

Las Vegas Wash Vegetation Monitoring Report, 2022

April 2024



SOUTHERN NEVADA
WATER AUTHORITY®

Las Vegas Wash
Coordination
Committee



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**Las Vegas Wash
Vegetation Monitoring Report, 2022**

**SOUTHERN NEVADA WATER AUTHORITY
Las Vegas Wash Project Coordination Team**

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Las Vegas Wash Coordination Committee

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ABSTRACT

For more than 20 years, revegetation efforts along the Las Vegas Wash have been a primary component in helping to meet the goals of the Las Vegas Wash Coordination Committee. Monitoring for this report took place from August through October, 2022. During surveys, approximately 270 acres of revegetation across 69 sites were monitored in the field. The remaining 89 sites (56.3%) were monitored for total cover using ArcGIS. Sites ranging in age from 1 to 22 growing seasons had total cover, noxious species cover, species richness, and Wetland Prevalence Index documented. Of the 69 sites monitored in the field, 36 (52.2%) had the same cover as they did in the previous monitoring season, 23 (33.3%) increased in cover, nine (13.0%) decreased in cover, and one was in its first year of monitoring (1.5%). Most older sites have matured to a point that vegetative cover does not change much between growing seasons.

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1.0 INTRODUCTION

1.1 Background

In 1997 a citizens advisory committee was assembled by the Southern Nevada Water Authority (SNWA) to evaluate water quality issues in the Las Vegas Wash (Wash), Las Vegas Bay, and Lake Mead (Figure 1). From this, the Las Vegas Wash Coordination Committee (LVWCC), a 28-member stakeholder group consisting of federal, state, and local agencies; the University of Nevada, Las Vegas; private businesses; environmental groups; and citizens, was formed. In 2000, the LVWCC created the Las Vegas Wash Comprehensive Adaptive Management Plan (CAMP) (LVWCC 2000) to help guide stabilization and enhancement activities along the Wash. On-the-ground activities have been carried out since then to implement the goals of the CAMP, including constructing erosion control structures (weirs) in the stream channel and armoring the banks with rock. Wetland, riparian, and upland vegetation has been planted to help further protect the Wash from erosion, as well as to improve the functional attributes of the ecosystem.



Figure 1. Las Vegas Wash location and general study area map.

The goal of the revegetation program is to help stabilize and enhance the Wash. This is achieved by planting native species that act as soil anchors during flood events, binding their roots to soil particles on the surface, subsurface, and in deep subsurface horizons. In addition, it has been documented that a variety of wildlife species benefit from these revegetation efforts (Great Basin Bird Observatory 2020, Lantow 2020, Van Dooremolen 2021). At the time when the erosion control project began along the Wash, there were few native plants found along its banks, especially wetland and riparian species (LVWCC 2000). Salt cedar (*Tamarix ramosissima*; a.k.a., tamarisk), an exotic species, successfully established in the area and became the dominant species. At its peak, salt cedar covered approximately 1,500 acres along the Wash. The plants used to restore the Wash to a natural-type condition include a variety of species native to upland, wetland, and riparian areas in the region.

1.2 Purpose and Scope

This report is intended to document the status of SNWA's revegetation efforts along the Wash by reporting 2022 data as part of a comprehensive vegetation monitoring program. Vegetation monitoring results from 2002 through 2021 have been previously documented (SNWA 2005, Eckberg and Shanahan 2008, Eckberg 2023, Lantow 2023); therefore, they are not described in detail in this report. Since 2003, monitoring activities have been conducted on progressively larger land areas. Approximately 38 acres were monitored in 2003 and approximately 615 acres were monitored in 2022. All of these revegetation project sites are located within or bordering the Clark County Wetlands Park (Wetlands Park; Figure 2).

1.3 Need for Revegetation and Vegetation Monitoring

Revegetation projects along the Wash are not only conducted because of their environmental benefits but are also required for permitting purposes. Clean Water Act (CWA) Section 404 permits issued by the U.S. Army Corps of Engineers (Corps) to SNWA for erosion control projects occurring in jurisdictional waters of the U.S. require revegetation as compensatory mitigation for wetlands impacted. Section 404 of the CWA established a program to regulate the discharge of dredged or fill material into waters of the U.S. This includes wetlands associated with Wash erosion control projects. Section 404 permits required that revegetation projects are monitored for success; consequently, several performance indicators are monitored so performance criteria can be achieved. The primary criterion is that mitigation areas provide the functional attributes of a natural wetland system.

The Nevada Division of Environmental Protection (NDEP), which derives duties through state and federal implementing regulations (i.e., Chapter 445A of the Nevada Revised Statutes and Section 402 of the CWA), also requires revegetation to occur for Wash erosion control projects. NDEP issued general stormwater permits for Wash construction activities and permits require that final site stabilization is achieved. Vegetative cover serves as a form of final stabilization, defined by NDEP as "...perennial vegetative cover with a density of 70% of the native background vegetative cover...establishing at least 70% of the natural cover of the native vegetation...e.g., if the native vegetation covers 50% of the ground, 70% of 50% would require 35% total cover."

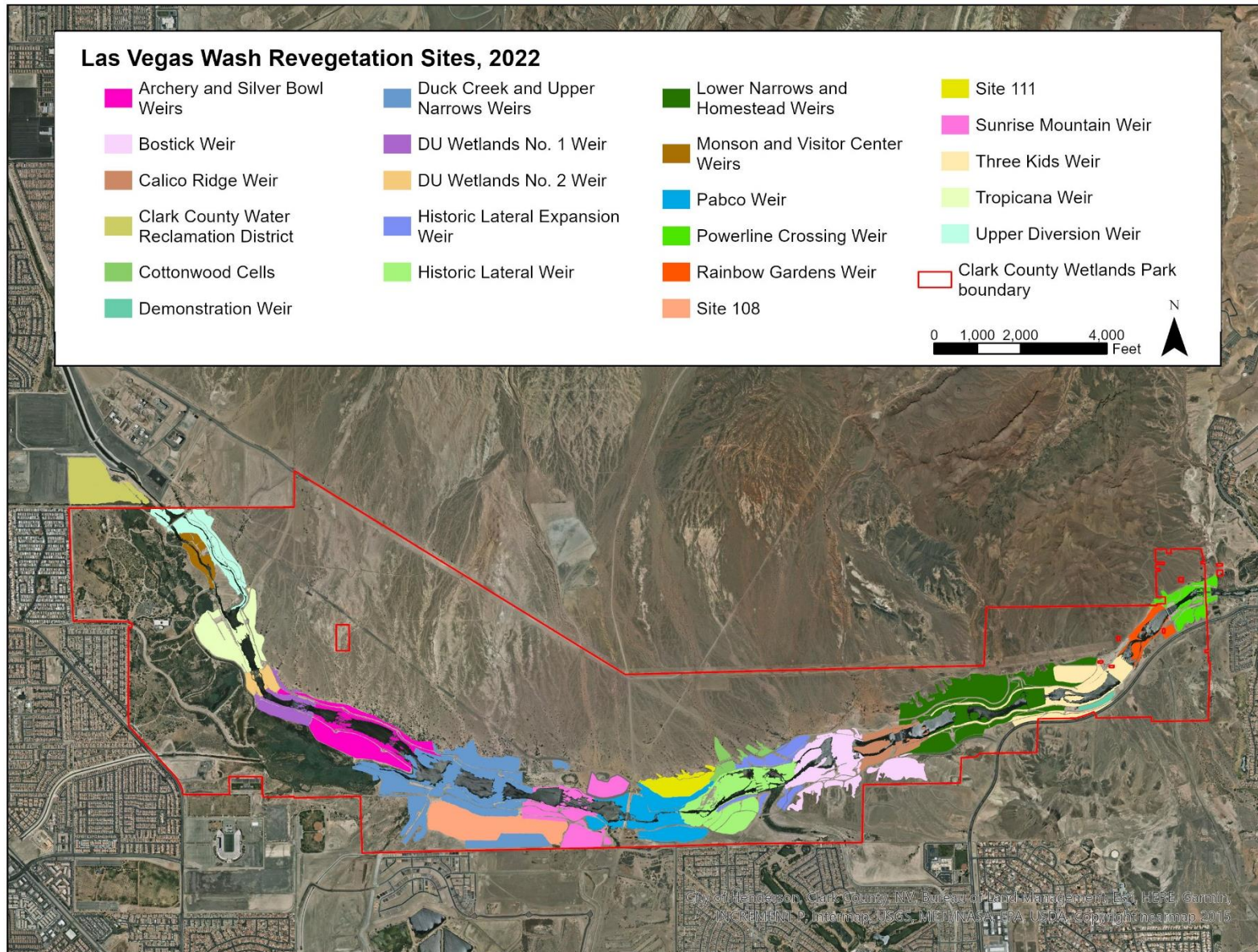


Figure 2. Location of the 2022 Las Vegas Wash revegetation sites.

In addition to permit-required revegetation, SNWA has received multiple federal, state, and local grants to help fund the erosion control program as well as ecological enhancement along the Wash. Granting agencies, such as the Bureau of Reclamation (BOR), require that revegetation projects are successful; therefore, specific criteria are measured during monitoring to ensure compliance with these requirements. For program consistency, all revegetation sites are monitored annually for the same criteria and with the same general methodology.

Also, stakeholders such as the LVWCC and Las Vegas Valley Watershed Advisory Committee (LVVWAC) need to be kept aware of the status of projects along the Wash including the revegetation program. Many stakeholder meetings were held to establish the goals of the Wash program and providing regular updates ensures members are informed of progress. In addition, the LVVWAC, which provides funding and oversight for the LVWCC's activities, needs to know how funds are spent and that efforts are successful.

Finally, data from past revegetation efforts along the Wash informs future decisions. Information on which species are regularly successful and which ones rarely survive without substantial human intervention helps project managers decide which species should be used in future restoration efforts. This increases revegetation project success and helps ensure funds are used effectively.

1.4 Program Funding

The Las Vegas Wash Capital Improvements Plan, state and federal grants, Clark County (primarily for specific projects related to the Wetlands Park), and the LVVWAC-funded Wash operating budget funded the revegetation program through June 2022. In July 2022, the Wash program transitioned from capital construction to the Las Vegas Wash Long-Term Operating Plan (LTOP). The LTOP lays out 36 actions to sustain program assets, including revegetation, and is funded by LVVWAC member agencies. State and federal grants continue to be important components of the budget for revegetation activities.

1.5 Typical Revegetation Establishment Activities

1.5.1 Planning

Most revegetation sites along the Wash were established in association with the construction of erosion control structures. Plant selection and irrigation design were done in conjunction with the engineering plans for the site. Hydroseed was included in the construction of the erosion control structures. Hydroseeding represented the final step in the construction process and the initial step in most revegetation projects. Species were specifically selected to be most successful on each weir site. Procedures were described in construction plans to include tackifier, mulch, and fertilizer along with the seeds themselves.

1.5.2 Plant Procurement

After plants are selected, procurement activities take place in order to have material in time for planting at the sizes needed to have a successful restoration site. Plants are either ordered from government or commercial nurseries or grown by the Las Vegas Wash Project Coordination Team

(Wash Team). Local nurseries, such as Mountain States Wholesale Nursery and the Nevada Division of Forestry have provided most plants for this work. Plants grown by the Wash Team involve collecting seed or cuttings, establishing the seedlings, transplanting them into larger containers, irrigating, and delivering them back to the Wash for final planting. With revegetation activities taking place for more than 20 years, there are now sufficient native species established along the Wash to procure seeds and cuttings without going to surrogate areas. Plant propagation for the Wash Team takes place at the SNWA-owned and -operated Warm Springs Natural Area propagation facility in Moapa, NV.

1.5.3 Invasive and Other Undesirable Species Removal

Prior to revegetation efforts, most of the sites described in this report were previously covered in part or entirely by salt cedar, an invasive species that is prolific and spreads easily and can encroach on revegetation sites if removal does not take place. Some other invasive species that are found on sites and require constant monitoring are tall whitetop (*Lepidium latifolium*), silverleaf nightshade (*Solanum elaeagnifolium*), giant reed (*Arundo donax*), Malta starthistle (*Centaurea melitensis*), and johnsongrass (*Sorghum halepense*). Without removal, the native species used in revegetation efforts would not be able to grow, germinate, and become self-sustaining. Considerable effort, therefore, is given to continually surveying sites for encroachment, identifying invasive species, and planning for their removal as soon as possible.

Other species that are closely monitored because of their ability to grow vigorously and outcompete revegetated plants are common reed (*Phragmites australis*) and quailbush (*Atriplex lentiformis*). Quailbush is a native species and the Wash has both native and non-native common reed as well as hybrids of the two (Saltonstall et al. 2016). The goal with these species is not to completely remove them, since this is likely unattainable, but to selectively thin them so that other vegetation can have time to establish and create a species-rich environment.

1.5.4 Irrigation

Non-wetland revegetation sites along the Wash require irrigation for the first 1–3 growing seasons to become established. Sites are irrigated with infrastructure components that are easily moved to new sites as they are planted. Irrigation water is pumped out of the Wash using gasoline- or biodiesel-powered pumps to a single mainline and then to multiple lateral lines that are fitted with drip irrigation tubing. Past efforts included spray irrigation.

Over the years, the sizes of the sites that are irrigated have ranged from under one acre to almost 60 acres. Regular checks and maintenance on irrigation system components are critical to ensure the water is reaching the plants. On average, southern Nevada gets less than five inches of rain annually, so a break in the irrigation system could be detrimental to the plants health and the overall success of the site. Irrigation maintenance includes fixing leaks, tightening connections, and fixing or replacing broken pipes or heads.

1.5.5 Trash Removal

Trash along the Wash is prevalent and caused by flood events, wind, and illegal dumping. Although illegal dumping has decreased over the years, its presence is still there. If this trash ends up at a newly established revegetation site, it can hinder the site's success. The Wetlands Park has grown in popularity over the years which may be a reason for the decrease in illegal dumping, or perhaps it is due, in part, to the revegetation program making the Wash a more scenic location. In addition, the public outreach program has helped educate the community about the Wash, its importance, and why people should keep it clean (Harris et al. 2013).

1.5.6 Herbivore Control

Fencing was installed on some revegetation sites to help reduce the damage caused by beavers and rabbits. Some sites have a single fence that goes around the site's entirety while other sites have individual fences for each plant. Both situations require continual inspection for damage, repairs, and adjustments to the spacing of the fences to reduce plant damage. Once a site is considered fully established, the fencing is typically removed. Only a few locations at the Wash still have fencing; these sites should be inspected, and if deemed appropriate, all fencing should be removed.

1.5.7 Long-Term Management

The Las Vegas Wash Long-Term Revegetation Management Plan (RMP; Eckberg 2019) was created to help identify activities that would improve revegetation sites along the Wash after initial establishment. Initial establishment activities were completed in the spring of 2022.

In general, the RMP focuses on how to improve the ecological function of revegetation sites including diversifying plant structure types and plant species, increasing wildlife benefits in the form of food and shelter, and removing undesirable species and trash from the sites.

2.0 MATERIALS AND METHODS

Monitoring was conducted between August and October 2022, following the same guidelines as previous years (Eckberg and Shanahan 2009). As of August 2022, there were 82 wetland and 76 non-wetland revegetation sites. Many larger sites were broken up into multiple monitoring areas (Table 1). These smaller monitoring areas have their information combined using a weighted average of cover statistics, with acreage as the weight, to properly combine sites of different sizes.

ArcGIS was used to monitor 89 of the 158 total revegetation sites in 2022 for total cover; these sites did not have data collected regarding species richness, individual species cover, or Wetland Prevalence Index (WPI). Sites are only monitored using ArcGIS if they meet specific criteria as laid out in Eckberg and Shanahan (2009) or if on-the-ground obstacles prevent in-person monitoring.

Major Site	Acreage		No. of Monitoring Areas	
	2021	2022	2021	2022
Archery and Silver Bowl Weirs	37	38.6	9	9
Bostick Weir	50.2	44.6	15	15
Calico Ridge Weir	18	14.9	11	11
CCWRD	28.4	29.5	1	1
Cottonwood Cells	8.3	8.3	9	9
Demonstration Weir	2.3	2.3	2	2
Duck Creek Confluence and Upper Narrows Weirs	85.1	86.3	13	13
DU Wetlands No. 1 Weir	13.5	13.5	5	5
DU Wetlands No. 2 Weir	6.3	6.3	5	5
Historic Lateral Weir	38.2	39.7	14	14
Historic Lateral Expansion	13.1	13.1	6	6
Lower Narrows and Homestead Weirs	70.8	71.4	8	8
Monson and Visitor Center Weirs	8.6	8.5	4	4
Pabco Road Weir	39.2	39.5	18	18
Powerline Crossing Weir	14	14.1	17	17
Rainbow Gardens Weir	12.8	8.3	8	8
Site 108	38.9	39.4	59	59
Site 111	14.9	14.9	26	26
Sunrise Mountain Weir	23.1	33.6	7	8
Three Kids Weir	34	34.7	8	8
Tropicana Weir	28.2	29.4	6	6
Upper Diversion Weir	24.8	24.2	24	24
TOTAL	609.7	615.1	275	276

Table 1. Change in cumulative acreage monitored and number of monitoring areas from 2021 to 2022.

3.0 RESULTS AND DISCUSSION

The following subsections describe monitoring results for each site and for groupings of sites. From 2021 to 2022, the number of areas monitored increased by one and the acreage increased by just over five acres (Table 1). The total areas and acreage include sites monitored in the field as well as with ArcGIS.

Cumulatively, there have been 124.76 acres of wetlands created above those required by mitigation permits (Table 2), including 3.16 acres associated with the Cottonwood Cells, which were fully funded by grants from the BOR, and the 5.99 acres created at CCWRD, which had its permit held

Mitigation Project	Mitigation Permit Number	Mitigation Required (acres)	Wetland Area Created (acres)
Archery and Silver Bowl Weirs	SPK-2011-00796-SG	0 ^c	8.32
Bostick Weir	200125114	7.88	15.63
Calico Ridge Weir	200450004	3.80	9.40
Clark County Water Reclamation District	SPK-2009-00227-SG	6.79	5.99^a
Cottonwood Cells	N/A	—	3.16^b
Demonstration Weir	199825148	0.90	0.55
Duck Creek Confluence and Upper Narrows Weirs	SPK-2009-00042	1.33	22.89
DU Wetlands No. 1 Weir	SPK-2010-00285-SG	1.22	4.23
DU Wetlands No. 2 Weir	2007-1961-SG	0.05	1.72
Historic Lateral Weir	199825148	4.90	20.06
Historic Lateral Expansion	SPK-2014-01108	0 ^c	0.42
Lower Narrows and Homestead Weirs	SPK-2008-01417-SG	6.25	14.26
Monson and Visitor Center Weirs	200250111	4.81	1.82
Pabco Road Weir	199725375	2.20	8.79
Powerline Crossing Weir	200450454	4.87	3.01
Rainbow Gardens Weir	200250054	1.00	4.62
Sunrise Mountain Weir	SPK-2014-01108	0 ^c	4.68
Three Kids Weir	SPK-2012-01138-SG	0 ^c	17.96
Tropicana Weir	SPK-2016-00293	0 ^c	22.36
Upper Diversion Weir	200550514	0.01	7.96
Bank Protection Projects	—	7.06	—
TOTAL		53.07	177.83

^a Permit held by Clark County Water Reclamation District and not eligible for Wash wetland mitigation.

^b Federally funded revegetation not eligible for wetland mitigation.

^c Permits authorized under nationwide Permit Number #27 after 2012 have no mitigation requirement.

Table 2. Mitigation requirements and wetland areas established as of October 2022.

by the property owners. Some individual project results show the wetlands created do not meet the required acreage (Table 2). For these instances, multiple projects were combined to meet the required acreage. Federally funded projects are not eligible for use as mitigation of wetlands impacted in accordance with permits issued by the Corps.

3.1 Archery and Silver Bowl Weirs

The Archery and Silver Bowl weirs were simultaneously completed in 2015 (Table 3, Figure 3). The revegetation for these weirs was also conducted simultaneously and there is no separation between the two weirs for revegetation sites (Figure 3). All revegetation sites were monitored using ArcGIS in 2022, so only total cover was recorded for each site.

Total cover for six of nine sites remained the same as documented in 2021. Archery Silver Bowl North (ASBN) and Archery Silver Bowl South 2 (ASBS2) both saw a slight decrease. However, as previously suggested in the 2021 report, data shows that these sites’ total cover appears to be underestimated when monitored using ArcGIS. This is likely due to the inability to identify the main species present, desert saltbush (*Atriplex polycarpa*), with aerial imagery. At these sites, desert saltbush made up 62.5% and 87.5% total cover, respectively in 2021.

The two weir sites, Archery Weir (AW) and Silver Bowl Weir (SBW), had all of the vegetation removed from the face of the weirs in 2019 as part of final benchmarking of the weirs to return them to their original lines and grades. Since then, both sites have seen increases in acreage most years. AW increased in acreage from 1.16 in 2021 to 1.34 in 2022. SBW increased from 1.36 acres in 2021 to 1.91 acres in 2022. These results demonstrate that, while the required maintenance activity of removing vegetation from the weirs has an immediate large impact, the recovery is also swift.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
ASBN	7	6.47	non-wet	50–75%	nm	nm	nm
ASBNB	7	2.69	wet	75–100%	nm	nm	nm
ASBNUB	7	1.63	non-wet	75–100%	nm	nm	nm
ASBS1	7	11.41	non-wet	75–100%	nm	nm	nm
ASBS2	7	8.60	non-wet	50–75%	nm	nm	nm
ASBSB	7	2.38	wet	75–100%	nm	nm	nm
ASBSUB	7	1.66	non-wet	75–100%	nm	nm	nm
AW	6	1.34	wet	75–100%	nm	nm	nm
SBW	6	1.91	wet	75–100%	nm	nm	nm

¹ASBN= Archery Silver Bowl North, ASBNB= Archery Silver Bowl North Bank, ASBNUB= Archery Silver Bowl North Upper Bank, ASBS1= Archery Silver Bowl South 1, ASBS2= Archery Silver Bowl South 2, ASBSB= Archery Silver Bowl South Bank, ASBSUB= Archery Silver Bowl South Upper Bank, AW=Archery Weir, SBW=Silver Bowl Weir

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 =wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland
nm = this attribute was not monitored

Table 3. Vegetation monitoring results for Archery and Silver Bowl weirs revegetation sites in 2022.

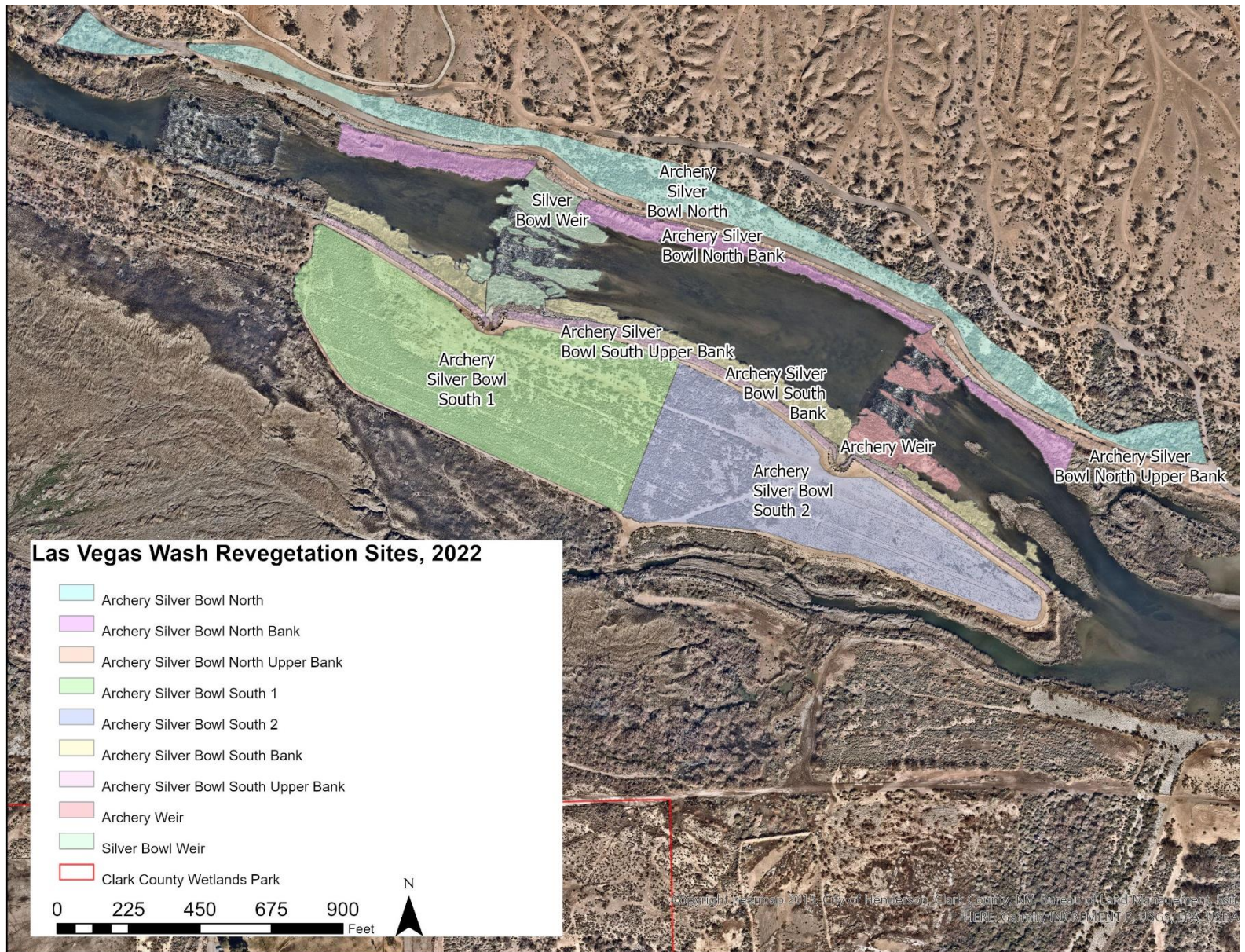


Figure 3. Aerial photograph of 2022 delineated Archery and Silver Bowl weirs revegetation sites.

3.2 Bostick Weir

Five of the 14 revegetation sites at the Bostick Weir were monitored in the field in 2022 (Table 4, Figure 4). Most of the sites were in the 18th or 19th growing season and are considered well established. The only relatively young site is Bostick South Tamarisk (BST) which was in its seventh growing season. Measuring over 21 acres, BST is a very large site when compared to most other Wash revegetation sites, and one of the largest measured as a single monitoring area. Beginning in 2023, this site will be broken up into three monitoring areas, increasing the total number of monitoring areas for Bostick Weir from 17 to 19. The size of this site has made it difficult to assess the overall cover. Breaking this site up into smaller monitoring areas will allow us to understand whether this site is a good candidate for enhancement under the RMP. This site was placed on the candidate list in the 2021 report but has since been removed. BST will be re-evaluated following the 2023 monitoring season.

Site Code ¹	Growing Season	Acres	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
BW	19	7.12	wet	75–100%	nm	nm	nm
BI	19	3.75	wet	75–100%	nm	nm	nm
BN	19	0.85	non-wet	50–75%	0.0%	4	4.67
BS	18	1.23	non-wet	75–100%	0.1%	16	4.09
BST	7	21.02	non-wet	50–75%	nm	nm	nm
DBN	19	0.51	non-wet	25–50%	nm	nm	nm
DBS	18	0.22	non-wet	50–75%	nm	nm	nm
DBSE	18	0.61	wet	75–100%	0.7%	19	2.60
UBN	19	0.56	non-wet	75–100%	0.0%	7	3.02
UBNB	18	2.18	wet	75–100%	0.5%	4	2.33
UBNE	18	0.84	wet	75–100%	nm	nm	nm
UBS	19	2.28	non-wet	75–100%	nm	nm	nm
UBS	19	1.13	wet	75–100%	nm	nm	nm
UBSB	18	1.75	non-wet	75–100%	nm	nm	nm

¹B=Bostick Weir, BI=Bostick Islands, BN=Bostick North, BS=Bostick South, BST=Bostick South Tamarisk, DBN=Downstream Bostick North, DBS=Downstream Bostick South, DBSE=Downstream Bostick South Emergent, UBN=Upstream Bostick North, UBNB=Upstream Bostick North Bank, UBNE=Upstream Bostick North Emergent, UBS=Upstream Bostick South, UBSB=Upstream Bostick South Bank

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland
nm = this attribute was not monitored

Table 4. Vegetation monitoring results for Bostick Weir revegetation sites in 2022.

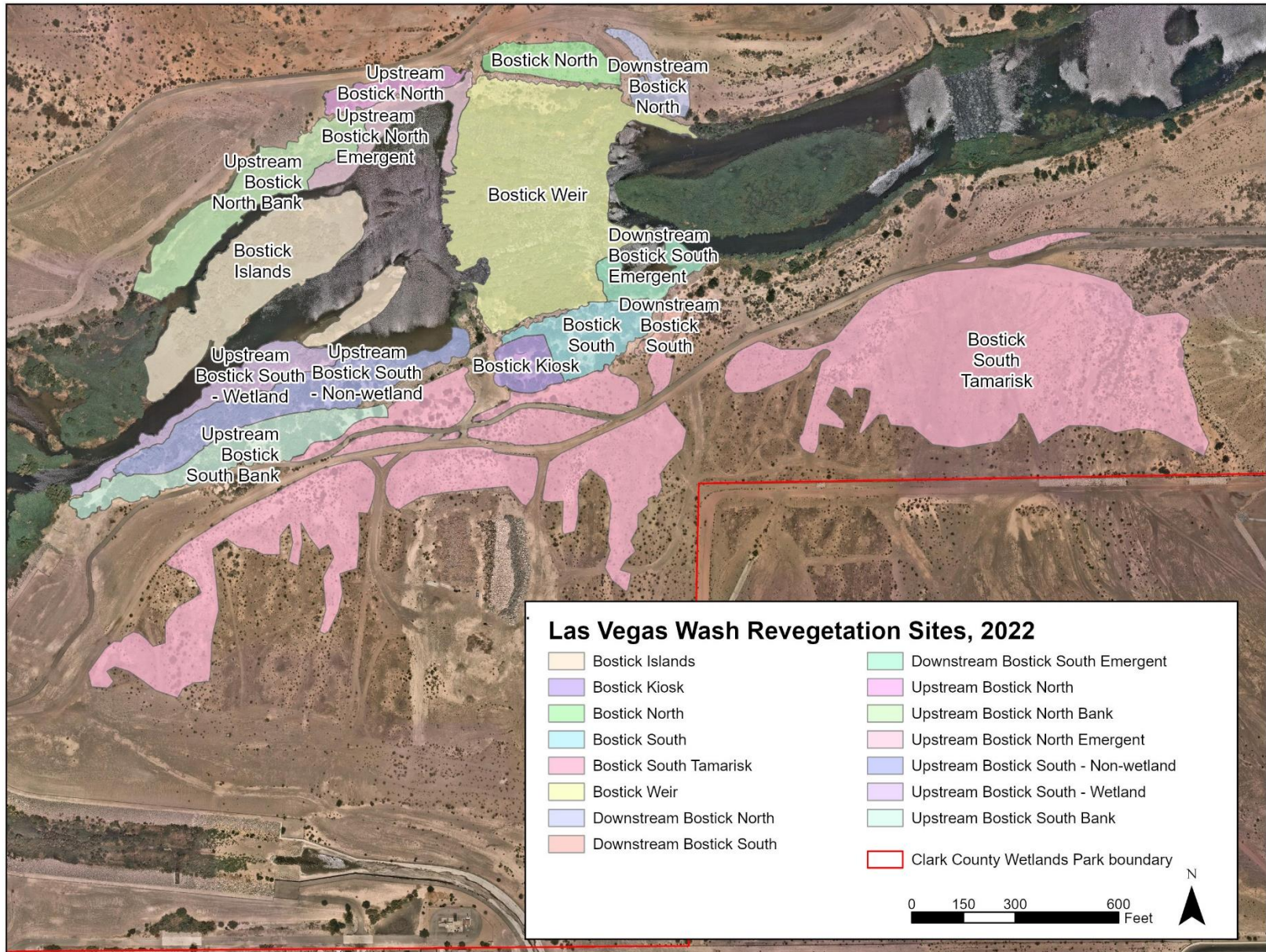


Figure 4. Aerial photograph of 2022 delineated Bostick Weir revegetation sites.

Upstream Bostick North (UBN) saw an increase in cover going from 50–75% recorded in 2020 and 2021 to 75–100% recorded in 2022. Bostick North (BN) saw an increase in total cover from 25–50% in 2021 to 50–75% in 2022. This site was monitored in the field both years. Although total coverage has increased, BN saw a decrease in number of species, going from 6 in 2021 to 4 in 2022. This site remains a great candidate for enhancement under the RMP.

Downstream Bostick North (DBN) has consistently had a total cover of less than 50% for the past four years. When surveyed in the field in 2021, only 4 plant species were identified, and creosote bush (*Larrea tridentata*) made up more than half of that cover. This site remains a good candidate for enhancement under the RMP.

3.3 Calico Ridge Weir

Seven of the 10 revegetation sites related to this weir were monitored in the field in 2022 (Table 5, Figure 5). The Calico Ridge Weir is known as a two-stage weir. There is a typical rock rip-rap section in the center of the Wash channel, then two higher elevation components to the north and south. These two higher elevation portions are slightly above the water table and passively filled in with wetland vegetation soon after construction was completed. This site is known as Calico (C) for vegetation monitoring and is broken up into two monitoring sites, Calico North and South. The center channel has typically not had vegetation, likely due to the higher velocities in the narrower section. Calico Ridge Weir (CRW) had 0.02 acres of wetlands, which is a decrease from the previous two years that recorded 0.8 acres (Table 5, Figure 5).

Site Code ¹	Growing Season	Acreeage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
C	18	1.24	wet	75–100%	1.3%	6	1.98
CRW	18	0.02	wet	75–100%	nm	nm	nm
DCN	18	0.65	non-wet	50–75%	nm	nm	nm
DCS	18	2.30	non-wet	25–50%	0.5%	8	4.73
DCS	18	0.93	wet	75–100%	2.5%	3	1.88
UCE	18	3.56	wet	75–100%	nm	nm	nm
UCN	18	1.91	non-wet	25–50%	0.1%	7	4.01
UCN	18	0.62	wet	75–100%	0.1%	4	2.00
UCS	18	2.89	non-wet	75–100%	0.0%	13	4.09
UCS	18	0.73	wet	75–100%	0.5%	10	2.15

¹C=Calico, CRW=Calico Ridge Weir, DCN=Downstream Calico North, DCS=Downstream Calico South, UCE=Upstream Calico Emergent, UCN=Upstream Calico North, UCS=Upstream Calico South

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 =wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland
nm = this attribute was not monitored

Table 5. Vegetation monitoring results for Calico Ridge Weir revegetation sites in 2022.

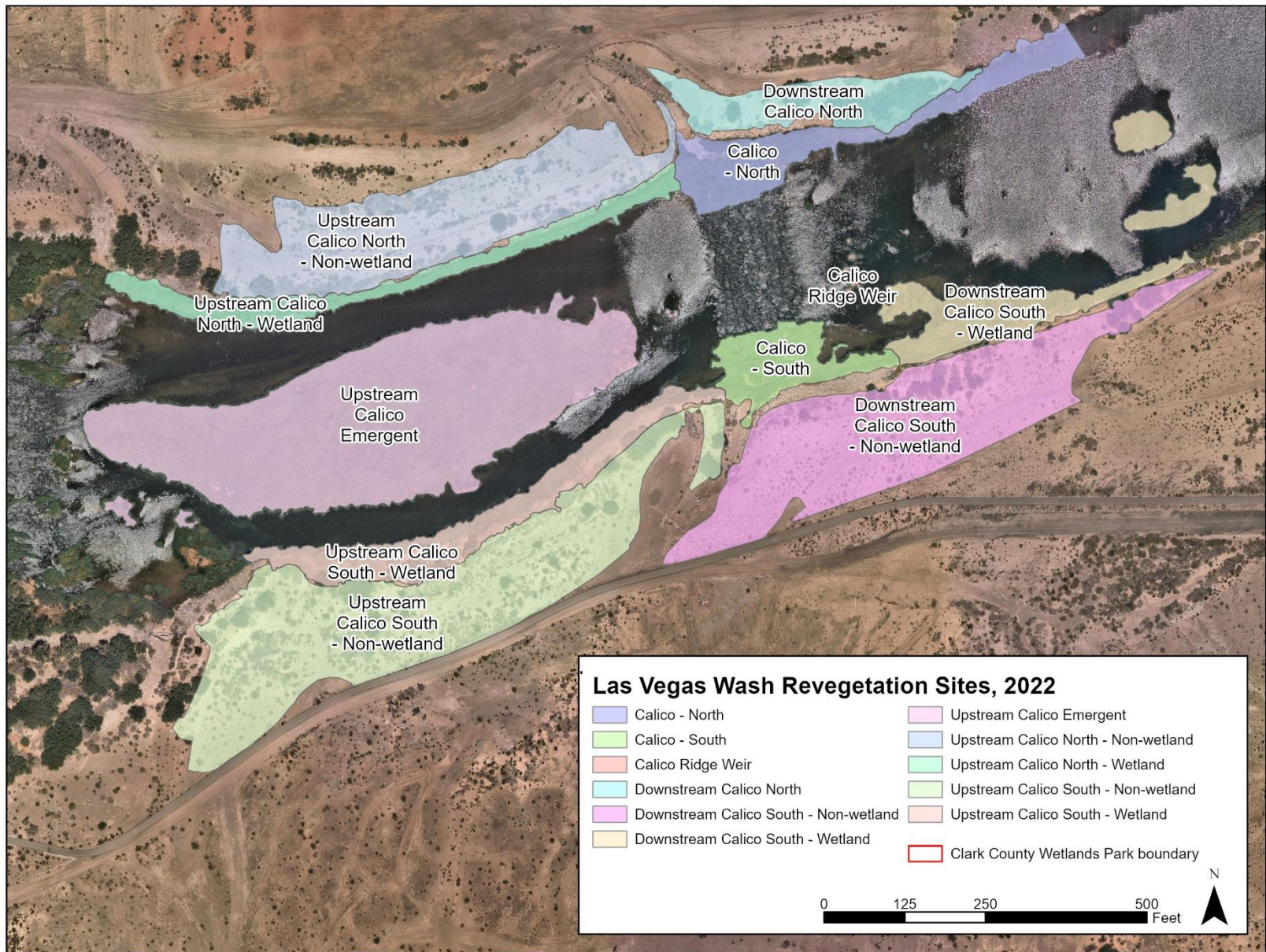


Figure 5. Aerial photograph of 2022 delineated Calico Ridge Weir revegetation sites.

The Calico Ridge Weir sites are in their 18th growing season (Table 5, Figure 5), so most sites do not vary year to year in total cover. Downstream Calico South - Non-Wetland (DCS-N) had a total cover of 5–25% in 2020 and 25–50% when monitored in the field in 2022. Although this is an increase, the number of species decreased from 9 in 2020 to 8 in 2022. Creosote bush made up more than 35% of the total cover in 2022. This site is a good candidate for enhancement under the RMP.

Upstream Calico Emergent (UCE) remains a good candidate for enhancement but is difficult to reach; so, priority will go to sites that are good candidates for enhancement and are more accessible.

3.4 Clark County Water Reclamation District

The CCWRD revegetation site (Table 6, Figure 6) was monitored with ArcGIS in 2022 for the fourth year in a row and will likely continue to be monitored this way moving forward. In 2020, it was determined that access was difficult to any interior area of the site. Although vegetation is visible along the perimeter, that vegetation would not be an accurate representation of the entire site.

If funding is available, removing weeds such as salt cedar, which has reestablished on the site, as well as larger undesirable species such as quailbush, would be priority. Removing these plants should allow for better access to the interior of the site. Measuring the total cover of the site using ArcGIS shows it remained at 75–100% for the sixth year in a row. While there is a wetland component to the site used for mitigation of Corps permits (Table 2), there is no distinction on the ground. Therefore, the site is monitored as a single monitoring area.

Site Code	Growing Season	Acreage	Wetland Status ¹	Total Cover	Noxious Species Cover	Number of Species	WPI ²
CCWRD	13	22.84	both	75–100%	nm	nm	nm

¹Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

²Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland

nm = this attribute was not monitored

Table 6. Monitoring results for the CCWRD revegetation site in 2022.



Figure 6. Aerial photograph of the 2022 delineated CCWRD revegetation site.

3.5 Cottonwood Cells

All revegetation sites at the Cottonwood Cells were monitored using ArcGIS in 2022 (Table 7, Figure 7). The Cottonwood Cells range from 10 to 21 growing seasons. Four of the seven sites had the same total cover as in 2021, while Cottonwood Cell 2 (CC2) increased and Cottonwood Cell North (CCN) and Cottonwood Cell North Stockpile (CCNS) both decreased. CCN is made up of three monitoring areas; CCN-1 saw a significant decrease from 75-100% recorded in 2021 to 5-25% recorded in 2022. The other two sites' total cover remained the same. CCNS also showed a drastic decrease in total cover from 50-75% recorded in the field in 2021 to 5-25% estimated using ArcGIS in 2022. These decreases in total cover suggest that the aerial imagery is unable to adequately show some of the vegetation on these upland sites.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
CC1	21	0.98	wet	75–100%	nm	nm	nm
CC2	18	0.54	wet	75–100%	nm	nm	nm
CC3	11	1.15	wet	75–100%	nm	nm	nm
CC3-2	10	0.40	wet	75–100%	nm	nm	nm
CC3-B	10	0.11	wet	75–100%	nm	nm	nm
CCN	11	4.38	non-wet	39.7%	nm	nm	nm
CCNS	11	0.77	non-wet	5-25%	nm	nm	nm

¹CC1=Cottonwood Cell 1, CC2=Cottonwood Cell 2, CC3=Cottonwood Cell 3, CC3-2=Cottonwood Cell 3-2, CC3-B=Cottonwood Cell 3 - Bank, CCN=Cottonwood Cell North, CCNS=Cottonwood Cell North Stockpiles

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland
nm = this attribute was not monitored

Table 7. Vegetation monitoring results for Cottonwood Cells revegetation sites in 2022.

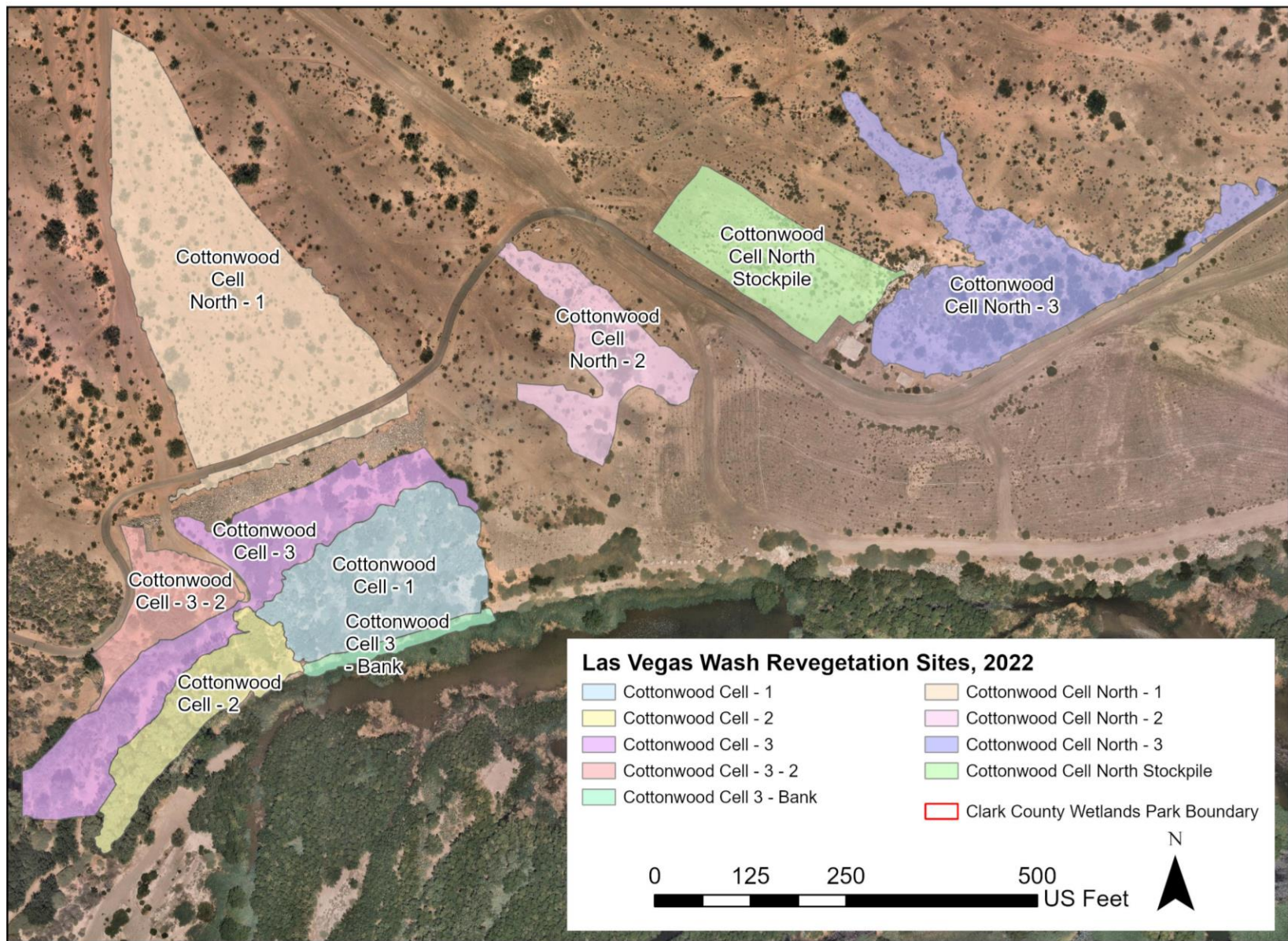


Figure 7. Aerial photograph of 2022 delineated Cottonwood Cells revegetation sites.

3.6 Demonstration Weir

The two sites at the Demonstration Weir were monitored in the field in 2022 (Table 8, Figure 8). Upstream Demonstration South - Non-Wetland (UDS-N) had an increase in total cover from 25-50% in 2021 using ArcGIS to 50-75% in the field in 2022. This site has not changed much in terms of species composition or cover in many years. Saltlover (*Halogeton glomeratus*) was first identified in the field in 2020 but has not been identified since. Although for now this species does not seem to be a threat, saltlover is known across many Wash sites and is rapidly spreading. Continued monitoring for this species is critical to make sure it does not become an issue with the overall health of native vegetation. Upstream Demonstration South - Wetland (UDS-W) has had the same cover of 75–100% for all but two monitoring years since 2006. Number of species for this site fluctuates between 8 and 11. Salt cedar was identified at 2.5% cover in 2022, the first time since 2019 that it has been identified. Future surveys will verify whether this species continues to spread.

Site Code ¹	Growing Season	Acreeage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
UDS	20	1.77	non-wet	50–75%	0.0%	10	3.95
UDS	20	0.55	wet	75–100%	2.5%	8	3.35

¹UDS=Upstream Demonstration South

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 =wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland

nm = this attribute was not monitored

Table 8. Vegetation monitoring results for Demonstration Weir revegetation sites in 2022.

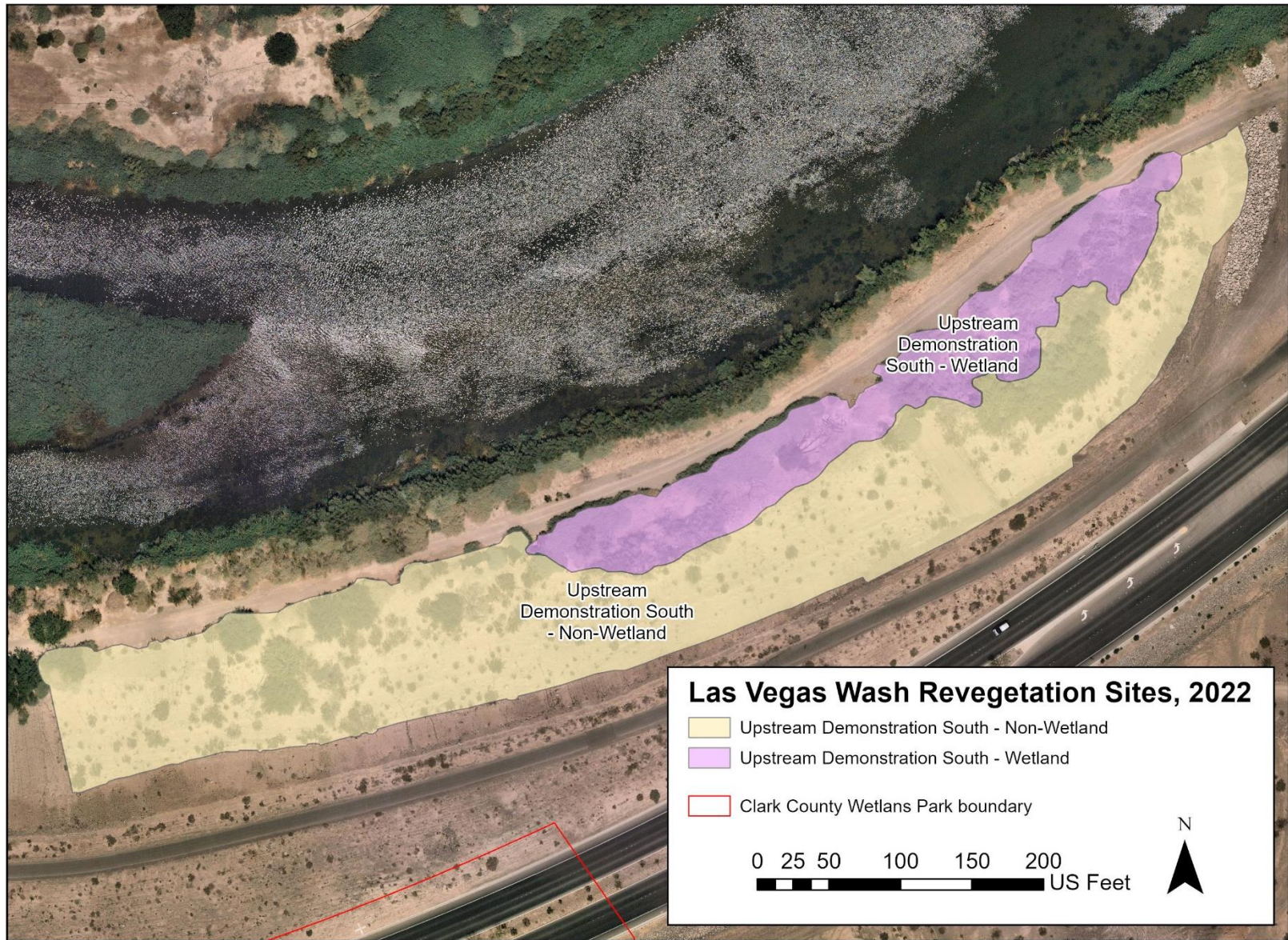


Figure 8. Aerial photograph of 2022 delineated Demonstration Weir revegetation sites.

3.7 Duck Creek Confluence and Upper Narrows Weirs

Seven of the 13 sites were monitored in the field in 2022 (Table 9, Figure 9). Duck Creek Upper Narrows North Stockpile (DCUNNS) total cover remained that same as in the past four years ranging from 5-25%. This site is a great candidate for enhancement under the RMP. Duck Creek Upper Narrows South-2 (DCUNS-2) had an increase in total cover from 5-25% recorded in the field in 2020 and using ArcGIS in 2021 to 50-75% recorded in the field in 2022. Results showed a significant increase in Anderson’s wolfberry (*Lycium andersonii* var. *andersonii*), honey mesquite (*Prosopis glandulosa* var. *torreyana*), and quailbush. Additional plantings and irrigation of this site began in 2021 and results indicate that these efforts have been successful. Duck Creek Upper Narrows South Fill (DCUNSF) has had less than 5% total cover for several years. This site is another great candidate for enhancement under the RMP.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DCUNE	10	9.91	wet	75–100%	nm	nm	nm
DCUNN	9	14.86	non-wet	75–100%	0.0%	15	3.95
DCUNNR	9	1.52	non-wet	75–100%	0.0%	6	4.00
DCUNNS	9	1.31	non-wet	5–25%	0.1%	6	4.25
DCUNS-1	9	9.53	non-wet	75–100%	2.5%	9	4.14
DCUNS-2	8	10.60	non-wet	50–75%	0.0%	8	3.99
DCUNS-3	8	10.58	non-wet	75–100%	2.5%	16	3.91
DCUNSF	7	11.47	non-wet	1–5%	nm	nm	nm
DCUNSR	8	3.08	non-wet	75–100%	2.5%	6	3.95
DCCS	8	1.36	wet	75–100%	nm	nm	nm
DCCW	9	3.95	wet	75–100%	nm	nm	nm
UDCCI	9	2.84	wet	75–100%	nm	nm	nm
UNW	9	3.54	wet	75–100%	nm	nm	nm

¹DCUNE=Duck Creek Upper Narrows Emergent, DCUNN=Duck Creek Upper Narrows North, DCUNNR=Duck Creek Upper Narrows North Riparian, DCUNNS=Duck Creek Upper Narrows North Stockpile, DCUNS-1=Duck Creek Upper Narrows South 1, DCUNS-2=Duck Creek Upper Narrows South 2, DCUNS-3=Duck Creek Upper Narrows South 3, DCUNSF= Duck Creek Upper Narrows South Fill, DCUNSR= Duck Creek Upper Narrows South Riparian, DCCS= Duck Creek Channel South, DCCW=Duck Creek Confluence Weir, UDCCI=Upstream Duck Creek Confluence Channel, UNW=Upper Narrows Weir

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 9. Vegetation monitoring results for Duck Creek Confluence and Upper Narrows weirs revegetation sites in 2022.

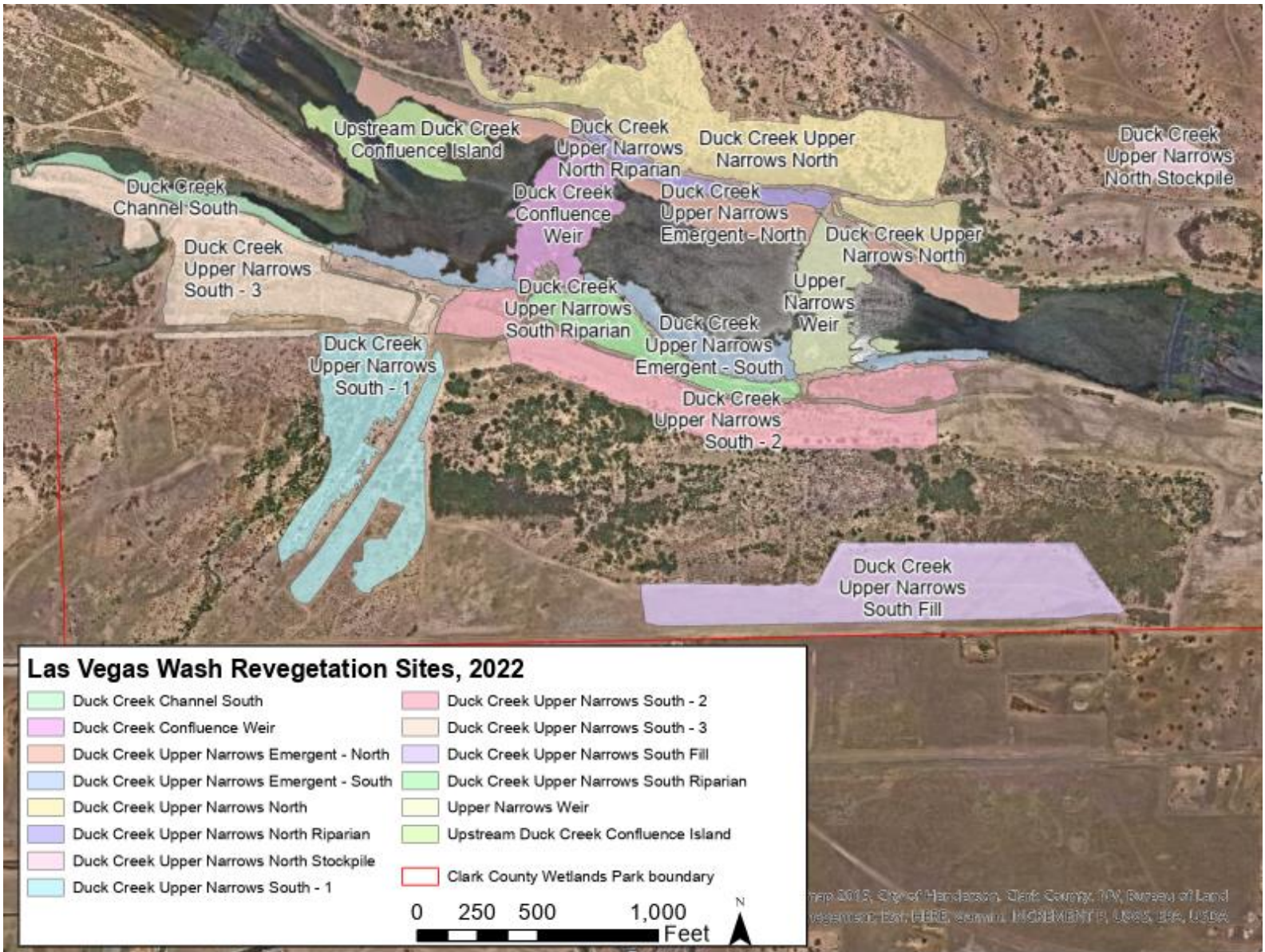


Figure 9. Aerial photograph of 2022 delineated Duck Creek Confluence and Upper Narrows weirs revegetation sites.

3.8 DU Wetlands No. 1 Weir

All sites at the DU Wetlands No. 1 Weir were monitored using ArcGIS in 2022 (Table 10, Figures 10 and 11). Of the two planted sites, DU Wetlands No. 1 South (DU1S) decreased in cover from the previous year, while DU Wetlands No. 1 Emergent (DU1E) increased. Total cover for both sites was the same as recorded in the previous year using ArcGIS. Therefore, this may indicate that using ArcGIS can cause errors in both over and underestimating total cover.

Since the vegetation was removed from DU Wetlands No. 1 Weir (DU1W) in 2019, the site has continued to grow in acreage, with 1.53 acres of passively established vegetation measured in 2022.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DU1E	10	2.70	wet	75–100%	nm	nm	nm
DU1S	10	7.97	non-wet	50–75%	nm	nm	nm
DU1T	7	1.32	non-wet	50–75%	nm	nm	nm
DU1W	10	1.53	wet	75–100%	nm	nm	nm

¹DU1E=DU Wetlands No. 1 Emergent, DU1S=DU Wetlands No. 1 South, DU1T=DU Wetlands No. 1 Tamarisk, DU1W=DU Wetlands No. 1 Weir

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 10. Vegetation monitoring results for DU Wetlands No. 1 Weir revegetation sites in 2022.



Figure 10. Photo overlooking site DU Wetlands No. 1 Emergent South.

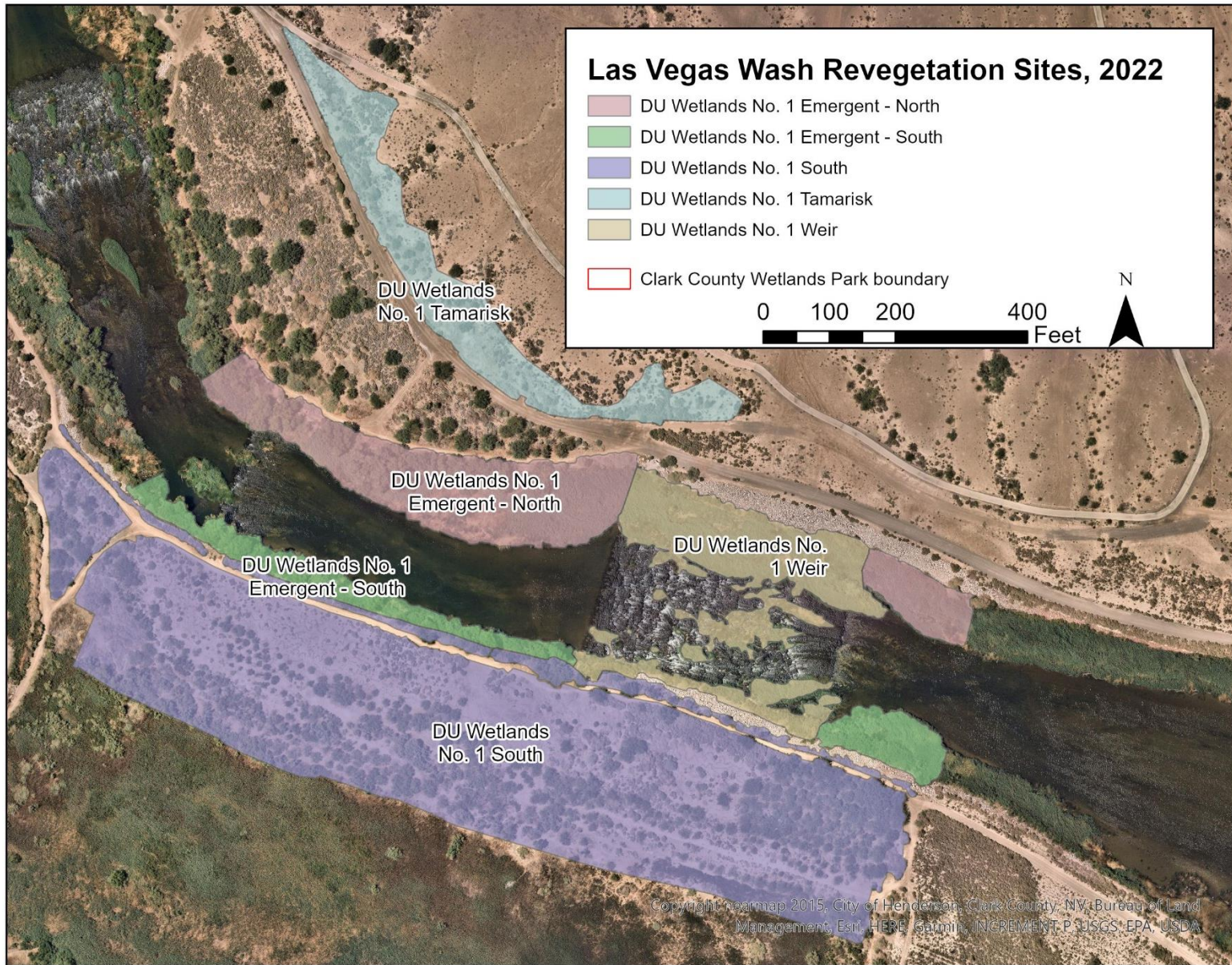


Figure 11. Aerial photograph of 2022 delineated DU Wetlands No. 1 Weir revegetation sites.

3.9 DU Wetlands No. 2 Weir

One of the four revegetation sites at the DU Wetlands No. 2 Weir was monitored in the field in 2022, while the remaining three were monitored using ArcGIS (Table 11, Figure 12). DU Wetlands No. 2 South (DU2S) increased in cover from 25–50% using ArcGIS in 2021 to 75–100% in the field in 2022. These results are likely due to the inability to identify all plant species using ArcGIS, which results in lower total cover percentages. The three sites that were monitored using ArcGIS had the same total cover as recorded in 2021.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DU2E	13	1.48	wet	75–100%	nm	nm	nm
DU2N	13	3.05	non-wet	75–100%	nm	nm	nm
DU2S	13	1.56	non-wet	75–100%	2.5%	9	3.90
DU2W	13	0.25	wet	75–100%	nm	nm	nm

¹DU2E=DU Wetlands No. 2 Emergent, DU2N=DU Wetlands No. 2 North, DU2S=DU Wetlands No. 2 South, DU2W=DU Wetlands No. 2 Weir

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 11. Vegetation monitoring results for DU Wetlands No. 2 Weir revegetation sites in 2022.

Future monitoring of DU Wetlands No. 2 Emergent (DU2E) and DU Wetlands No. 2 North (DU2N) will allow tracking of noxious species cover. In 2021, salt cedar accounted for 9.7% and 15% of these sites, respectively. If an increase in noxious species continues to occur, both sites will be good candidates for invasive and other undesirable species removal under the RMP.

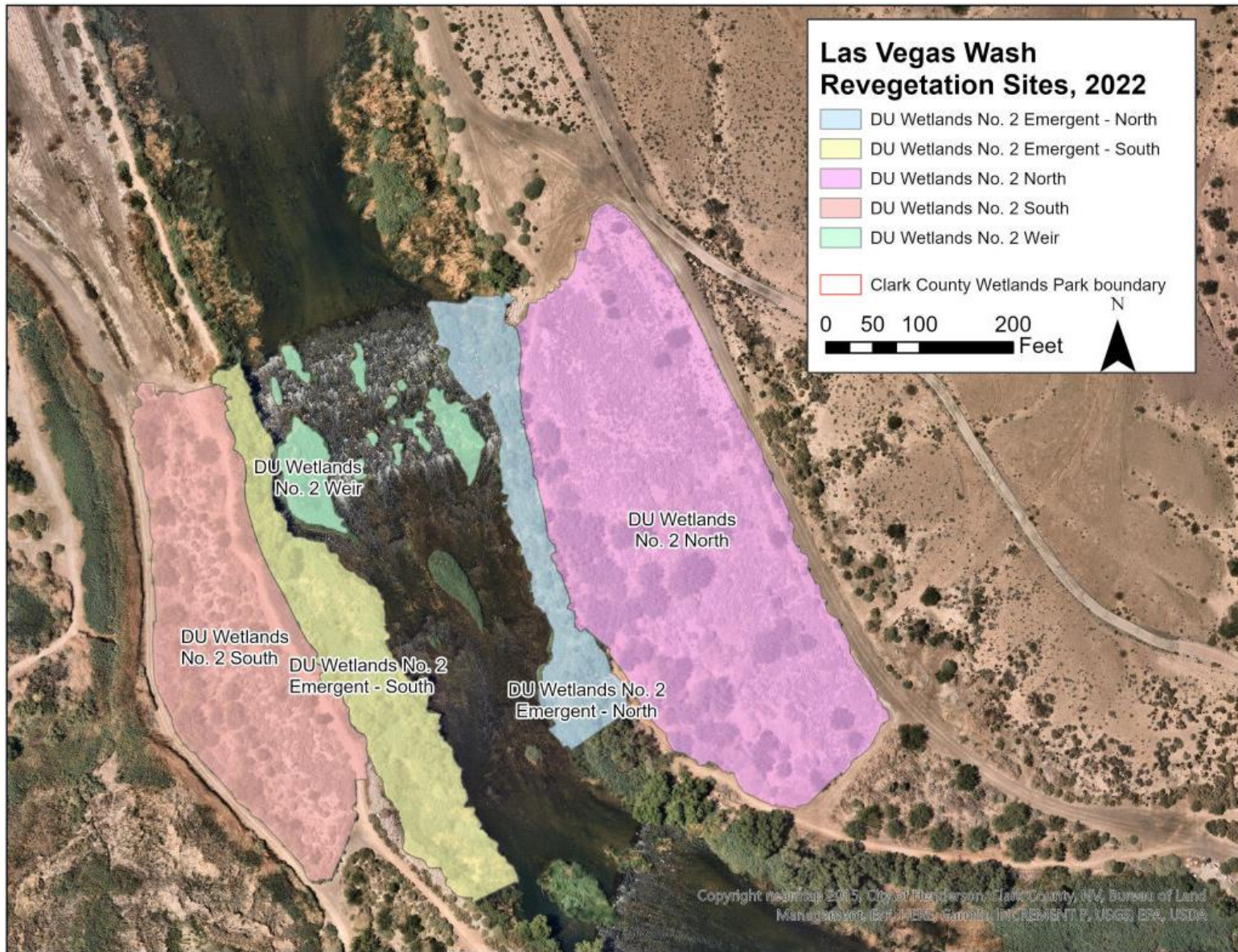


Figure 12. Aerial photograph of 2022 delineated DU Wetlands No. 2 Weir revegetation sites.

3.10 Historic Lateral Weir

Two sites were monitored in the field. This was the third growing season for both Historic Lateral Weir Emergent - North (HLWE-N) and Historic Lateral Weir Emergent - South (HLWE-S). HLWE-N grew slightly in acreage, from 0.79 to 0.90 acres in 2022. Total cover was 75–100% for both years. Like HLWE-N, HLWE-S increased in acreage, from 0.50 to 0.54 recorded in 2022 (Table 12, Figure 13). Total cover remained the same at 75–100%. In their second year of monitoring, both sites saw a decrease in number of species. HLWE-N went from 18 in 2021 to 10 in 2022, and HLWE-S decreased from 11 to 8 in 2022.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DHLPW	22	4.35	wet	75–100%	nm	nm	nm
HLWE-N	3	0.90	wet	75–100%	2.5%	10	2.15
HLWE-S	3	0.54	wet	75–100%	0.0%	8	2.09
HLW	22	3.07	wet	75–100%	nm	nm	nm
UHLN	22	4.26	non-wet	75–100%	nm	nm	nm
UHLN	22	2.14	wet	75–100%	nm	nm	nm
UHLNS	22	1.65	wet	50–75%	nm	nm	nm
UHLPW	22	6.46	wet	75–100%	nm	nm	nm
UHLSB	22	1.24	non-wet	75–100%	nm	nm	nm
UHLSB	22	0.95	wet	75–100%	nm	nm	nm
UHLSUP	15	3.23	non-wet	50–75%	nm	nm	nm
UHLSUP2	12	10.96	non-wet	33.8%	nm	nm	nm

¹DHLPW=Downstream Historic Lateral Passive Wetlands, HLWE-N= Historic Lateral Weir Emergent North, HLWE-S=Historic Lateral Weir Emergent South, HLW=Historic Lateral Weir, UHLN=Upstream Historic Lateral North, UHLNS=Upstream Historic Lateral North South, UHLPW=Upstream Historic Lateral Passive Wetlands, UHLSB=Upstream Historic Lateral South Bank, UHLSUP=Upstream Historic Lateral South Upper Plateau, UHLSUP2=Upstream Historic Lateral South Upper Plateau 2

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 12. Vegetation monitoring results for Historic Lateral Weir revegetation sites in 2022.

New upland areas were created with the Historic Lateral Expansion as well. These areas are being separated into their own section for monitoring purposes to emphasize that they were created only as a result of the expansion project. Details on these sites can be found in the following section of this report.

Many of the other emergent wetland sites at the Historic Lateral Weir were also impacted by the expansion project. The Historic Lateral Weir (HLW) revegetation site was reduced to 0.42 acres in 2018, grew to 1.07 in 2019 and in 2020, a year after construction was completed, there were 2.95 acres of vegetation established on the weir. In 2022, HLW measured at 3.07 acres, the highest acreage ever recorded for the site. This could be partially attributed to the expansion creating additional space for vegetation to establish. However, other weir-clearing projects have also led to

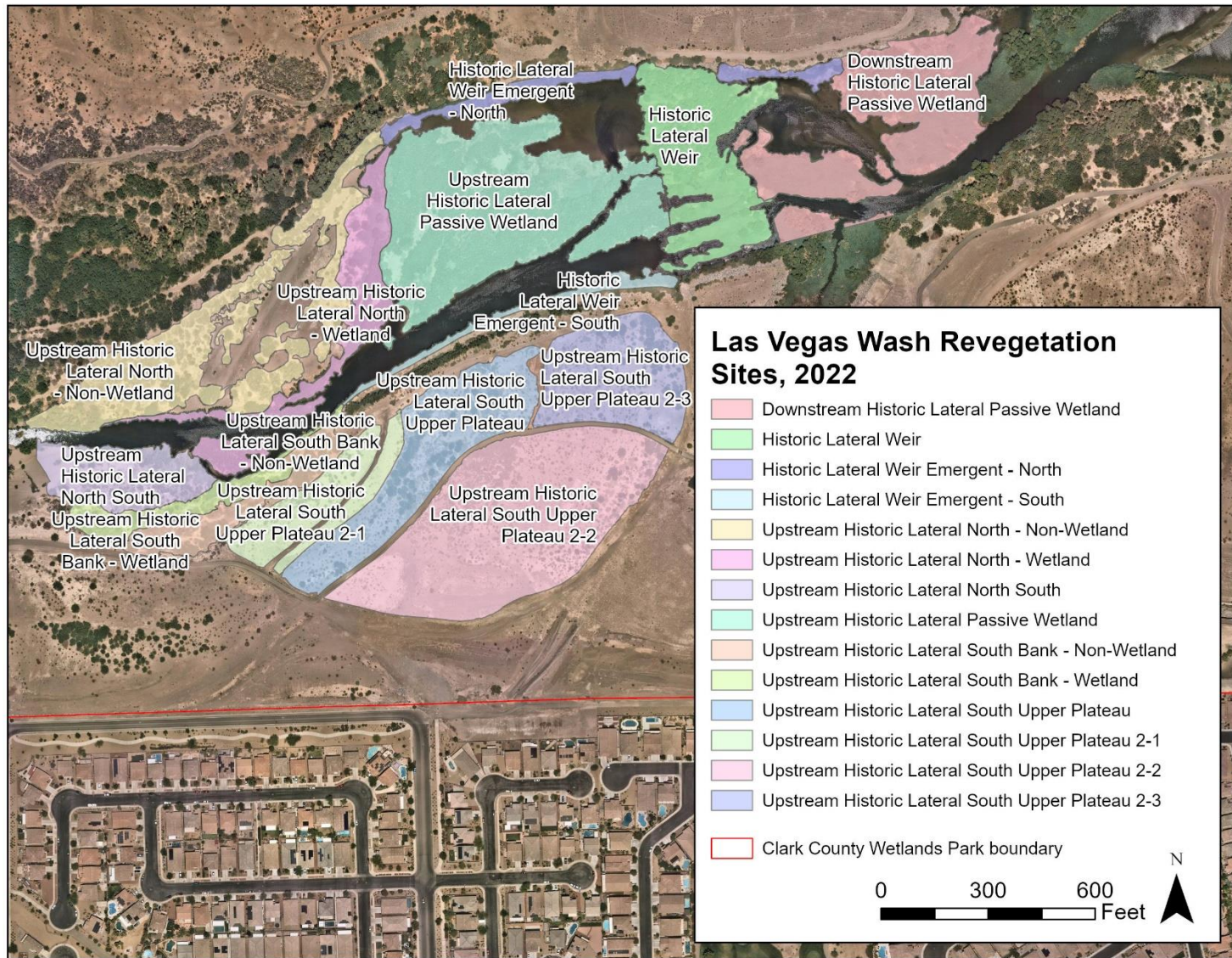


Figure 13. Aerial photograph of 2022 delineated Historic Lateral Weir revegetation sites.

increased acreage. It appears that the disturbance is promoting growth of emergent wetland vegetation on the weirs.

There are passively created wetland areas upstream and downstream of the weir that were moderately impacted by the expansion project. Upstream Historic Lateral Passive Wetland (UHLPW) was 4.49 acres in 2017. In 2018 and 2019, there was no vegetation visible in the channel upstream of the weir using aerial imagery. In 2020, the vegetation had regrown to a size of 5.54 acres. The site measured 6.09 acres in 2021 and 6.46 acres in 2022, which is greater than any previous monitoring year. The Downstream Historic Lateral Passive Wetland (DHLPW) site was reduced from 6.66 acres in 2017 to 1.95 acres in 2018 and stayed at a similar amount in 2019. The site measured 3.27 acres in 2020, 3.89 acres in 2021, and 4.35 acres in 2022.

Upstream Historic Lateral North - Non-Wetland (UHLN-N) saw an increase in cover from 2021 to 2022. Upstream Historic Lateral North South (UHLNS) went from 75–100% reported in 2021 to 50–75% reported in 2022. Upstream Historic Lateral South Upper Plateau-2 (UHLSUP2) went from 62.5% in 2021 to 33.8% in 2022.

Upstream Historic Lateral North - Wetland (UHLN-W) recorded 15% noxious species cover in 2019 and 15.5% in 2021. Although recent years have not varied much, this is a significant jump from the 3% recorded in 2017. Noxious species at this site should continue to be monitored to make sure they do not take over the site. If noxious species percentages continue to increase, this site would become a good candidate for invasive and other undesirable species removal under the RMP.

3.11 Historic Lateral Weir Expansion

The three Historic Lateral Weir Expansion sites are in their third growing season, and all were surveyed in the field in 2022 (Table 13, Figure 14). For monitoring purposes, Historic Lateral Expansion North (HLEN) was separated into four areas. These were the four stations that the volunteers were separated into during the fall 2019 Green-Up. Total cover for all four sites remained the same. Using a weighted average of the mid-point of each area’s total cover with each area’s acreage as the weight, the site had a total cover of 41.3%, which is the same as recorded in 2021. The dominant species on the site were alkali sacaton (*Sporobolus airoides*), desert globemallow (*Sphaeralcea ambigua* ssp. *rugosa*), and brittlebush (*Encelia farinosa*); these made up most of the total cover. Quailbush dominated the site in 2020 but was reduced to 1.4% total cover in 2022. Therefore, efforts to thin this native shrub have been working and allowing other native species to grow. The only noxious weed identified was salt cedar with a low cover of 0.08%, which is a slight decrease from 2021. Numerous milkweed plants were planted at this site after multiple sightings of monarchs in the Cottonwood Cell to the west. No monarchs have been identified at this specific site, but a dead monarch caterpillar was found on the Historic Lateral Expansion South 4 (HLES-4) site in November 2021.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
HLEN	3	9.73	non-wet	41.3%	0.1%	26	1.94
HLES	3	2.92	non-wet	41.6%	0.1%	25	2.25
HLES-T	3	0.42	wet	75–100%	0.0%	11	2.05

¹HLEN=Historic Lateral Expansion North, HLES=Historic Lateral Expansion South, HLES-T=Historic Lateral Expansion South Trench

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 =wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland

nm = this attribute was not monitored

Table 13. Vegetation monitoring results for Historic Lateral Weir Expansion revegetation sites in 2022.

Historic Lateral Expansion South (HLES) was divided into five sections with four planted so far. The four planted areas were planted by Girl Scouts as part of achieving their Gold Star Award. The first area was planted in the fall of 2019; the other three were planted in the fall of 2020. The fifth, unplanted, area at HLES is intended to be used for additional Scout or small group plantings and does not count toward total acreage or total number of monitoring areas for Historic Lateral Weir Expansion since it has not been planted yet. Historic Lateral Weir Expansion South 1 (HLES-1) remains a large contributor in bringing the overall total cover for this site down. HLES-1 recorded a total cover of 0.01% in 2022, down from the 0.025% recorded in 2021. Historic Lateral Expansion South 2 (HLES-2), Historic Lateral Expansion South 3 (HLES-3), and HLES-4 had total covers of 50-75%, 25-50%, and 75-100% respectively. The only of those that changed from 2021 was HLES-4, increasing from 25-50% to 75-100%. The overall cover for the site increased from 27.3% to 41.6%, but the number of species decreased from 31 to 25. These sites are only in their third growing season, so fluctuations in total cover and species richness are expected. As these sites mature, we should begin to see more consistent results from year to year.

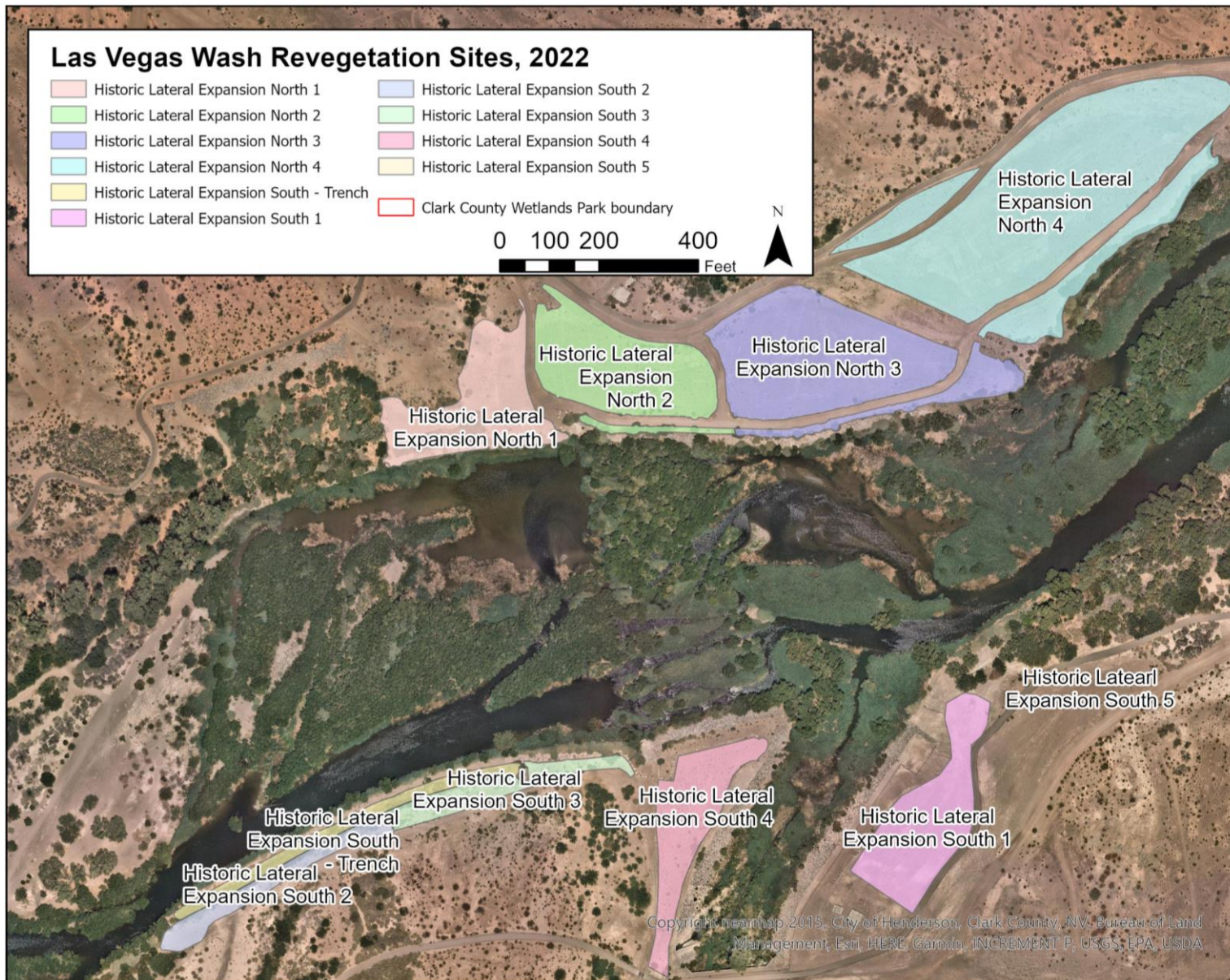


Figure 14. Aerial photograph of 2022 delineated Historic Lateral Weir Expansion revegetation sites.

The third revegetation site is Historic Lateral Expansion South – Trench (HLES-T), which resulted from an engineering design only used here and at the Sunrise Mountain Weir. A large trench was dug outside of the Wash channel on the back side of the bank protection installed along the water. This trench is designed to allow for riparian trees and other vegetation to grow near the banks of the Wash without the risk of impeding the flows. This trench remained at 75–100% cover for the third year in a row and was dominated by common reed and Fremont’s cottonwood (*Populus fremontii*). A total of 11 species were recorded.

3.12 Lower Narrows and Homestead Weirs

Three sites were monitored in the field in 2022 (Table 14, Figure 15). Lower Narrows Homestead South 1 (LNHS1) and Lower Narrows Homestead South 2 (LNHS2) both saw an increase in total cover from 2021 to 2022. Creosote bush went from 2.5% cover to 37.5% for LNHS1. LNHS1 and LNHS2 were both planted as Green-Up volunteer events. LNHS1 was planted in the fall of 2011 and LNHS2 was planted in the fall of 2012.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
HW	11	4.18	wet	75–100%	nm	nm	nm
LNW	11	3.63	wet	75–100%	nm	nm	nm
LNHE	11	6.46	wet	75–100%	2.5%	10	2.02
LNHN	11	40.92	non-wet	50–75%	nm	nm	nm
LNHS1	11	7.38	non-wet	75–100%	0.0%	3	4.97
LNHS2	10	6.65	non-wet	50–75%	0.0%	5	4.97
LNHS3	11	2.22	non-wet	5–25%	nm	nm	nm

¹HW=Homestead Weir, LNW=Lower Narrows Weir, LNHE=Lower Narrows Homestead Emergent, LNHN=Lower Narrows Homestead North, LNHS1=Lower Narrows Homestead South 1, LNHS2=Lower Narrows Homestead South 2, LNHS3=Lower Narrows Homestead South 3

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual.

“wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 14. Vegetation monitoring results for Lower Narrows and Homestead weirs revegetation sites in 2022.

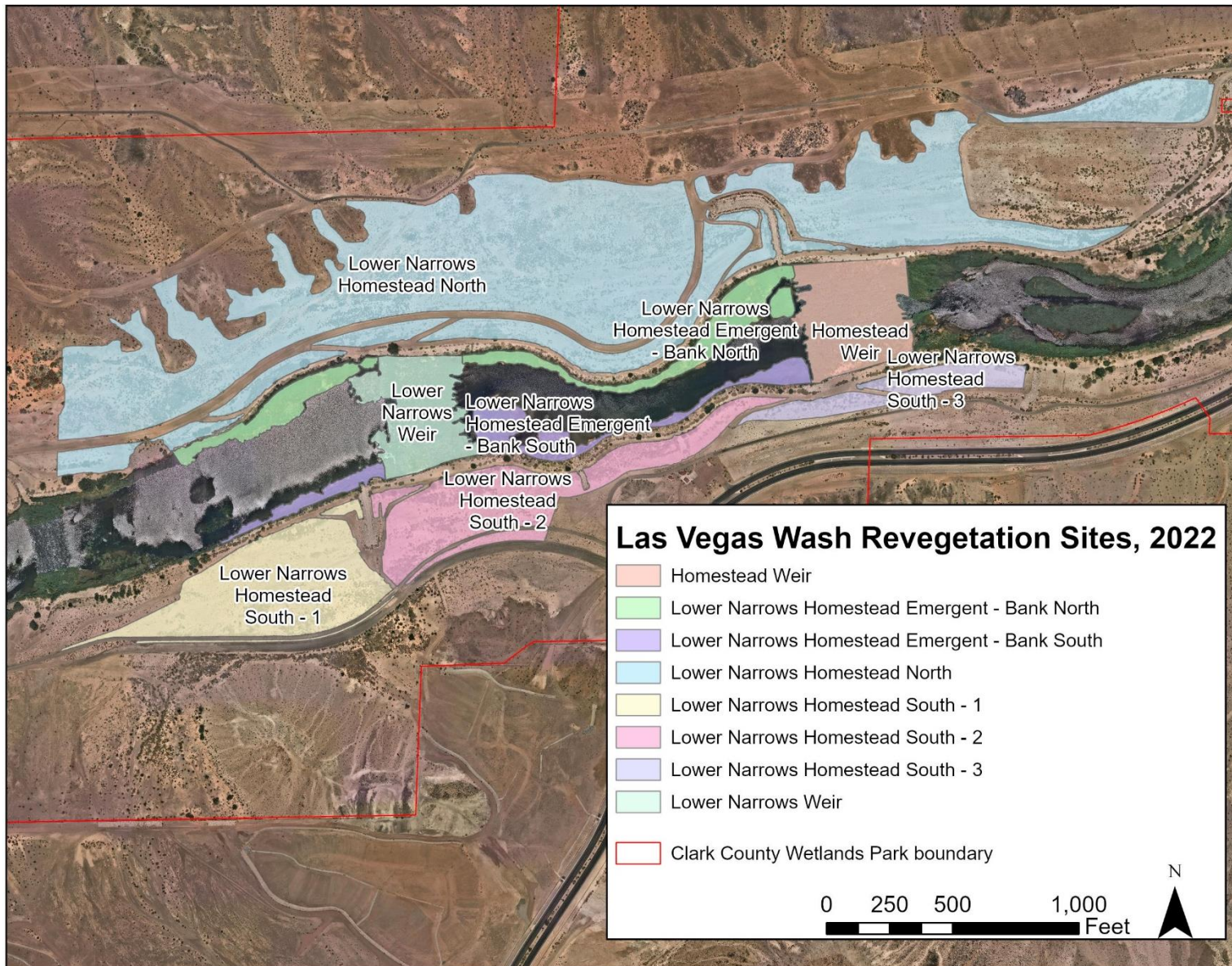


Figure 15. Aerial photograph of 2022 delineated Lower Narrows and Homestead weirs revegetation sites.

Lower Narrows Homestead Emergent (LNHE) has two monitoring areas, Lower Narrows Homestead Emergent North (LNHE-N) and Lower Narrows Homestead Emergent South (LNHE-S). Only LNHE-S was measured in the field in 2022 so the results in the table are only for that site. LNHE-N was measured using ArcGIS and showed a total cover of 75-100%.

All sites monitored using ArcGIS in 2022 had the same total cover as recorded in 2021. Acreage for each site either remained the same or saw a slight increase except for Lower Narrows Weir (LNW). Homestead Weir (HW) increased from 4.07 to 4.18 acres in 2022. LNW decreased slightly from 3.71 recorded in 2021 to 3.63 acres in 2022.

3.13 Monson and Visitor Center Weirs

Two revegetation sites at the Monson and Visitor Center weirs were monitored in the field in 2022 and the other two were monitored using ArcGIS (Table 15, Figure 16). Like previous years, all sites had a total cover of 75–100%. Given the maturity of these sites, there is not much change in species and their cover year to year.

Downstream Monson North - Non-Wetland (DMN-N) and Downstream Monson North - Wetland (DMN-W) both saw a significant decrease in noxious species cover. DMN-N went from 15% recorded in 2021 to 2.5% recorded in 2022. DMN-W decreased from 20% recorded in 2021 to 3% in 2022. While promising, we should continue to monitor these sites to ensure that noxious weeds do not begin to expand again.

Noxious plant cover for Downstream Monson South - Wetland (DMS-W) was last recorded at 45.5% in 2021. The three main noxious species were salt cedar, johnsongrass, and silver-leaf nightshade, totaling 40% total cover. This site was not monitored in the field in 2022, so results from 2023 surveys will help determine if these species are still a concern. If the noxious weed cover does not decrease by 2023 surveys, this site will be good candidate for invasive and other undesirable species removal under the RMP.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DMN	20	3.73	non-wet	75–100%	2.5%	9	3.97
DMN	20	1.11	wet	75–100%	3%	14	2.46
DMS	20	2.92	non-wet	75–100%	nm	nm	nm
DMS	20	0.71	wet	75–100%	nm	nm	nm

¹DMN=Downstream Monson North, DMS=Downstream Monson South

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 =wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland

nm = this attribute was not monitored

Table 15. Vegetation monitoring results for Monson and Visitor Center weirs revegetation sites in 2022.

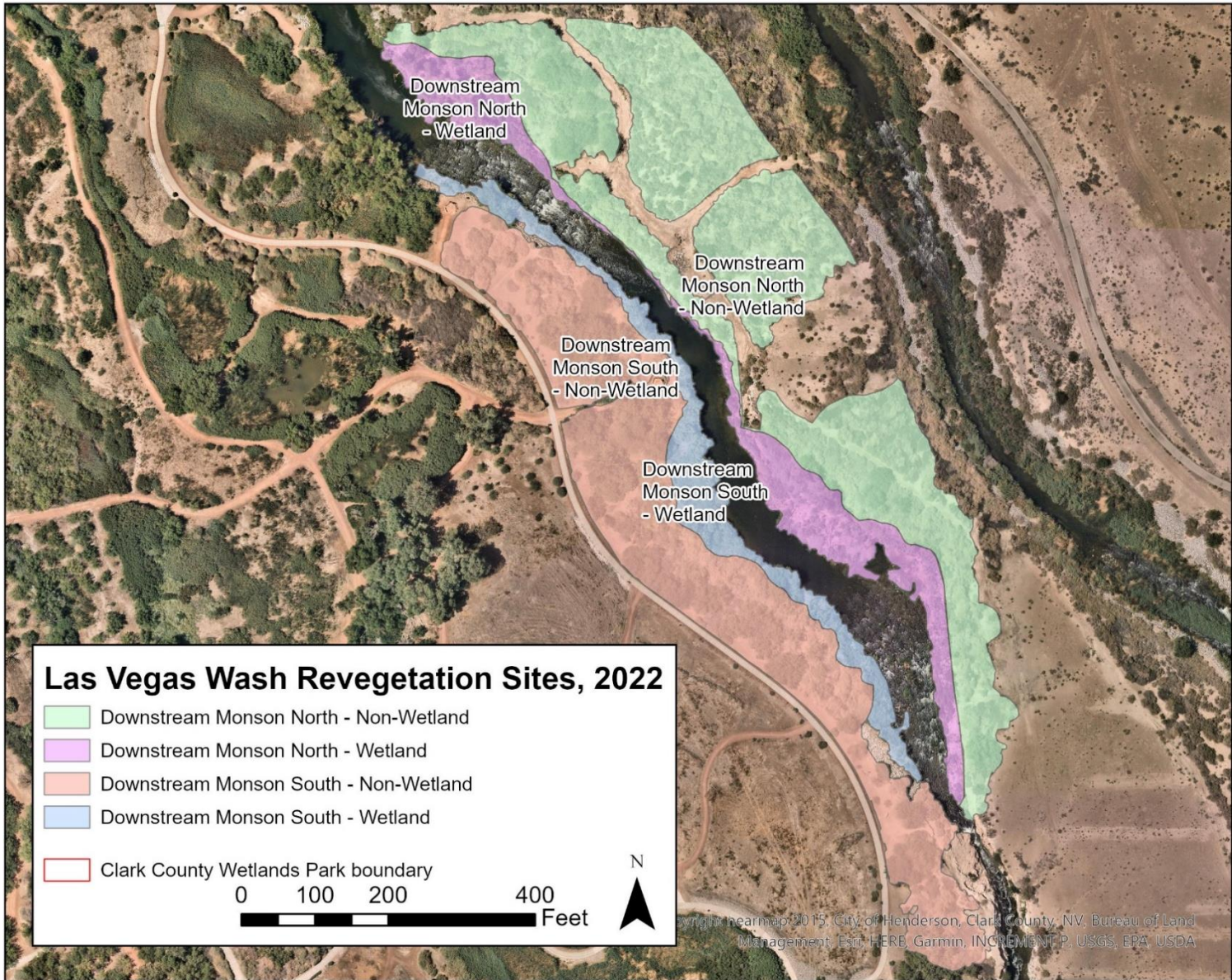


Figure 16. Aerial photograph of 2022 delineated Monson and Visitor Center weirs revegetation sites.

3.14 Pabco Road Weir

Nine of the 15 revegetation sites associated with the Pabco Road Weir were monitored in the field in 2022 (Table 16, Figure 17). Five of the sites saw an increase in total cover. Downstream Pabco South (DPS) and Downstream Pabco South Upper Bank (DPSUB) went from 25-50% recorded using ArcGIS in 2021 to 50-75% measured in the field in 2022 and 1-5% recorded using ArcGIS in 2021 to 5–25% measured in the field in 2022, respectively. These increases are likely due to the inability to identify plants using ArcGIS resulting in underestimating total cover. This is also true for Pabco North - Non-Wetland (PN-N) which showed an increase in total cover from 2021 to 2022 (25-50% to 50-75%).

The Upstream Pabco Island (UPI) site was removed in early 2020 but had grown to 0.17 acres in 2022. Although Upstream Pabco North (UPN) was mostly removed in 2020, it measured 2.63 acres of passively established wetlands in 2022. This site was originally planted in 2001 but continued to grow due to sediment deposition and began to impede water flow over the weir. Figure 18 shows the transition of the site with aerial imagery from February 2020 to October 2022.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DPI	22	1.28	wet	75–100%	nm	nm	nm
DPN	14	9.52	non-wet	75–100%	0.0%	11	3.75
DPNB	11	0.89	wet	75–100%	0.1%	12	3.24
DPS	22	4.00	wet	50–75%	2.6	20	2.28
DPSUB	12	1.01	non-wet	5–25%	0.1%	12	3.94
DPSUP	12	9.56	non-wet	50–75%	0.0%	13	3.82
DPSUP-3	5	0.60	non-wet	50–75%	0.1%	10	3.78
PN	22	3.55	non-wet	50–75%	0.6%	19	3.45
PN	22	0.85	wet	75–100%	2.5%	12	2.07
PS	22	1.27	non-wet	75–100%	nm	nm	nm
PS	22	0.38	wet	75–100%	nm	nm	nm
UPI	22	0.17	wet	75–100%	nm	nm	nm
UPN	17	2.63	wet	75–100%	nm	nm	nm
UPS	21	1.57	wet	50–75%	nm	nm	nm
UPSUP	21	2.24	non-wet	75–100%	0.5%	9	3.26

¹DPI=Downstream Pabco Island, DPN=Downstream Pabco North, DPNB=Downstream Pabco North Bank, DPS=Downstream Pabco South, DPSUB=Downstream Pabco South Upper Bank, DPSUP=Downstream Pabco South Upper Plateau, DPSUP-3=Downstream Pabco South Upper Plateau-3 PN=Pabco North, PS=Pabco South, UPI=Upstream Pabco Island, UPN=Upstream Pabco North, UPS=Upstream Pabco South, UPSUP=Upstream Pabco South Upper Plateau

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 16. Vegetation monitoring results for Pabco Road Weir revegetation sites in 2022.

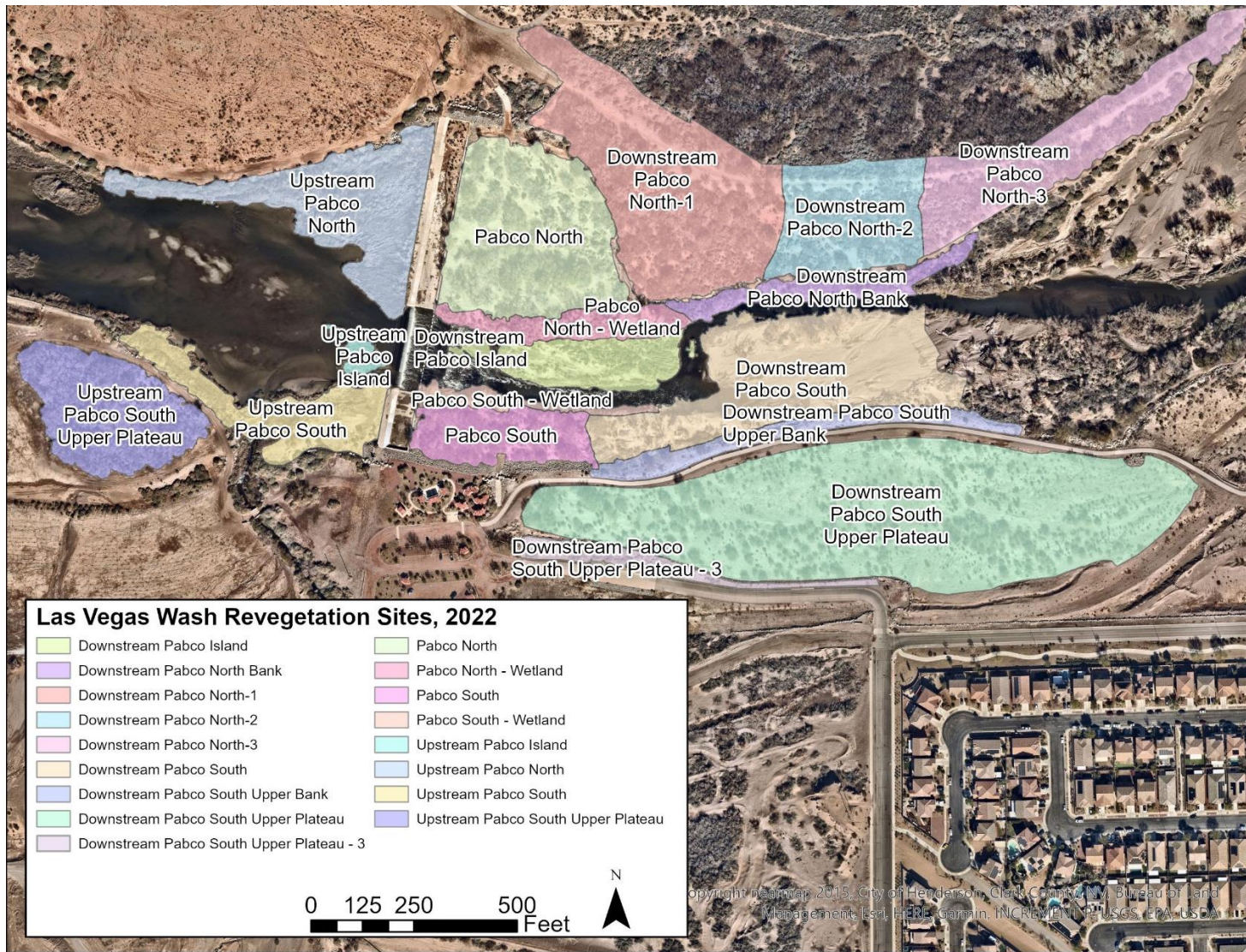


Figure 17. Aerial photograph of 2022 delineated Pabco Road Weir revegetation sites.



Figure 18. Upstream Pabco North’s transformation from February 2020 (top), October 2021 (middle) to October 2022 (bottom).

3.15 Powerline Crossing Weir

All 11 revegetation sites at the Powerline Crossing Weir were monitored using ArcGIS in 2022 (Table 17, Figure 19). Total cover for all sites remained the same except for Upstream Powerline South Plateau (UPLSP) which increased slightly. All sites were in their 16th growing season and therefore do not experience much change over the years. However recent storms and Wash flows have removed Upstream Powerline Island (UPI) in its entirety. Therefore, this site had no cover in 2022. Both Downstream Powerline North Bank (DPLNB) and Downstream Powerline South Bank (DPLSB) both recorded high noxious weed cover in 2021. If this does not decrease by 2023 surveys, these sites will be good candidates for invasive and other undesirable species removal under the RMP.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DPLNB	16	0.32	wet	75–100%	nm	nm	nm
DPLSB	16	0.30	wet	75–100%	nm	nm	nm
PCW	16	0.15	wet	75–100%	nm	nm	nm
PLSB	16	0.59	non-wet	50–75%	nm	nm	nm
UPI	16	0	wet	-	nm	nm	nm
UPLNB	16	0.67	non-wet	5–25%	nm	nm	nm
UPLNE	16	1.11	wet	75–100%	nm	nm	nm
UPLNP	16	3.94	non-wet	25–50%	nm	nm	nm
UPLNW	16	0.39	wet	75–100%	nm	nm	nm
UPLSB	16	0.73	wet	75–100%	nm	nm	nm
UPLSP	16	5.90	non-wet	62.5%	nm	nm	nm

¹DPLNB=Downstream Powerline North Bank, DPLSB=Downstream Powerline South Bank, PCW=Powerline Crossing Weir, PLSB=Powerline South Bank, UPI=Upstream Powerline Island, UPLNB=Upstream Powerline North Bank, UPLNE=Upstream Powerline North Emergent, UPLNP=Upstream Powerline North Plateau, UPLNW=Upstream Powerline North Wetland, UPLSB=Upstream Powerline South Bank, UPLSP=Upstream Powerline South Plateau

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. WPI≤2.0 =wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland
nm = this attribute was not monitored

Table 17 . Vegetation monitoring results for Powerline Crossing Weir revegetation sites in 2022.

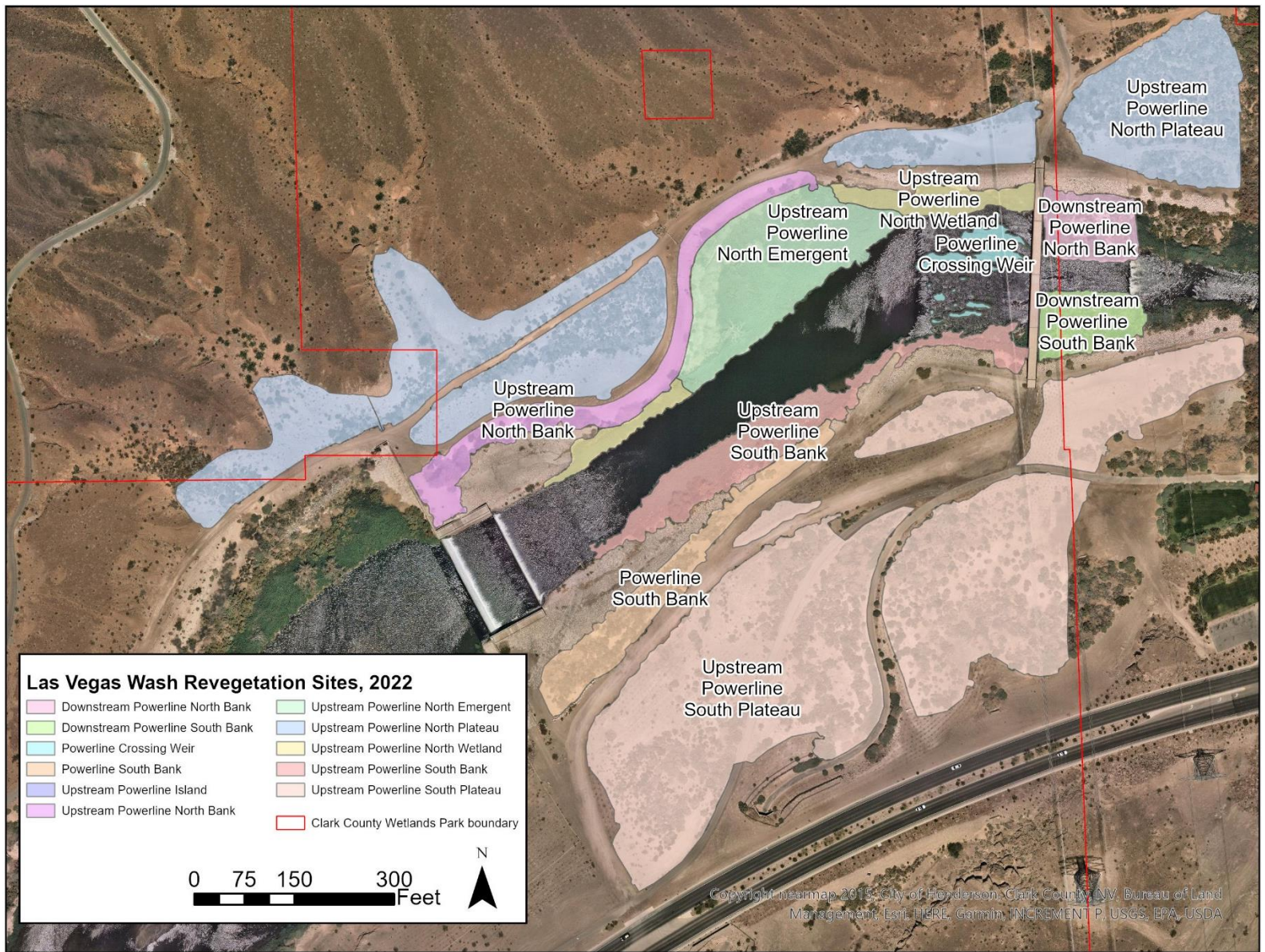


Figure 19. Aerial photograph of 2022 delineated Powerline Weir revegetation sites.

3.16 Rainbow Gardens Weir

Five sites at the Rainbow Gardens Weir were surveyed in the field in 2022 (Table 18, Figure 20). Upstream Rainbow Island (URI) saw a significant decrease in acreage going from 4.75 recorded in 2021 to 1.93 recorded in 2022. Similarly, recent storms and Wash flows have removed Rainbow Islands (RI) in its entirety. Therefore, no data was recorded for this site in 2022.

Upstream Rainbow South Bank 2 (URSB2) and Upstream Rainbow South Emergent (URSE) both recorded high percentages of noxious species cover, with salt cedar making up 37.5% total cover at URSB2 and 15% at URSE. Both sites are good candidates for invasive and other undesirable species removal under the RMP.

All sites that were monitored using ArcGIS had the same total cover as recorded in 2021.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
RI	18	0	wet	-	-	-	-
URI	18	1.93	wet	75–100%	nm	nm	nm
URNB	13	1.63	non-wet	25–50%	nm	nm	nm
URNPW	18	2.28	wet	75–100%	nm	nm	nm
URSB1	17	0.02	non-wet	50–75%	0.0%	2	2.50
URSB2	15	0.65	non-wet	75–100%	37.5%	12	2.28
URSE	18	0.41	wet	75–100%	15%	8	2.33
URSP	17	1.39	non-wet	5–25%	0.0%	3	4.57

¹RI=Rainbow Islands, URI=Upstream Rainbow Island, URNB=Upstream Rainbow North Bank, URNPW=Upstream Rainbow North Passive Wetlands, URSB1=Upstream Rainbow South Bank 1, URSB2=Upstream Rainbow South Bank 2, URSE=Upstream Rainbow South Emergent, URSP=Upstream Rainbow South Plateau

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland
nm = this attribute was not monitored

Table 18. Vegetation monitoring results for Rainbow Gardens Weir revegetation sites in 2022.

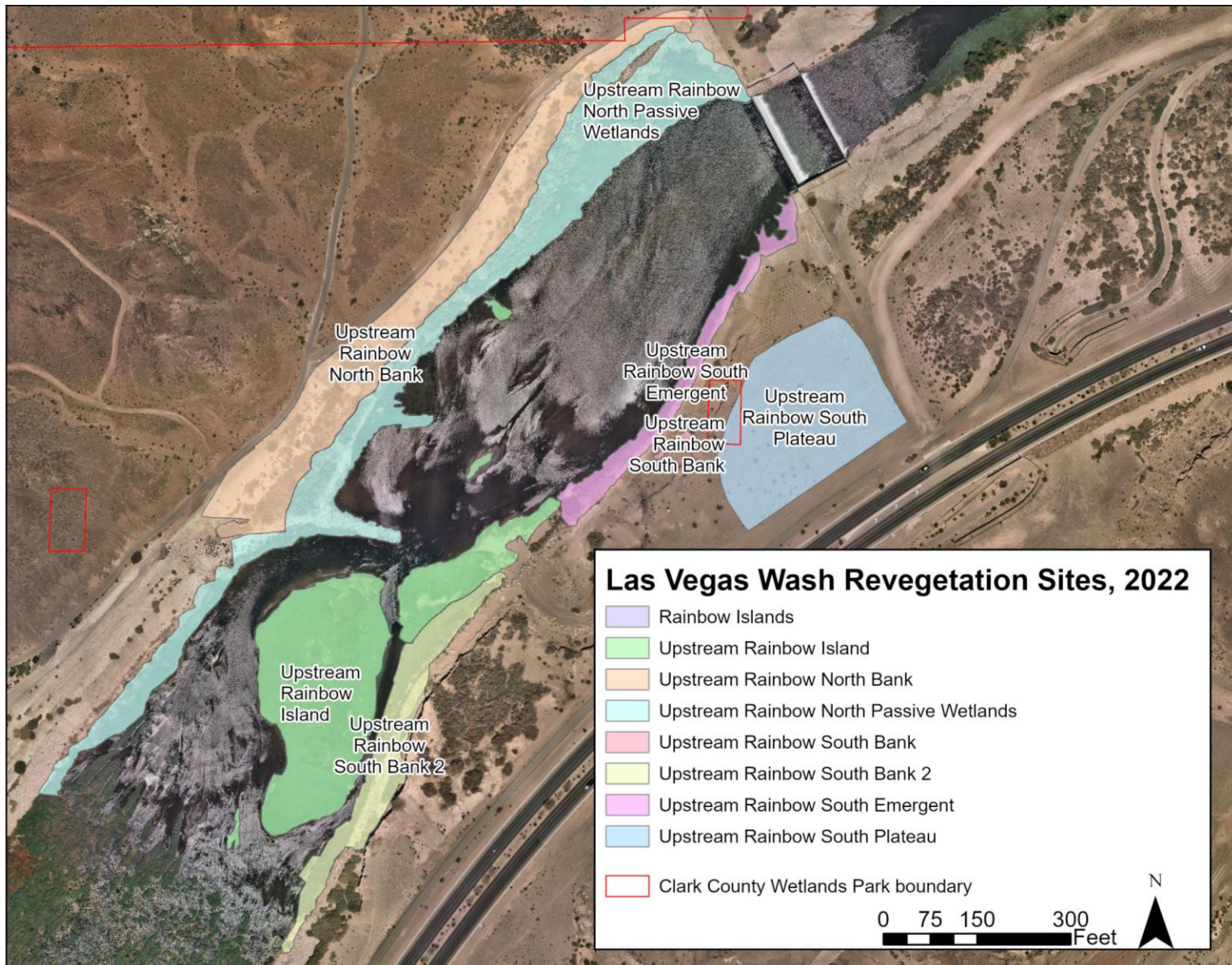


Figure 20. Aerial photograph of 2022 delineated Rainbow Gardens Weir revegetation sites.

3.17 Site 108

Site 108 was monitored in the field in 2022 (Table 19, Figure 21). This is still the largest contiguous revegetation site along the Wash, at 39.4 acres, despite being much larger at completion at nearly 60 acres. It was planted in phases through its four different funding sources (grants from NDEP, NDSP, and two rounds of SNPLMA [IV and V]) in the spring and fall of 2006. While this is a large site, it is broken up into 59 monitoring areas, all less than two acres and most less than one acre in size.

All four sites saw an increase in cover from when they were last surveyed in the field in 2019. A greater than 30% total cover increase occurred at both NDEP and SNPLMA V. However, comparing results to 2021 when all sites were monitored using ArcGIS, all sites except NDSP saw a decrease in total cover. Although ArcGIS is a good tool to use, it tends to be misleading for overall cover of sites.

Monitoring area S108-73 in SNPLMA IV was inaccessible so only total cover was recorded. Since this site was unable to have plant species identified, it was not included in the weighted averages for species richness, and site condition. S108-73 was included in the overall acreage for SNPLMA IV.

Funding Areas	Growing Season ³	Acreage	Wetland Status ¹	Total Cover	Noxious Species Cover	Number of Species	WPI ²
NDEP	16	5.86	non-wet	69.1%	0.7%	10	3.69
NDSP	16	13.54	non-wet	86.3%	1.1%	10	3.63
SNPLMA IV	16	7.89	non-wet	69%	0.7%	10	2.14
SNPLMA V	16	12.11	non-wet	81.0%	1.6%	10	3.32
TOTAL	16	39.4	non-wet	76.35%	nm	nm	nm

¹Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

²Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

³Portions of funding areas SNPLMA IV and SNPLMA V were planted in the spring of 2006 and others in the fall of 2006
nm = this attribute was not monitored

Table 19. Vegetation monitoring results for the Site 108 revegetation site in 2022.

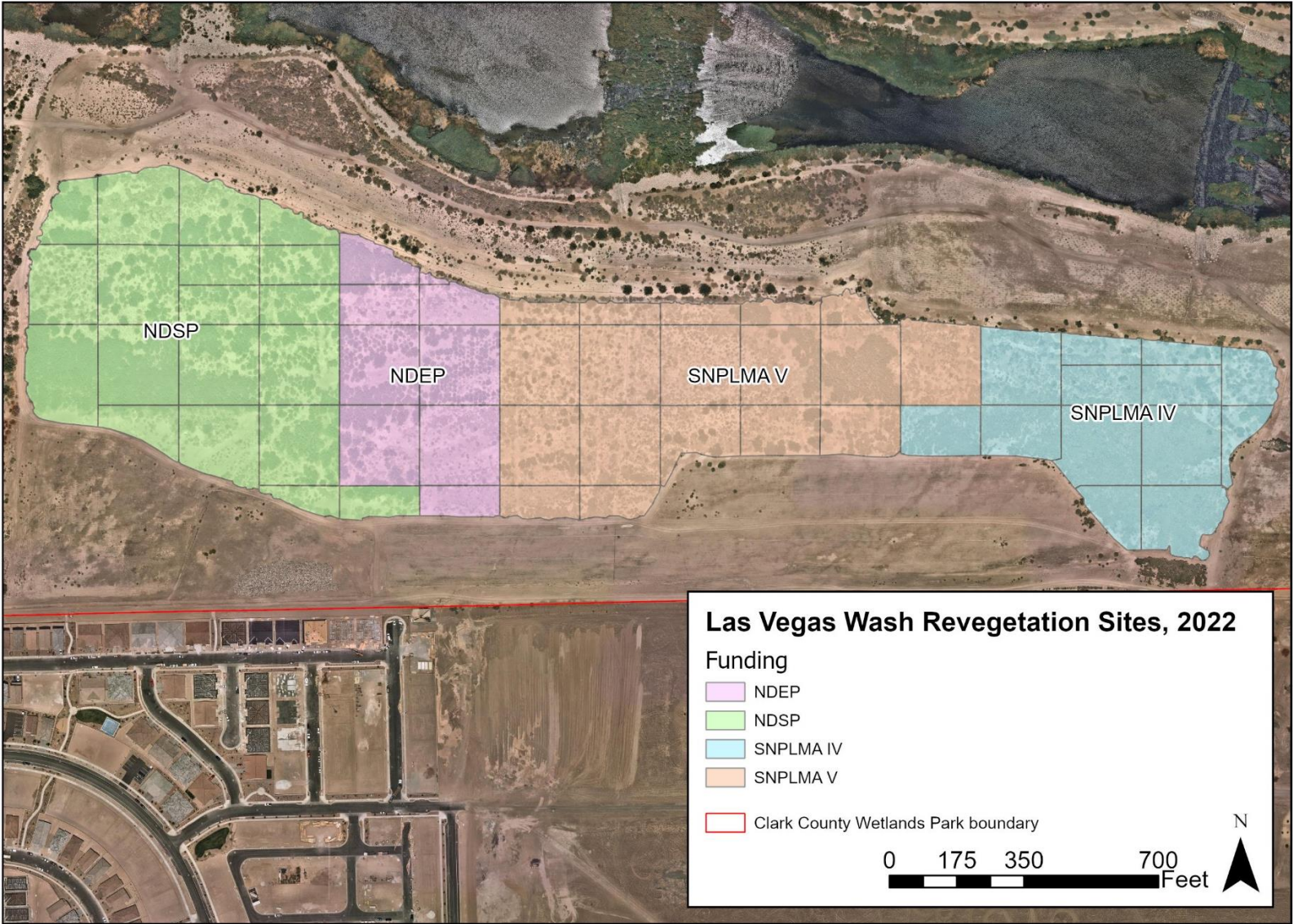


Figure 21. Aerial photograph of Site 108 with 2022 delineations based on funding source.

3.18 Site 111

Site 111 was planted as a single site but due to being one of the larger revegetation sites along the Wash, it is broken up into 26 monitoring areas (Table 20, Figures 22 and 23). All areas were monitored in the field in 2022. However, sites S111-3, S111-4, and S111-29 were inaccessible, so they only contributed to acreage in the table below. This site is in its 15th growing season so there is not much change that occurs year to year. Total cover for this site went from 81.4% measured using ArcGIS in 2021 to 67.9% measured in the field in 2022. This decrease in total cover may be partly due to misidentifying plants while obtaining total cover in ArcGIS. Although ArcGIS is not the most accurate way to determine total cover, it allows us to get an estimated cover even when access is limited.

Site Code	Growing Season	Acreage	Wetland Status ¹	Total Cover	Noxious Species Cover	Number of Species	WPI ²
S111	15	14.99	non-wet	67.9%	2.1%	17	3.25

¹Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

²Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland
nm = this attribute was not monitored

Table 20. Vegetation monitoring results for the Site 111 revegetation site in 2022.



Figure 22. Photo of monitoring area S111-14 which is a monitoring area within Site 111.

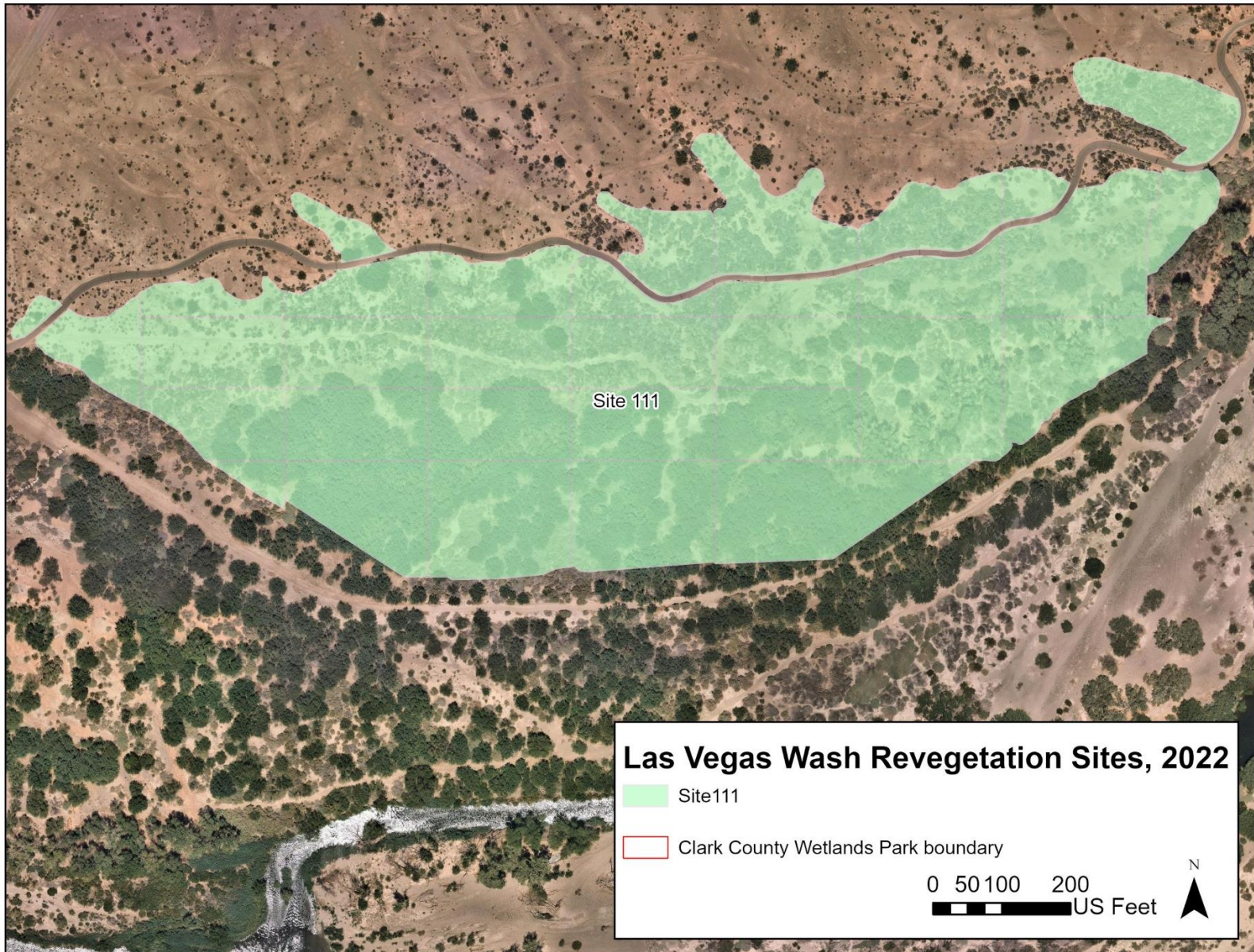


Figure 23. Aerial photograph of the 2022 delineated Site 111 revegetation site.

3.19 Sunrise Mountain Weir

One new revegetation site was added in 2022, bringing the total number of sites up to eight. Of these sites, six were monitored in the field in 2022, while the remaining two were monitored using ArcGIS (Table 21, Figure 24). Sunrise Mountain North (SMN) was originally slated to be planted during the March 2020 Green-Up, but the event was postponed until March 2022 due to COVID-19. SMN saw a decrease in total cover, going from 50–75% in 2021 to 25–50% in 2022. A flash flooding event that occurred prior to 2022 monitoring caused extensive damage at SMN. Since this site is only in its second growing season, it should have time to recover and continue to increase in total cover.

Sunrise Mountain South-1 (SMS-1) was planted during a Green-Up in May 2021. This site saw an increase in total cover from 50–75% to 75–100%. This is likely due to the plants that were planted growing and providing more cover.

Sunrise Mountain Emergent-South (SME-S) and Sunrise Mountain South Trenches (SMT) still have a concerning level of noxious weeds, accounting for 15% and 37.5% of total cover, respectively. Salt cedar is the noxious species found at both SME-S and SMT. If noxious species cover continues to increase at these sites, removal under the RMP should be considered.

Sunrise Mountain South-2 (SMS-2) was planted as a Green-Up in March 2022. This site measures just over 10 acres, with a total cover of 25–50%. Like all newly planted sites, the total cover is likely a product of the small plant size and should increase as the plants grow.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
SME-N	3	1.33	wet	75–100%	0.0%	11	1.99
SME-S	3	0.81	wet	75–100%	15.0%	21	1.43
SMI	3	1.81	wet	75–100%	nm	nm	nm
SMS-1	2	8.88	non-wet	75–100%	0.5%	10	1.28
SMS-2	1	10.21	non-wet	25–50%	0.1%	23	0.79
SMN	2	9.11	non-wet	25–50%	0.1%	25	1.82
SMT	3	0.71	non-wet	75–100%	37.5%	10	1.72
SMW	3	0.73	wet	75–100%	nm	nm	nm

¹SME=Sunrise Mountain Emergent, SMI=Sunrise Mountain Islands, SMT=Sunrise Mountain Trenches, SMW=Sunrise Mountain Weir

³Wetland Prevalence Index (WPI) value. WPI≤2.0 = wetland, 2.0<WPI<2.5 = likely wetland, 2.5≤WPI<3.5 = may be wetland, 3.5≤WPI<4.0 = not likely a wetland, and WPI≥4.0 = upland

nm = this attribute was not monitored

Table 21. Vegetation monitoring results for the Sunrise Mountain Weir revegetation sites in 2022.

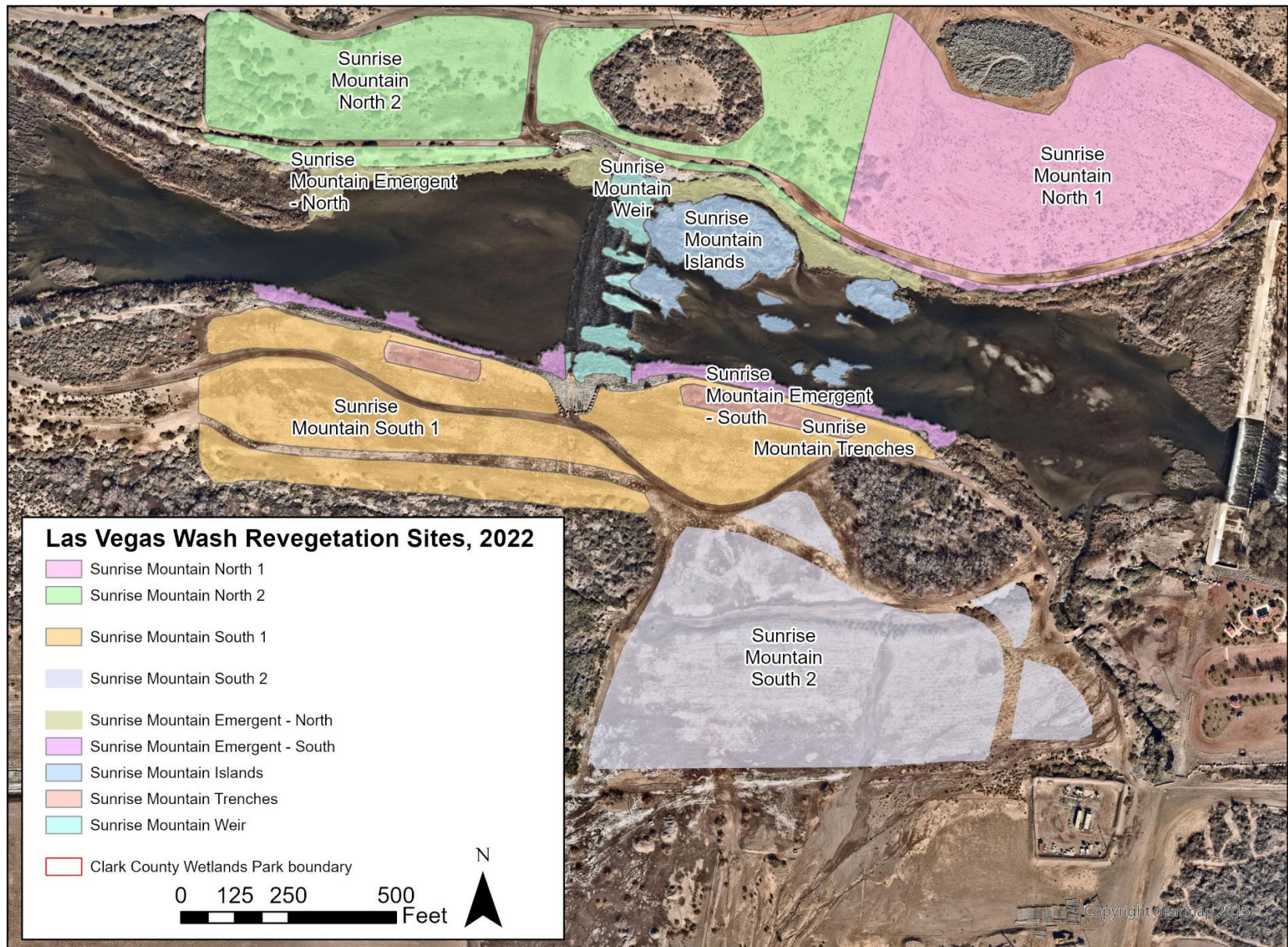


Figure 24. Aerial photograph of 2022 delineated Sunrise Mountain Weir revegetation sites.

3.20 Three Kids Weir

All revegetation sites at the Three Kids Weir were monitored using ArcGIS in 2022 (Table 22, Figure 25). Lower Narrows Homestead North 2 (LNHN2) was separated from LNHN at the Lower Narrows and Homestead weirs during construction of the Three Kids Weir and hydroseeded again after the Three Kids Weir was completed. Upstream Three Kids South (U3KS) is the lone Green-Up site associated with the Three Kids Weir. U3KS was planted in March 2017. This site was also hydroseeded after weir construction but unlike LNHN2, the site was also planted with approximately 4,000 container plants and irrigated for three growing seasons.

Lower Narrows Homestead Bank-N (LNHB-N), LNHN2, and U3KS all saw a decrease in total cover from 2021 to 2022. LNHN2 went from 50–75% to 5–25%, LNHB-N went from 75–100% to 50–75%, and U3KS saw the largest decrease going from 75–100% to 5–25%. Although these changes are worth noting, the results are likely due to being unable to properly identify all plant species using ArcGIS.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
LNHB-N	7	2.12	wet	50–75%	nm	nm	nm
LNHB-S	7	3.44	wet	75–100%	nm	nm	nm
LNHN2	6	9.67	non-wet	5–25%	nm	nm	nm
3KW	6	4.74	wet	75–100%	nm	nm	nm
U3KI	6	1.21	wet	75–100%	nm	nm	nm
U3KNB	7	4.68	wet	75–100%	nm	nm	nm
U3KS	6	7.08	non-wet	5–25%	nm	nm	nm
U3KSB	7	1.77	wet	75–100%	nm	nm	nm

¹LNHB-N=Lower Narrows Homestead Bank North, LNHB-S=Lower Homestead Bank South, LNHN2=Lower Narrows Homestead North 2, 3KW=Three Kids Weir, U3KI=Upstream Three Kids Island, U3KNB= Upstream Three Kids North Bank, U3KS=Upstream Three Kids South, U3KSB= Upstream Three Kids South Bank

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps’ 1987 Wetland Delineation Manual. “wet” = wetland and “non-wet” = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 22. Vegetation monitoring results for Three Kids Weir revegetation sites in 2022.

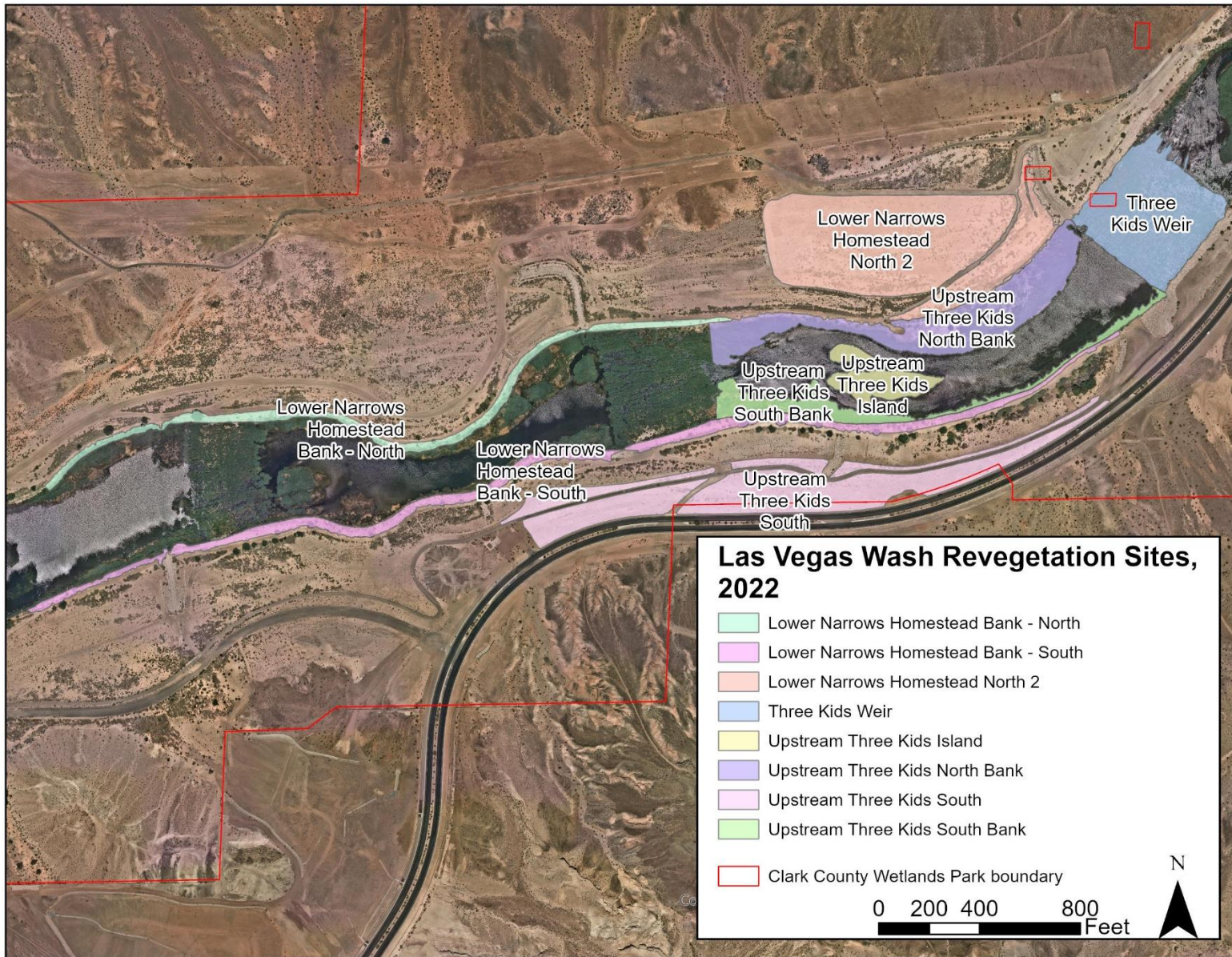


Figure 25. Aerial photograph of 2022 delineated Three Kids Weir revegetation sites.

3.21 Tropicana Weir

There are five sites associated with the Tropicana Weir (Table 23, Figure 26). All sites but Tropicana Weir (TW) were monitored in the field in 2022. Three of the sites were actively planted as Green-Up volunteer events. Tropicana West 1 (TW1) was the spring 2018 event, Tropicana West 2 (TW2) was the fall 2018 event, and Tropicana East (TE) was the spring 2019 event. The remaining two sites were passively created. Tropicana Weir (TW) is the vegetation growing on the weir itself and Tropicana Weir Emergent (TWE) is the vegetation growing on the Wash banks upstream and downstream of the weir. TWE is broken up into two monitoring areas, east and west, and then combined using a weighted average based on acreage.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
TE	4	7.02	non-wet	75–100%	0.0%	16	2.95
TW	3	2.34	wet	75–100%	nm	nm	nm
TW1	5	6.45	wet	75–100%	17.5%	16	2.31
TW2	4	10.70	wet	75–100%	40%	20	2.59
TWE	4	2.87	wet	75–100%	7.1%	24	1.87

¹TE=Tropicana East, TW=Tropicana Weir, TW1=Tropicana West 1, TW2=Tropicana West 2, TWE=Tropicana Weir Emergent

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 23. Vegetation monitoring results for Tropicana Weir revegetation sites in 2022.

Tropicana East (TE) was in its fourth growing season at the time of monitoring in 2022. Total cover went from 50–75% in 2021 to 75–100% in 2022. For the fifth year in a row, Tropicana West 1 (TW1) had the maximum total cover value of 75–100%. Although total cover remained the same, there continued to be a reduction in species richness. In 2022, this site had 16 species, compared to 37 originally identified in 2018. A reduction in species richness is normal for Wash revegetation sites in the first few years after establishment, once irrigation is stopped on site. The open space and frequent irrigation when revegetation sites are first created allow both native and non-native species to establish quickly. Once irrigation is reduced or ceases, many of these species are not able to survive. One of the non-native species that established on TW1 is bassia (*Bassia hyssopifolia*), which was the dominant species on the site from 2019 through 2021. In 2022, this species had a total cover of just 2.5%. This result shows that the effort put in place to reduce its abundance is working. TW2 was in its fourth growing season in 2022. This site had a total cover of 75–100% which is up from the previous year. Also, like TW1, TW2's previously documented dominant species, bassia, has seen significant reductions and is now only 2.5% of the site's total cover. TW1, TW2 and TWE all had high noxious species cover in 2022. Salt cedar was the dominant species at all three sites, making up 7% at TWE, 15% at TW1, and 37.5% at TW2. TW2 saw an increase in noxious species cover from 15.1% in 2021 to 40% in 2022. TWE decreased from 30.3% to 7.1%, and TW1 also saw a decrease in noxious species cover from 30% in 2021 to 17.5% in 2022. Noxious species at these sites should continue to be monitored and removal efforts may need to be discussed in the future.

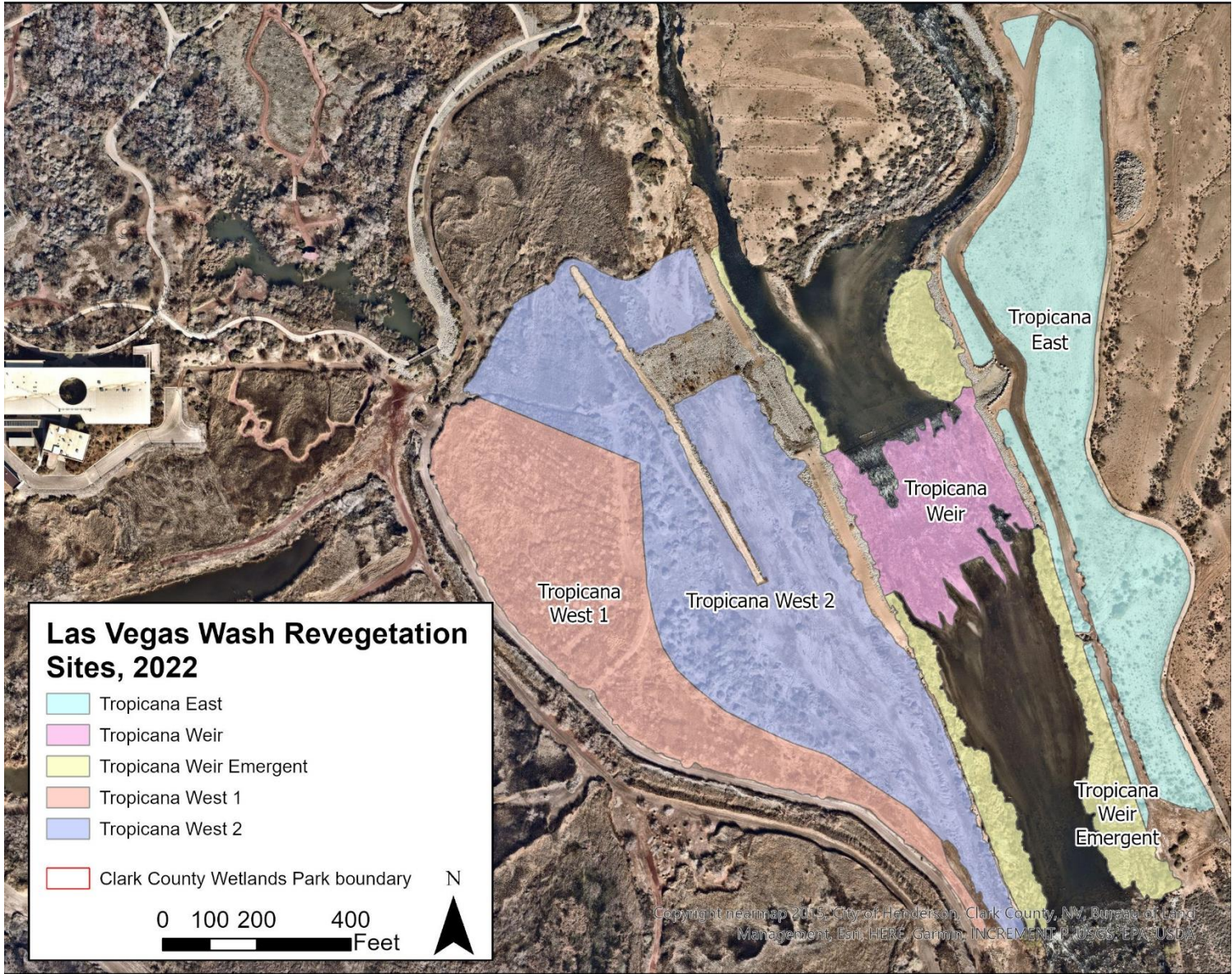


Figure 26. Aerial photograph of 2022 delineated Tropicana Weir revegetation sites.

On the other side of the Wash, TE was also monitored for the fourth time in 2022. There was an increase in bassia cover from 2020 to 2021 but a decrease from 2021 to 2022, with bassia recorded at 0.5% of the total cover. This site saw a slight increase in number of species, going from 12 species identified in 2021 to 16 in 2022. Fluctuations in species are not unexpected because TE is only in its fourth growing season, and changes in species richness are likely to occur for the first several years. The total cover of the site was 75–100% which was an increase from the 50–75% recorded in 2021.

The TW site has fluctuating in acreage over the past three years. In 2020, there were 1.90 acres of vegetation passively created, then TW saw a decrease in acreage measuring at 1.65 acres in 2021. In 2022, TW saw a slight increase going from 1.65 acres to 2.34 acres. The passively established TWE site has grown substantially since 2019 when it measured at 0.73 acres, increasing to 2.87 acres in 2022.

3.22 Upper Diversion Weir

All revegetation sites at the Upper Diversion Weir were monitored in the field in 2022 (Table 24, Figure 27). Upper Diversion Island (UDI; Figure 28) did not change much in total cover but saw a decrease in noxious species, going from 33.3% in 2021 to 17% in 2022. Noxious species should continue to be monitored closely during the next field sampling season, and if percentages do not decrease, this site will be a good candidate for invasive and other undesirable species removal under the RMP. Upstream Upper Diversion South also saw an increase in noxious plant cover, going from 0.0% in 2020 to 15% in 2022. Future sampling will help determine if this site is a good candidate for invasive and other undesirable species removal under the RMP.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DUDE	14	3.64	wet	75-100%	1.6%	12	1.73
DUDN	14	10.11	non-wet	49.2%	0.3%	7	4.91
DUDS	14	1.28	wet	87.5%	1.2%	11	2.11
UDI	14	5.12	non-wet	75.4%	17.0%	21	3.64
UDIE	14	0.36	wet	37.5%	3.0%	16	2.15
UDIS	14	0.22	non-wet	75-100%	0.0%	2	4.94
UUDE	14	2.54	wet	75-100%	0.1%	13	1.10
UUDS	14	0.79	non-wet	75-100%	15%	4	4.04

¹DUDE=Downstream Upper Diversion Emergent, DUDN=Downstream Upper Diversion North, DUDS=Downstream Upper Diversion Shelves, UDI=Upper Diversion Island, UDIE=Upper Diversion Island Emergent, UDIS=Upstream Upper Diversion Island South, UUDE=Upstream Upper Diversion Emergent, UUDS=Upstream Upper Diversion South

²Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

³Wetland Prevalence Index (WPI) value. $WPI \leq 2.0$ = wetland, $2.0 < WPI < 2.5$ = likely wetland, $2.5 \leq WPI < 3.5$ = may be wetland, $3.5 \leq WPI < 4.0$ = not likely a wetland, and $WPI \geq 4.0$ = upland

nm = this attribute was not monitored

Table 24. Vegetation monitoring results for Upper Diversion Weir revegetation sites in 2022.

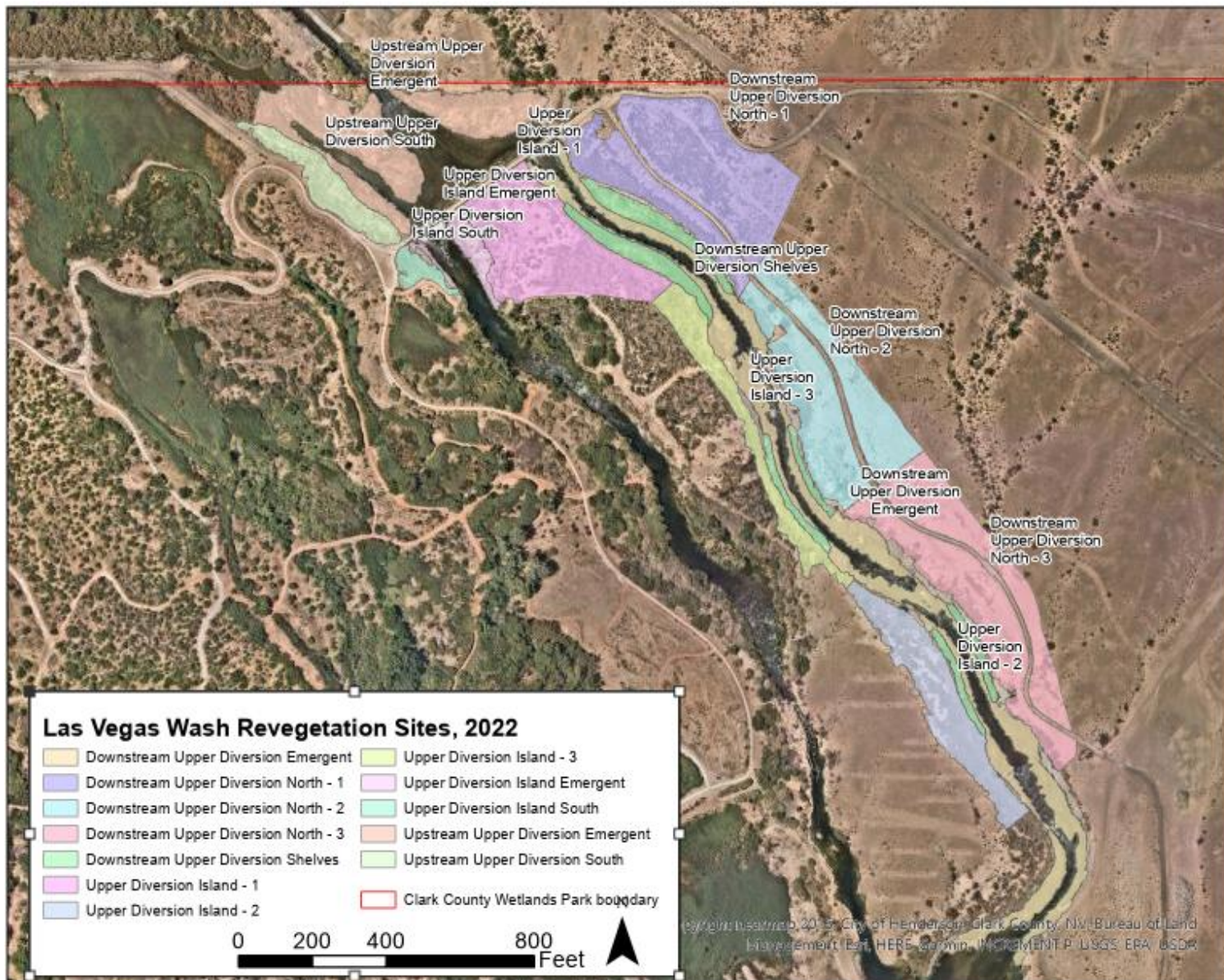


Figure 27. Aerial photograph of 2022 delineated Upper Diversion Weir revegetation sites.

Downstream Upper Diversion North (DUDN) total cover went from 39.3% in 2021 to 49.2% in 2022. This is the first time since 2019 that the site has seen an increase in total cover. Although this is an increase, the site still had less than 50% total cover on its 10.11 acres in 2022. This site is a good candidate for enhancement under the RMP.



Figure 28. Photo of Upper Diversion Island, mostly dominated by four-wing saltbush (*Atriplex canescens*).

4.0 CONCLUSIONS

For comprehensive environmental programs such as the one along the Wash, there are various goals and multiple facets of each goal. This monitoring report is designed to describe how the Wash program is performing in relation to select quantitative measurements of native plant restoration. For the revegetation program as a whole and for individual sites, success occurs when there is an increase in native plant cover up to a self-sustaining level, high survivorship of planted plants, and an ongoing control or reduction of noxious weeds. More difficult to measure goals include providing wildlife habitat and increasing the overall ecological health of the system. However, wildlife surveys and the summation of other measurements should indicate to managers and stakeholders whether these goals are being met as well.

Sixty-nine sites were monitored in the field with Site 108 separated by funding source. Of those sites, 36 (52.2%) had the same cover as they did in the previous monitoring season, 23 (33.3%) increased in cover, nine (13.0%) decreased in cover, and one was in its first year of monitoring (1.5%). ArcGIS was used to measure the total cover for the remaining 89 (56.3%) sites. Most older sites have matured to a point that vegetative cover does not change much between growing seasons.

Regular maintenance of weir structures includes removal of vegetation. Although this has an immediate large impact, the recovery is swift. Table 25 shows site acreage for each weir beginning in 2018. The two weirs created after 2018, Tropicana and Sunrise Mountain, show acreage beginning in 2020. Three Kids Weir, which was constructed in 2015, is the largest at 4.74 acres (Figure 29). As we continue with scheduled maintenance, this table will be updated to reflect years in which vegetation was removed. Learning the immediate and long-term impacts of this maintenance will help with future planning. Additionally, understanding how quickly vegetation grows back can help determine the appropriate time between scheduled maintenance.

This report marks the first year of data collection under the LTOP. Although vegetation monitoring has moved into long-term operations, changes to the actual survey have not been made. Preparation of a new monitoring plan started in the fall of 2023, in hopes that sampling in fall of 2024 will follow the new procedures. This plan will support the goals and priorities of the RMP to improve habitat for wildlife, enhance current sites, and remove noxious and other undesirable species, among others.

This report determined there are currently seven sites that are good candidates for enhancement and two sites that are good candidates for invasive and other undesirable species removal (Table 26). There was one site, BST, that could be a good candidate for enhancement, but additional information is needed through future monitoring. There were also 10 sites that need to be watched closely and if noxious species cover does not decrease, they will also become candidates for invasive and other undesirable species removal. This table may change annually and will be used as a tool to guide future revegetation efforts along the Wash.

Weir	Year				
	2018	2019	2020	2021	2022
Archery Weir	0.71	0	1.16	1.11	1.34
Silver Bowl Weir	1.4	0	1.47	1.36	1.91
Bostick Weir	8.19	8.03	8.52	8.52	7.12
Calico Ridge Weir	0	0	0.08	0.08	0.02
Duck Creek Confluence Weir	3.32	2.93	3.88	3.99	3.95
Upper Narrows Weir	2.38	2.38	3.39	3.43	3.54
DU Wetlands No. 1 Weir	0.67	0	1.45	1.49	1.53
DU Wetlands No. 2 Weir	0.87	0.13	0.24	0.24	0.25
Historic Lateral Weir	0.42	1.07	2.95	3.05	3.07
Lower Narrows Weir	2.59	2.83	3.5	3.71	3.63
Homestead Weir	3.18	3.27	3.96	4.07	4.18
Powerline Crossing Weir	0.07	0.08	0.28	0.28	0.15
Sunrise Mountain Weir	-	-	0.53	0.58	0.73
Three Kids Weir	4.06	4.02	4.19	4.9	4.74
Tropicana Weir	-	-	1.69	1.65	2.34

Table 25. Changes in total acreage at each weir from 2018 through present. Numbers that are bold represent years in which vegetation was removed.



Figure 29. Aerial image of Three Kids Weir which was constructed in 2015. This weir site is the largest at 4.74 acres. Photo taken in 2020.

Site Code	Candidate for Enhancement	Candidate for Invasive and other Undesirable Species Removal	Possible Candidate for Enhancement Following Additional Monitoring	Possible Candidate for Invasive and Other Undesirable Species Removal Following Additional Monitoring
BST			X	
BN	X			
DBN	X			
DCS-N	X			
DCUNNS	X			
DCUNSF	X			
UCE	X			
DU2E				X
DUWN				X
UHLN-W				X
DMS-W				X
DPLNB				X
DPLSB				X
URSE		X		
URSB2		X		
SME-S				X
SMT				X
UDI				X
UUDS				X
DUDN	X			

Table 26. Vegetation sites that are good candidates for enhancement or invasive and other undesirable species removal following the Las Vegas Wash Long-Term Revegetation Management Plan.

5.0 RECOMENDATIONS

Annual monitoring of the vegetation has provided many years of data to compare. There are only a few sites where declines in total plant cover are a concern. As with individual sites and even individual species, single year increases or decreases are not of major concern to a large restoration project such as that occurring along the Wash.

The 2020 report recommended that LNHS1 and LNHS2 be closely monitored due to their lack of total cover. Both sites were planted as Green-Ups in 2011 and 2012 and their total cover declined to just 25–50% 2020. Results from this report show increases in total cover for both sites. However, both of these sites are dominated by just two species. To help enhance and diversify these sites, they have been selected as the 2024 spring Green-Up location. This will allow for additional plants to be planted to improve overall cover and also provide better habitat for wildlife.

Having 158 revegetation sites along the Wash, it is impossible to field survey all sites each year. Therefore, ArcGIS is used to determine total site cover of the sites that are not field monitored. This has been proven to be a useful tool to allow staff to evaluate every site each year, but results suggest it may not be the most accurate. Total cover of some sites decreases during ArcGIS monitoring years and increases during field survey years. This is likely due to the inability to identify some plants using ArcGIS. Although there is some inaccuracy using this system, ArcGIS should continue to be used and the results interpreted lightly. All sites are monitored in the field every other year, so management decisions should be based off field survey results only.

The RMP was created in 2019. This plan was created to identify activities that would improve revegetation sites along the Wash. It focuses on how to improve the ecological function of revegetation sites including diversifying plant structure types and plant species, increasing wildlife benefits in the form of food and shelter, and removing undesirable species and trash from the sites. There is now a need to put the RMP into action and create a Las Vegas Wash Long-Term Revegetation Monitoring Program. Vegetation monitoring may change. A new plan was started in the fall of 2023, in hopes that sampling in fall of 2024 will follow the new protocols and procedures. This plan will support the goals and priorities of the RMP to improve habitat for wildlife, enhance current sites, and remove noxious and other undesirable species, among others.

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