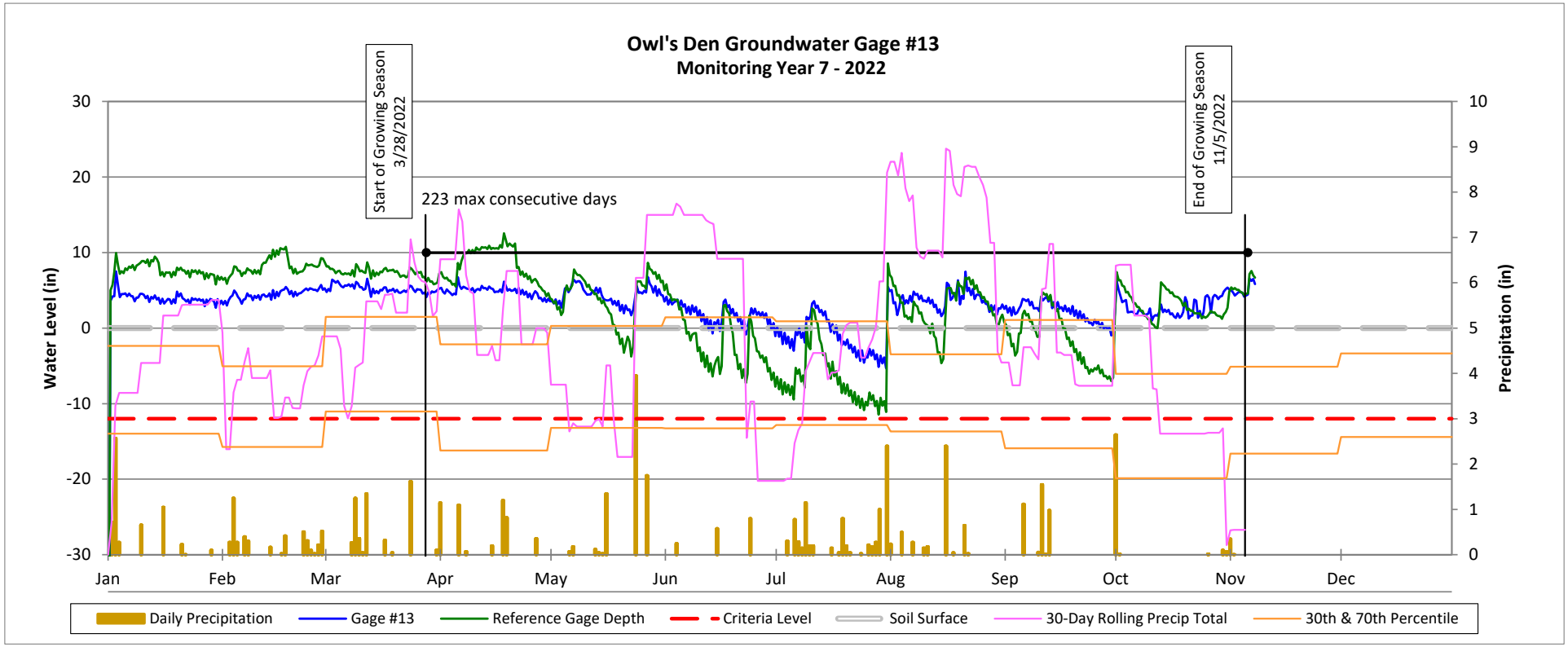

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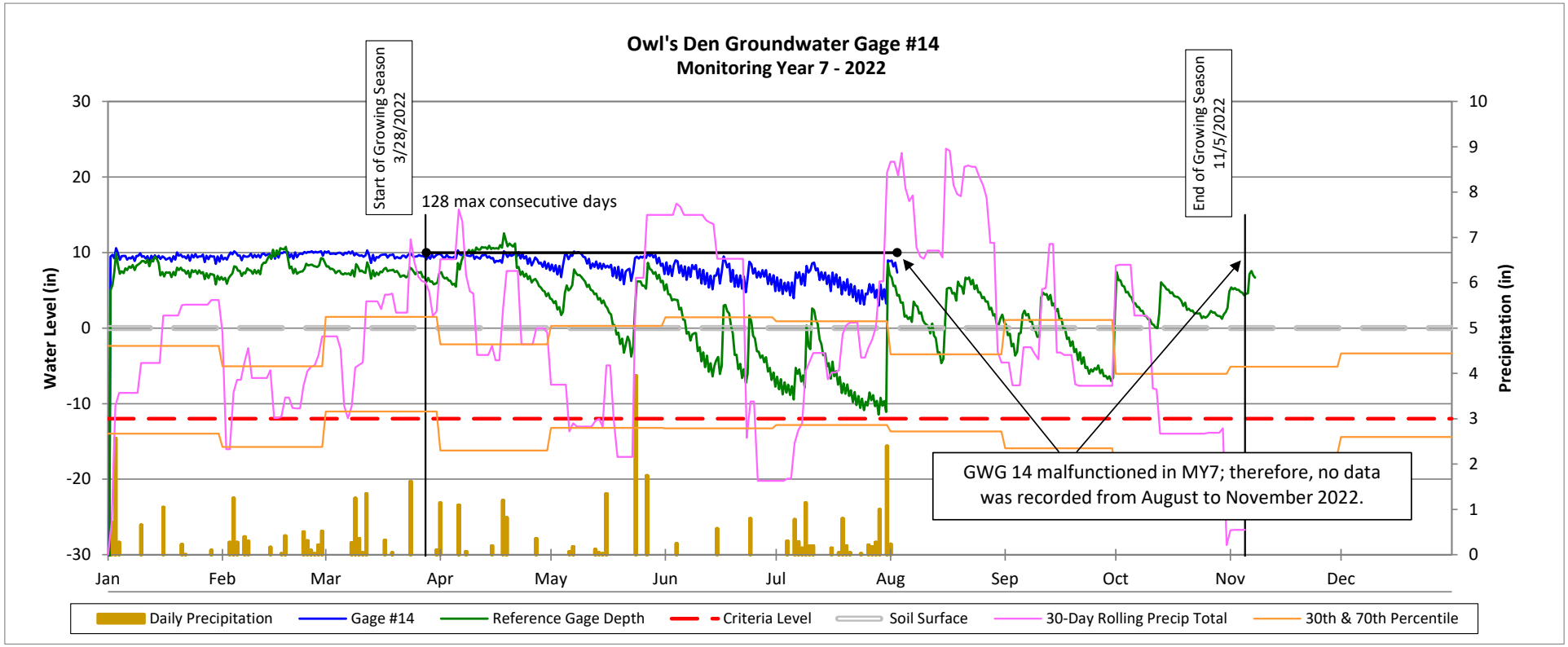
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
Wetland Rehabilitation



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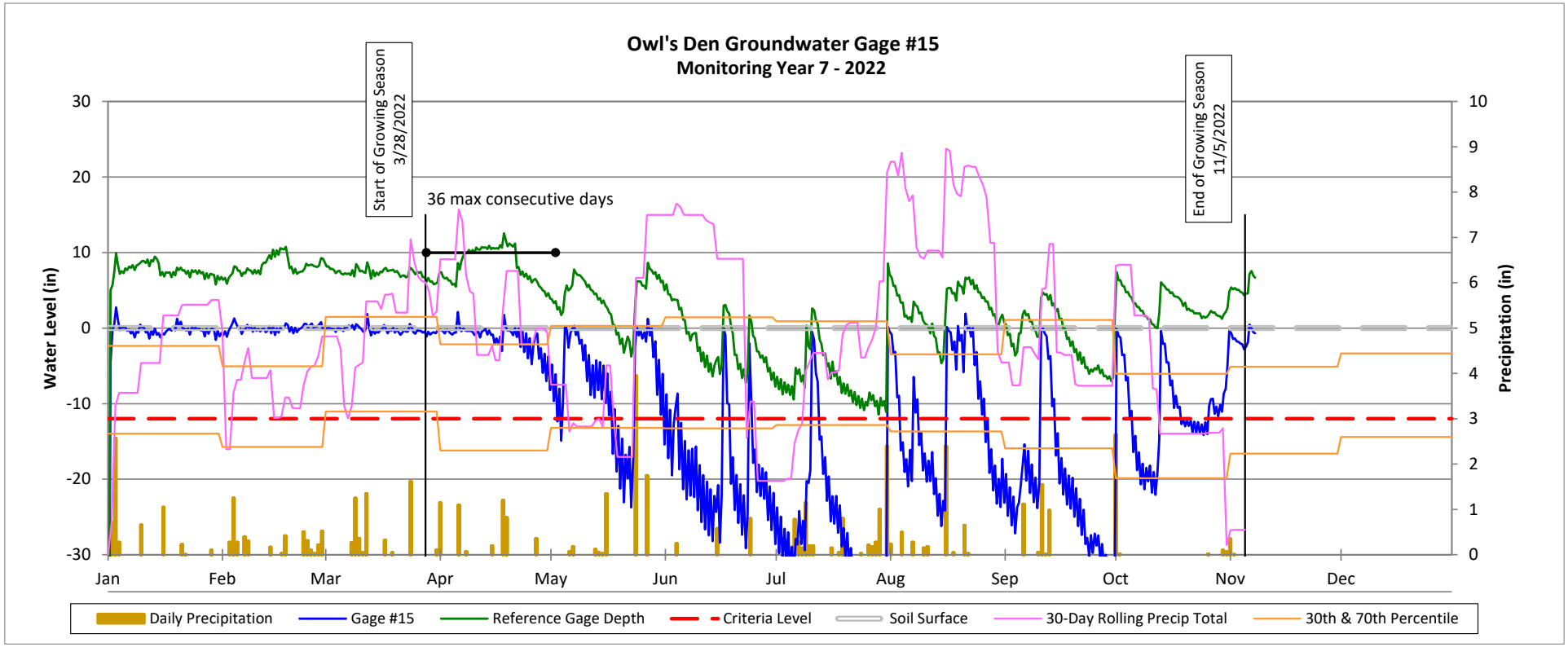

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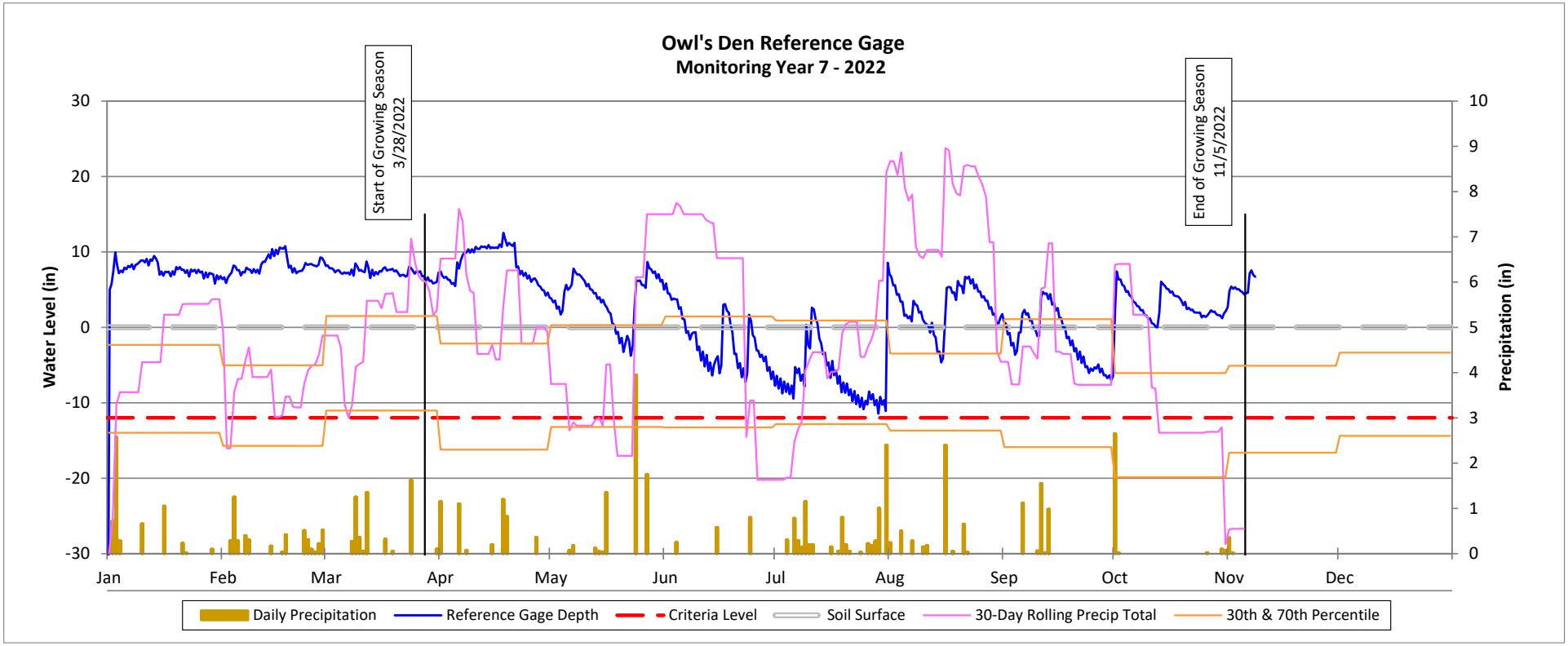

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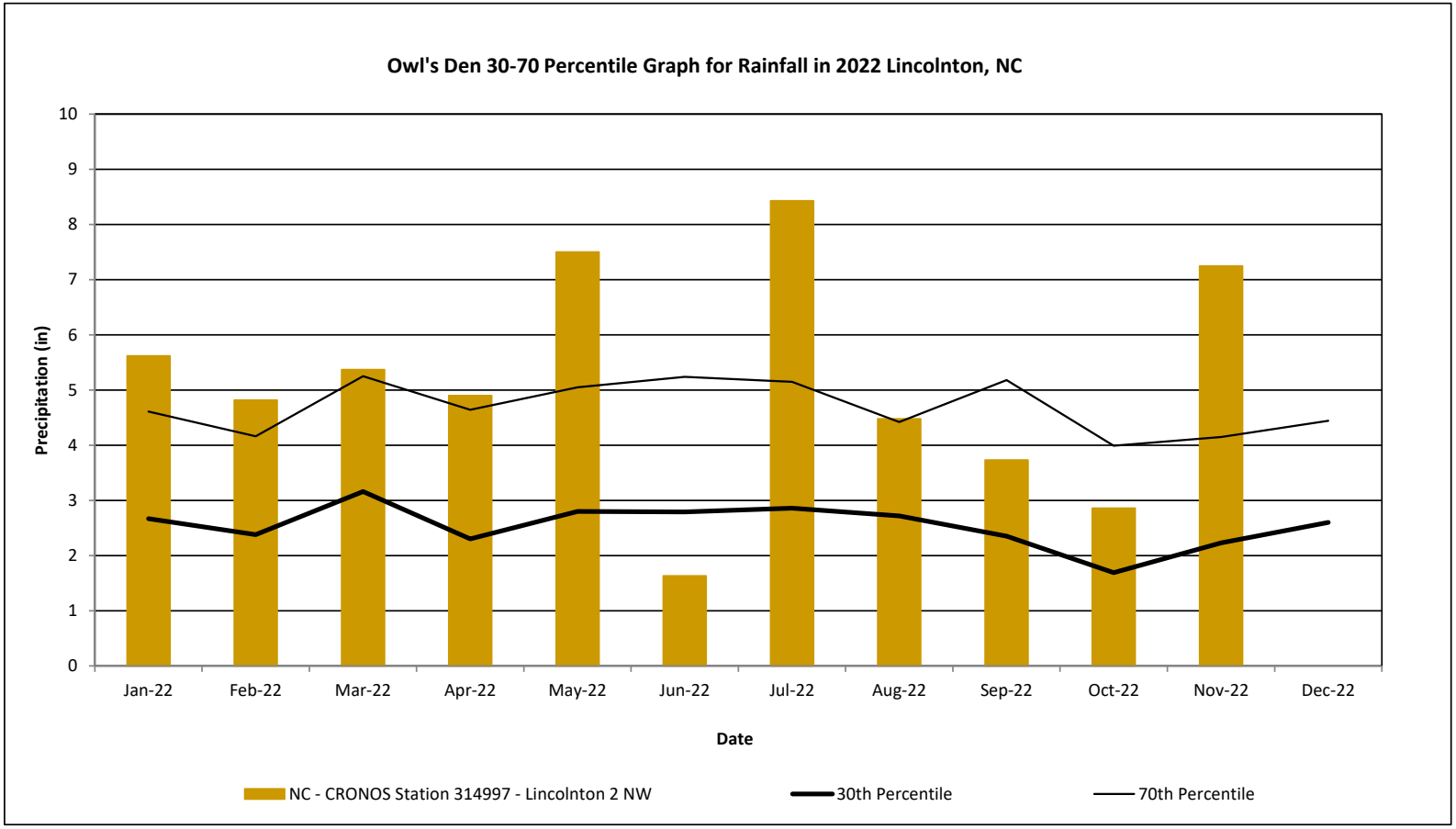
Table 15. Monthly Rainfall Plot

Owl's Den Mitigation Site

DMS Project No. 95808

Monitoring Year 7 - 2022



Annual Rainfall collected by NC - CRONOS Station 314997 - Vale 4.2 W, NC (Downloaded 11/9/2022).

30th and 70th percentile rainfall data collected from weather station NC4997, in Lincolnton, NC (USDA, 2000).

APPENDIX 6. DMS Boundary Inspection

Owl's Den Boundary Inspection Report- 9/14/2022

DMS conducted an easement inspection of the Owl's Den Site in Lincoln County on September 14, 2022. The easement inspection was conducted in accordance with the DMS Property Checklist and includes completion of a pre-inspection office review of the plat, as-built and monitoring reports. The field effort included inspection of the entire easement boundary to validate the easement integrity. The property inspection is documented in the attached checklist and summarized below:

Office Review:

- Mowing allowance provisions specified in the CE for fenced areas will be field checked. Documents indicate no fencing present.
- Line segments >200' are present onsite indicating in-line marking will be checked during the field inspection.
- Internal Crossing will be checked. The DMS .kmz displays the internal crossing as external.

Field Inspection:

- Corner markers and in-line markers were difficult to spot due to vegetation overgrowth. Flagging was added to improve visibility.
- Corner markers consisted of U-Channel with signs. The post and sign located at Mowed Area 1 was bent/damaged.
- Five stamped aluminum monument caps were field verified and consistent the plat.
- In-line T-Post markers were adequately spaced, multiple signs were missing from posts.
- Mowed Area 3 was previously marked with flagging.
- No fencing was present.
- Crossing was in good condition.

Action Items

- Upgrade marking at the three mowed areas with supplemental posts and horse tape, notify landowner of new posts.
- Repair damaged corner marker and sign at Mowed Area 1 and add tall PVC for visibility in this high traffic area.
- Trim vegetation blocking view of marker posts.
- Add missing signs to in-line markers (optional but recommended for consistency).

Property Boundary Verification Checklist			
Project Name	Owl's Den	**County**	Lincoln
DMS PM	Paul Wiesner	**Monitoring Phase**	MY7/2023 Closeout
DMS Project No.	95808	**DMS Inspector**	Phillips
Provider	Wildlands	**Provider Contact**	Eric Neuhaus

In-Office Review	
CE Document Review	**Comments**
Atypical Allowances/Restrictions	Crossing Allowance, mowing allowed within 10 feet of a fence within easement as platted, existing roads allowed.

Plat Review	**Yes**		**No**		**Comments**
	Plat	**As-Built**	**Plat**	**As-Built**	
Internal Roads/Trails			X	X	
Internal Crossings	X	X			
External Crossings			X	X	
Dedicated Ingress/Egress	X	X			
ROWs	X			X	Note 12 Electric line and R/W to be reloacted
Exclusion Fencing			X	X	
Infrastructure			X	X	
Corners of Survey with #	X			X	
Line Segments >200'	X	X			
Special Use Allowances	X	X			Crossing
Project History, Aerials, CCPVs	Review site monitoring for prior encroachments				None in MY6

In-Field Review (Inspection Date: 9/14/2022)

Field Verified Entity	**As-built Record Drawing Boundary/Verification**	**Observations/Results**
Corners monumented	#5 rebar x 30”, with aluminum cap on easement corners with number per plat. Three in-ground monuments verified; additional if not found or errors	5 monuments were verified and matched to the plat
Corners marked	6’ durable witness post with approved sign. All witness posts at corners in correct location, signed, stable and visible where necessary	All corners were adequately marked with U-channel. The northwest corner post and sign were bent at mowed area 1. Vegetation blocked view of multiple corner markers.
In-line marking	Posts and signs at minimum every 200' in line between corners; trees may be blazed in lieu of signs where possible. All lines > than 200' posted at acceptable intervals and visible where necessary	In-line marking was adequately spaced and marked with T-posts. Signs were missing from several of the posts. Multiple posts were obscured by vegetation.
Encroachments	Vegetative, vehicular, structural, grading, crossing infrastructure, fencing, etc. Note location on plat, extent (boundary and approximated size) and type of encroachment	Three mowed areas were observed. Mowed areas 1, 2 and 3 shown in the attached kmz.

Documentation	**Yes**	**No**	**DMS Inspector Signature/Date**
Site is fully compliant; adequately marked, no encroachments, plats appear to be complete and accurate		X	Kelly Phillips/9-14-2022

Notes:
The full process for property boundary verification inspections is described in the Method worksheet in this workbook
Supplemental support documentation will be included with this checklist as needed for non-compliant sites.
Checklist and report documents will be submitted to the PM and Property Supervisor and saved to the R: drive in the CE subfolder
Report and checklist will also be sent to Regional Supervisor for non-compliant sites
PM is responsible for coordinating with Providers for corrective actions such as adding signage/marking and assigning deadline
For sites needing SPO or legal interpretation PM is responsible for coordinating with Property Supervisor to initiate process
Sites resolutions requiring follow up in-office or in-field evaluations must be re-initiated by the PM via email request to Supervisor and Inspector

Example Monument

Missing Sign

Missing Sign

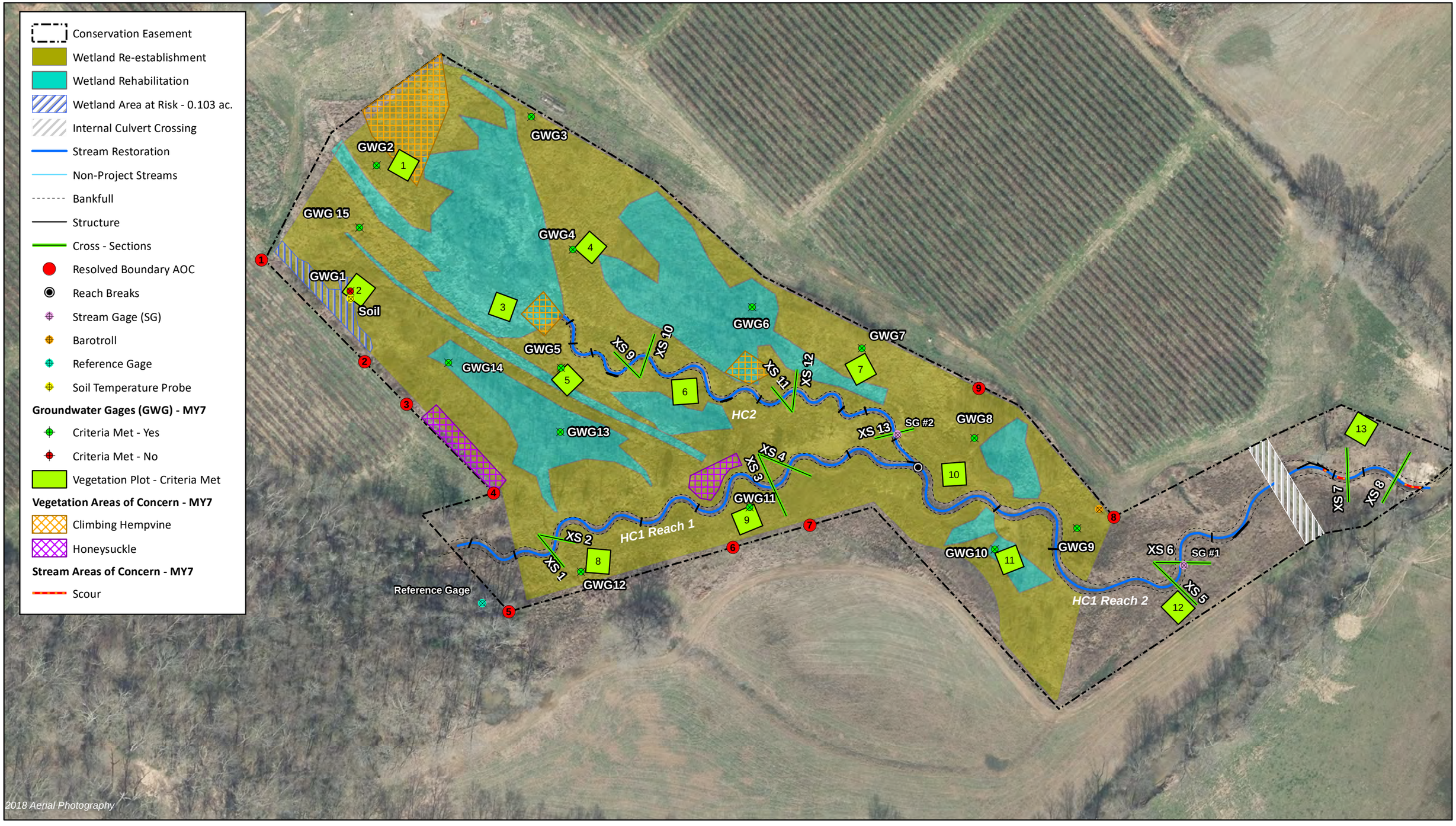
Missing Sign

Missing Sign

Mowed and Bent Sign

Mowed Area NW View

Mowed Area Previously Flagged



0 125 250 Feet

Figure 4.0 Resolved Boundary Areas of Concern
Owl's Den Mitigation Site
DMS Project No. 95808
Monitoring Year 7 - 2022
Lincoln County, NC

Resolved Boundary Areas of Concern Photographs

Monitoring Year 7

	
Easement AOC 1 – Mowed and bent sign *(9/14/2022)*	**Resolved Easement AOC 1** – Signpost reinforced (*11/14/2022)*
	
Easement AOC 2 – Missing sign *(9/14/2022)*	**Resolved Easement AOC 2** – Sign replaced *(11/8/2022)*
	
Easement AOC 3 – Missing sign *(9/14/2022)*	**Resolved Easement AOC 3** – Sign replaced *(11/14/2022)*

	
Easement AOC 4 – Mowed area NW view *(9/14/2022)*	**Resolved Easement AOC 4** – Horse tape added (*11/14/2022)*
	
Easement AOC 5 – Vegetation covering sign *(9/14/2022)*	**Resolved Easement AOC 5 –** Vegetation removed *(11/14/2022)*
	
Easement AOC 6 – Missing sign *(9/14/2022)*	**Resolved Easement AOC 6 –** Sign replaced *(11/14/2022)*

	
Easement AOC 7 – Missing sign *(9/14/2022)*	**Resolved Easement AOC 7** – Sign replaced (*11/14/2022)*
	
Easement AOC 8 – Mowed area previously flagged *(9/14/2022)*	**Resolved Easement AOC 8 –** Horse tape added *(11/14/2022)*
	
Easement AOC 9 – Vegetation covering sign *(9/14/2022)*	**Resolved Easement AOC 9 –** Vegetation removed *(11/8/2022)*