

las vegas wash coordination committee

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Las Vegas Wash Vegetation Monitoring Report, 2017



January 2019



SOUTHERN NEVADA
WATER AUTHORITY

Las Vegas Wash
Coordination
Committee



**Las Vegas Wash
Vegetation Monitoring Report, 2017**

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

Prepared for:

Las Vegas Wash Coordination Committee

Prepared by:

**Jason R. Eckberg, CERP, PWS, ESA Certified Ecologist
Southern Nevada Water Authority
100 City Parkway, Suite 700
Las Vegas, Nevada 89106**

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ABSTRACT

Revegetation projects have been conducted along the Las Vegas Wash for over 17 years to meet the goals of the Las Vegas Wash Coordination Committee. In the fall of 2017, when monitoring for this report took place, approximately 504 acres of revegetation across 133 sites were established. These sites were broken up into 284 monitoring areas for this report. Sites ranging in age from 1 to 17 growing seasons had total cover, noxious species cover, species richness, and the wetland prevalence index documented. Eight new sites were monitored in 2017. These include sites that weren't previously monitored at Lower Narrows and Homestead Weirs and Archery and Silver Bowl Weirs as well as newly established sites at Three Kids Weir and Powerline Crossing Weir. Survivorship was calculated for one of the most recently established sites, Upstream Three Kids South, which was the spring 2017 Green-Up site and had 87% survival of planted plants. Overall, most revegetation sites either increased in cover or remained the same as in 2016; approximately 12% of the sites decreased in cover. Most mature sites have stabilized and cover does not change much between growing seasons.

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1.0 INTRODUCTION

1.1 Background

In 1997, the Southern Nevada Water Authority (SNWA) assembled a citizen’s advisory committee to evaluate water quality issues in the Las Vegas Wash (Wash), Las Vegas Bay, and Lake Mead. These efforts resulted in the establishment of the Las Vegas Wash Coordination Committee (LVWCC), now a 28-member multi-stakeholder group consisting of federal, state, and local agencies, the university, private businesses, environmental groups, and citizens. In 2000, the LVWCC drafted a long-term management plan, the Las Vegas Wash Comprehensive Adaptive Management Plan (CAMP), to facilitate stabilization and enhancement activities along the Wash (LVWCC 2000; Figure 1). 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. After erosion control facilities are built, wetland, riparian, and upland vegetation is planted to help further protect the Wash from erosion, as well as to improve the functional attributes of the ecosystem.

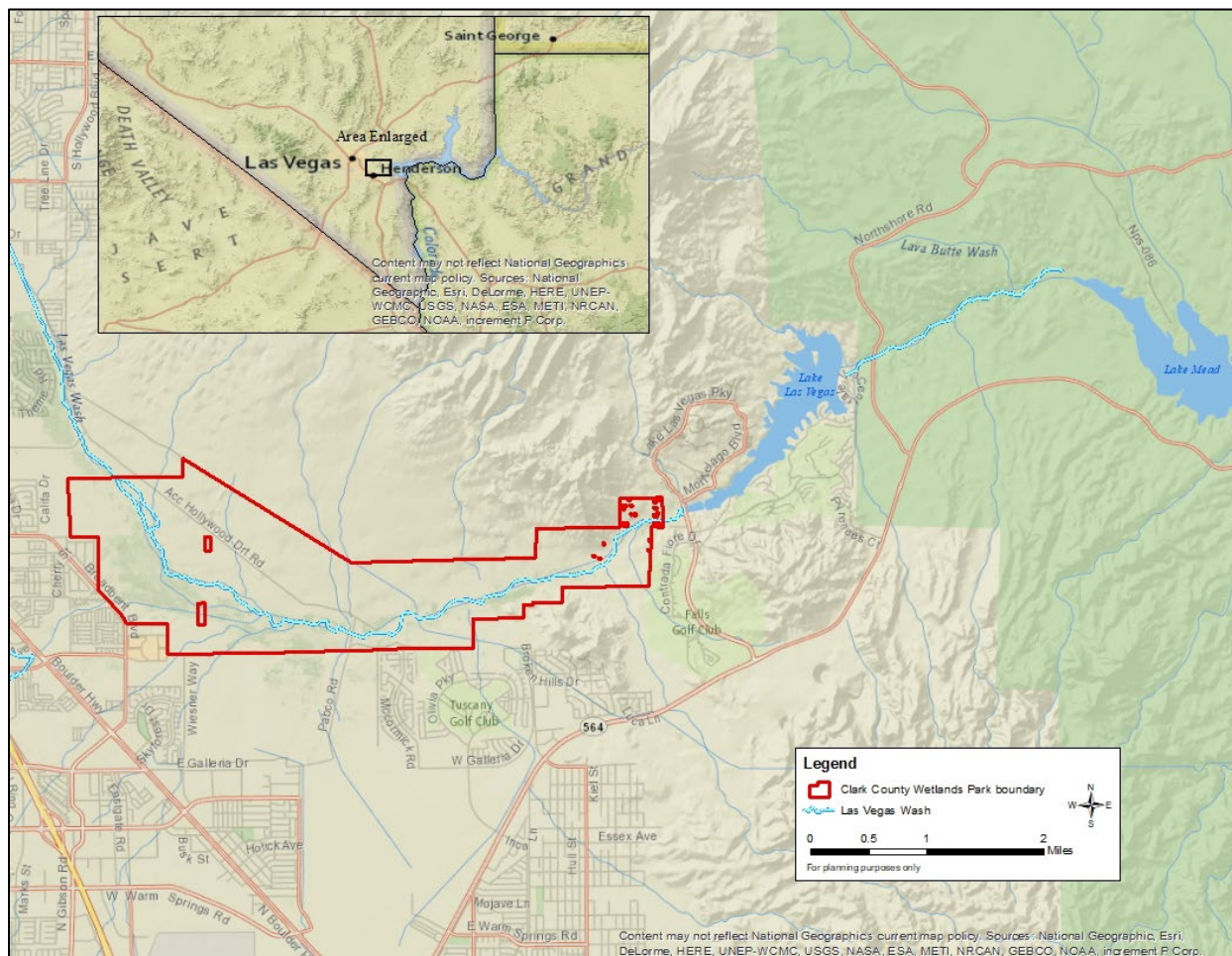


Figure 1. Las Vegas Wash location and general study area map.

A critical component of the overall plan to stabilize and enhance the Wash is the revegetation program. Erosion control is enhanced by plants by binding their roots to loose soil particles on the surface, subsurface and in deep subsurface horizons, thereby acting as soil anchors during scouring events (i.e., floods). In addition, a variety of wildlife species benefit from revegetation efforts. These areas planted with native species also potentially provide habitat for species formerly found to reestablish there. At the time when the erosion control project began along the Wash, there were very few native plants found along its banks, especially wetland and riparian species. Moreover, from the time flows increased and began to incise the channel, exotic species such as salt cedar (*Tamarix ramosissima*) successfully established in the area and became the dominant species. As a result, 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

The primary purpose of this report is to document the status of SNWA's revegetation efforts along the Wash by reporting 2017 data as part of a comprehensive vegetation monitoring program. Vegetation monitoring results from 2002 through 2016 have been previously documented (SNWA 2005, Eckberg and Shanahan 2008, Eckberg 2018); 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 504 acres were monitored in 2017. The majority of these activities have been conducted on revegetation project sites located within the boundaries of the Clark County Wetlands Park (CCWP; Figure 2). An additional revegetation area is located at the Clark County Water Reclamation District (CCWRD), which is located just north of the CCWP (Figure 2).

1.3 Need for Revegetation and Vegetation Monitoring

Revegetation projects along the Wash are conducted for multiple reasons. 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. Here, this includes wetlands associated with Wash erosion control projects. Section 404 permits require 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 issues general stormwater permits for Wash construction activities and permits require that final site stabilization is achieved. Vegetation 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

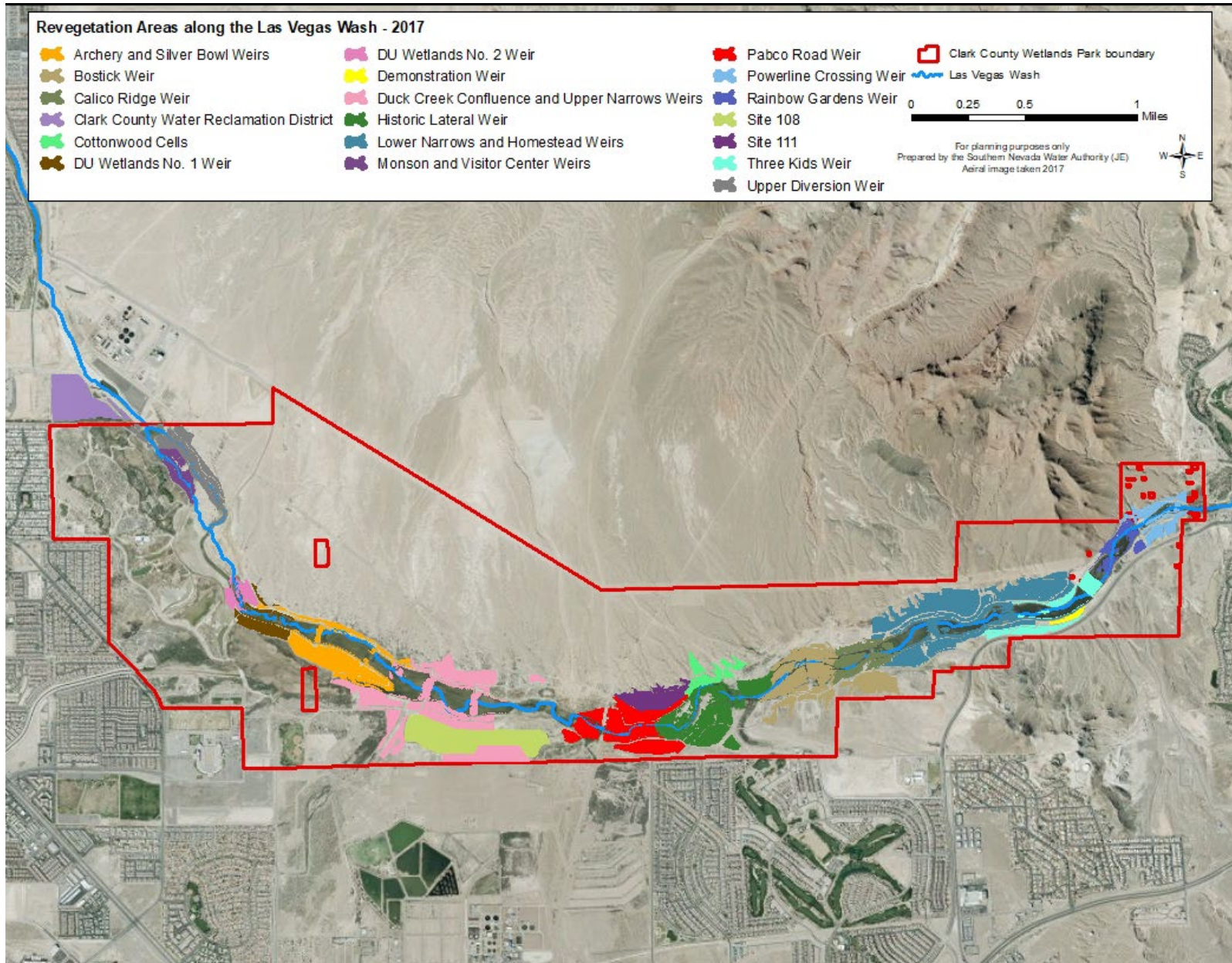


Figure 2. Location of the 2017 Las Vegas Wash revegetation sites.

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.”

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 and with the same general methodology.

1.4 Program Funding

The two major sources of funding for revegetation projects along the Wash are funding derived from grants and the Las Vegas Wash Capital Improvements Plan (Wash CIP). The Wash CIP funds revegetation activities stipulated in federal or state permits (e.g., wetland permits) obtained by SNWA as part of weir construction. Grant funds have been used to supplement the majority of revegetation projects implemented along the Wash, typically those areas adjacent to but not directly influenced by construction projects. Grants have been obtained from a variety of sources including the Clark County Multiple Species Habitat Conservation Plan, NDEP, Nevada Division of State Parks (NDSP), and three rounds of the Southern Nevada Public Land Management Act (SNPLMA IV, SNPLMA V, and SNPLMA VI); however, the majority of these grants have only provided funds for the initial components of implementation for specific revegetation projects. Once these areas have been established, the only source of funding for ensuring the successful establishment of these sites has been grants provided by the BOR.

1.5 Typical Revegetation Establishment Activities

1.5.1 Planning

The majority of revegetation sites along the Wash are in association with the construction of erosion control structures. This results in most site revegetation efforts being planned in conjunction with those construction activities. Once designs are complete on the structures including temporary and permanent footprints, design of revegetation areas begins. This includes plant selection and irrigation design. Once substantial completion has been reached on the structures, on-site soil testing may alter final plant selection and layout. Included in the design of these structures are species and procedures for hydroseeding. Hydroseeding doubles as the final step in the construction process and the initial step in revegetation.

1.5.2 Plant Procurement

After plant selection has been completed, procurement activities must 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). Plants grown by the Wash Team involve collecting seed or cuttings, establishing the seedlings, transplanting into larger containers, irrigating, and delivery back to the Wash for final planting. With revegetation activities taking place along the Wash since

2000, there are now sufficient native species established to procure seeds and cuttings without looking to surrogate areas. Plant propagation for the Wash Team takes place at the SNWA-operated Warm Springs Natural Area propagation facility in Moapa, NV.

1.5.3 Invasive and Other Undesirable Species Removal

The majority 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 of the 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 would not be able to grow, germinate, and become self-sustaining. Considerable effort, therefore, is given to continually surveying sites for encroachment, identifying the invasive species, and planning for their removal as soon as possible.

In addition to invasive species, there are other undesirable species that are closely monitored for their presence. Common reed (*Phragmites australis*) and quailbush (*Atriplex lentiformis*) can grow so vigorously that they outcompete native species that are trying to establish. The Wash has native and non-native common reed as well as hybrids of the two (Saltonstall et al. 2016). The goal with these is not to completely remove them 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 in order 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 bio-diesel powered pumps to a single mainline and then to multiple lateral lines that are fitted with sprinkler heads and/or drip irrigation tubing

The sizes of the sites that are irrigated have ranged from under 10 acres to almost 60 acres. Maintenance on irrigation system components is critical to ensure that plant material is given the proper amount of water. This is particularly true in Southern Nevada where less than five inches of rainfall occurs annually. Irrigation maintenance includes fixing leaks, tightening connections, and fixing or replacing broken pipes or heads.

1.5.5 Trash Removal

Furniture, landscape waste, and many other types of trash have been found on revegetation sites. On newly created sites, successful establishment can be hindered by trash and other debris collecting on the site. The revegetation program is reducing the amount of illegal dumping that is observed by making the Wash a more scenic location, involving the public in its revegetation activities, and continually removing trash. Without large amounts of visible trash, people are not encouraged to dump there; however, some trash does get into the Wash from wind or water runoff.

1.5.6 Herbivore Control

On revegetation sites, fences are installed to reduce the damage caused by rabbits to newly planted material. Some sites have had a single fence placed around the entire site while others have had smaller fences around the plants themselves. Both must be continually inspected for damage, have repairs made, and adjustments made to the spacing of the fences to reduce plant damage.

2.0 MATERIALS AND METHODS

Monitoring was conducted between August and October 2017, and the methods followed the same guidelines as previous years (Eckberg and Shanahan 2009). As of August 2017, there were 68 wetland and 65 non-wetland revegetation sites. Many of the non-wetland sites were broken up into multiple monitoring areas (Table 1). This marks the first year where wetlands sites outnumber non-wetland sites. The primary reason was the increase in passive wetland sites that have developed on weirs.

ArcGIS was used to monitor 62 of the 133 total revegetation sites in 2017 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 the 2008 Las Vegas Wash Vegetation Monitoring Report (Eckberg and Shanahan 2009).

3.0 RESULTS AND DISCUSSION

The following subsections describe monitoring results for each site and for groupings of sites. From 2016 to 2017, the number of areas monitored increased by 15 and the acreage increased by 21.7 (Table 1). The total areas and acreage include sites monitored in the field as well as with ArcGIS. The increase in acres is primarily due to two factors. First, there were new restoration sites associated with the Three Kids Weir. This area was planted as a volunteer event in the spring of 2017. Second, there were existing passively created areas along the Wash that had not previously been captured in monitoring, specifically the Archery and Silver Bowl Weirs.

Cumulatively, there have been 81.08 acres of wetlands created above those required by mitigation permits (Table 2); including, 3.74 acres associated with the Cottonwood Cells, which were fully funded by grants from the BOR and the CCWRD which had its permit held by the property owners. 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 constructed simultaneously, and their project boundaries are adjacent to each other (Figure 3). Therefore, the revegetation that took place after the weirs were completed does not use the boundaries of the individual weirs but rather the combined footprint of both structures. Planting began on six sites in 2015 and one site in 2016 (Table 3). These include two Green-Up sites; Archery Silver Bowl South 1 (ASBS1) in October 2015 and Archery Silver Bowl South 2 (ASBS2) in April 2016. This monitoring year added two new sites

Major Site	Acreage		No. of Monitoring Areas	
	2016	2017	2016	2017
Archery and Silver Bowl Weirs	29.3	31.9	7	9
Bostick Weir	47.3	47.3	15	14
Calico Ridge Weir	16.8	16.8	10	10
CCWRD	27.4	27.4	29	29
Cottonwood Cells	10.4	10.4	10	10
Demonstration Weir	2.0	2.0	2	2
Duck Creek Confluence and Upper Narrows Weirs	57.7	59.5	13	13
DU Wetlands No. 1 Weir	10.3	10.6	4	4
DU Wetlands No. 2 Weir	14.0	7.3	5	5
Historic Lateral Weir	43.8	43.8	14	13
Lower Narrows and Homestead Weirs	62.2	66.7	7	9
Monson and Visitor Center Weirs	8.8	8.7	4	4
Pabco Road Weir	41.8	41.7	20	18
Powerline Crossing Weir	13.8	13.9	16	17
Rainbow Gardens Weir	7.8	9.3	8	8
Site-108	40.9	40.9	55	61
Site-111	14.9	14.9	24	26
Three Kids Weir	7.4	28.1	4	8
Upper Diversion Weir	25.7	22.8	21	24
TOTAL	482.3	504.0	269	284

Table 1. Change in cumulative acreage monitored and number of monitoring areas from 2016 to 2017.

that were passively established wetlands that formed on the weirs themselves; Archery Weir (AW) and Silver Bowl Weir (SBW). The five remaining sites were planted by SNWA’s contractor beginning in 2015 and continuing into 2016 including all wetland sites (Figure 4).

At the time of monitoring this year, the only site occasionally being irrigated was Archery Silver Bowl North (ASBN) which had some additional plants added earlier in the year. The remaining non-wetland sites had intermittent irrigation earlier in the year (March-April) but the plants appeared to be well established and it was decided to cease applying additional water.

The non-wetland ASBS1 and ASBS2 each had high total cover values in 2017. ASBS1 had the maximum cover of 75-100% while ASBS2 had the second highest of 50-75%. These are the same total cover values they had in their first monitoring season in 2016. However, both sites had their species richness decline substantially. ASBS1 had the larger drop from 21 species in 2016 to just

Mitigation Project	Mitigation Permit Number	Mitigation Required (acres)	Wetland Area Created (acres)
Archery and Silver Bowl Weirs	SPK-2011-00796-SG	0 ^c	3.16
Bostick Weir	200125114	7.88	18.79
Calico Ridge Weir	200450004	3.80	9.13
Clark County Water Reclamation District	SPK-2009-00227-SG	6.79	6.02 ^a
Cottonwood Cells	N/A	—	3.74 ^b
Demonstration Weir	199825148	0.90	0.49
Duck Creek Confluence and Upper Narrows Weirs	SPK-2009-00042	1.33	12.24
DU Wetlands No. 1 Weir	SPK-2010-00285-SG	1.22	2.78
DU Wetlands No. 2 Weir	2007-1961-SG	0.05	2.87
Historic Lateral Weir	199825148	4.90	18.53
Lower Narrows and Homestead Weirs	SPK-2008-01417-SG	6.25	9.83
Monson and Visitor Center Weirs	200250111	4.81	1.92
Pabco Road Weir	199725375	2.20	14.79
Powerline Crossing Weir	200450454	4.87	2.91
Rainbow Gardens Weir	200250054	1.00	6.33
Three Kids Weir	SPK-2012-01138-SG	0 ^c	13.54
Upper Diversion Weir	200550514	0.01	7.08
Bank Protection Projects	—	7.06	—
TOTAL		53.07	134.15

^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 2017.

6 in 2017. ASBS2 went from 16 species in 2016 to 11 in 2017. Two factors contributed to this. First, most sites have a drop in species richness and/or cover after irrigation is terminated on a site. Second, both sites are dominated by desert saltbush (*Atriplex polycarpa*). This species has the same cover on each site as the total cover. There were plants planted as well as those that self-established while the sites were being irrigated that were not appropriate for the sites after they were no longer receiving regular supplemental water. The remaining plants, especially desert saltbush, are very healthy and growing. Therefore, there is no reason for concern on the status of these sites.

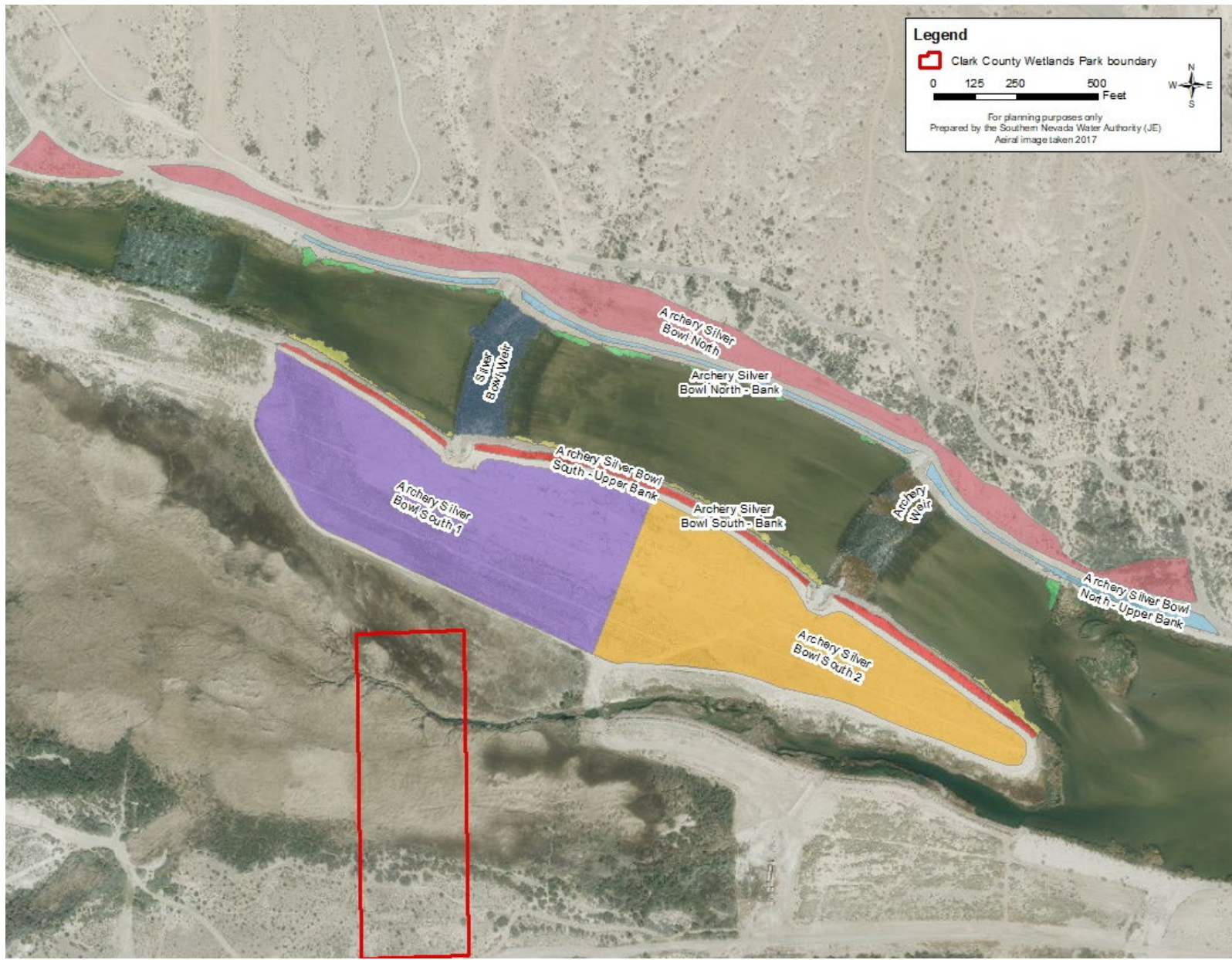


Figure 3. Aerial photograph of 2017 delineated Archery and Silver Bowl Weirs revegetation sites.

Site Code ¹	Growing Season	Acreeage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
ASBN	2	6.33	wet	50-75%	0.0%	30	3.58
ASBNB	2	0.49	wet	75-100%	0.6%	27	1.55
ASBNUB	2	1.22	wet	50-75%	0.0%	10	3.81
ASBS1	2	11.36	non-wet	75-100%	0.5%	6	3.97
ASBS2	2	8.64	non-wet	50-75%	0.0%	11	3.98
ASBSB	2	0.63	wet	75-100%	2.5%	18	1.23
ASBSUB	2	1.22	wet	75-100%	0.0%	7	3.97
AW	2	0.69	wet	75-100%	nm	nm	nm
SBW	2	1.35	wet	75-100%	nm	nm	nm

¹ASBN= Archery Silver Bowl North, ASBNB= Archery Silver Bowl North Bank, ASBNUB= Archery Silver Bowl North Upper Bank, ASBS-1= Archery Silver Bowl South 1, ASBS-2= 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. $WPI \leq 2.0$ = 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 3. Vegetation monitoring results for Archery and Silver Bowl Weirs revegetation sites in 2017.



Figure 4. Wetland and riparian vegetation line the banks of the Wash at Archery Silver Bowl North Bank (along water-photo left) and Archery Silver Bowl North Upper Bank (above rock-photo right).

3.2 Bostick Weir

There are 14 revegetation sites near the Bostick Weir (Table 4; Figure 5). The majority of the sites, 13, were either in the 13th or 14th growing season. The most recently planted site was Bostick South Tamarisk (BST) which was first planted in 2015 and was in its second season during 2017 monitoring. There was an increase in species richness mostly due to plants establishing by themselves on the site but also included a few new plants planted by contractors (Figure 6). These include a new species for the Wash, ocotillo (*Fouquieria splendens*) as well as cheesebush (*Ambrosia salsola*) which has been planted at many sites.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
B	14	8.00	wet	75-100%	nm	nm	nm
BI	14	4.80	wet	75-100%	nm	nm	nm
BN	14	0.84	non-wet	25-50%	0.0%	6	4.29
BS	13	1.20	non-wet	75-100%	0.1%	24	3.61
BST	2	21.03	non-wet	25-50%	0.6%	49	4.14
DBN	14	0.48	non-wet	25-50%	0.0%	4	4.72
DBS	13	0.22	non-wet	50-75%	0.0%	4	4.80
DBSE	13	0.79	wet	75-100%	nm	nm	nm
UBN	14	0.55	non-wet	75-100%	nm	nm	nm
UBNB	13	1.31	wet	75-100%	nm	nm	nm
UBNE	13	1.82	wet	75-100%	0.1%	10	1.97
UBS	14	2.50	non-wet	75-100%	2.5%	15	2.80
UBS	14	2.07	wet	75-100%	2.5%	19	3.20
UBSB	13	1.71	non-wet	75-100%	2.5%	10	3.69

¹B=Bostick, 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. $WPI \leq 2.0$ = 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 4. Vegetation monitoring results for Bostick Weir revegetation sites in 2017.

In addition to BST, Bostick North (BN) and Downstream Bostick North (DBN) also have a lower total cover value of 25-50%. As opposed to BST, BN and DBN are in their 14th growing season. The most dominant species in terms of cover on both sites are creosote bush (*Larrea tridentata*) and honey mesquite (*Prosopis glandulosa* var. *torreyana*). These species look average in terms of health but their growth rate is much slower than found on other sites. The soils in these areas are very dense and the elevation is higher than most as well. These would both be logical explanations, however since there is little mortality on the sites an in-depth investigation is not needed.

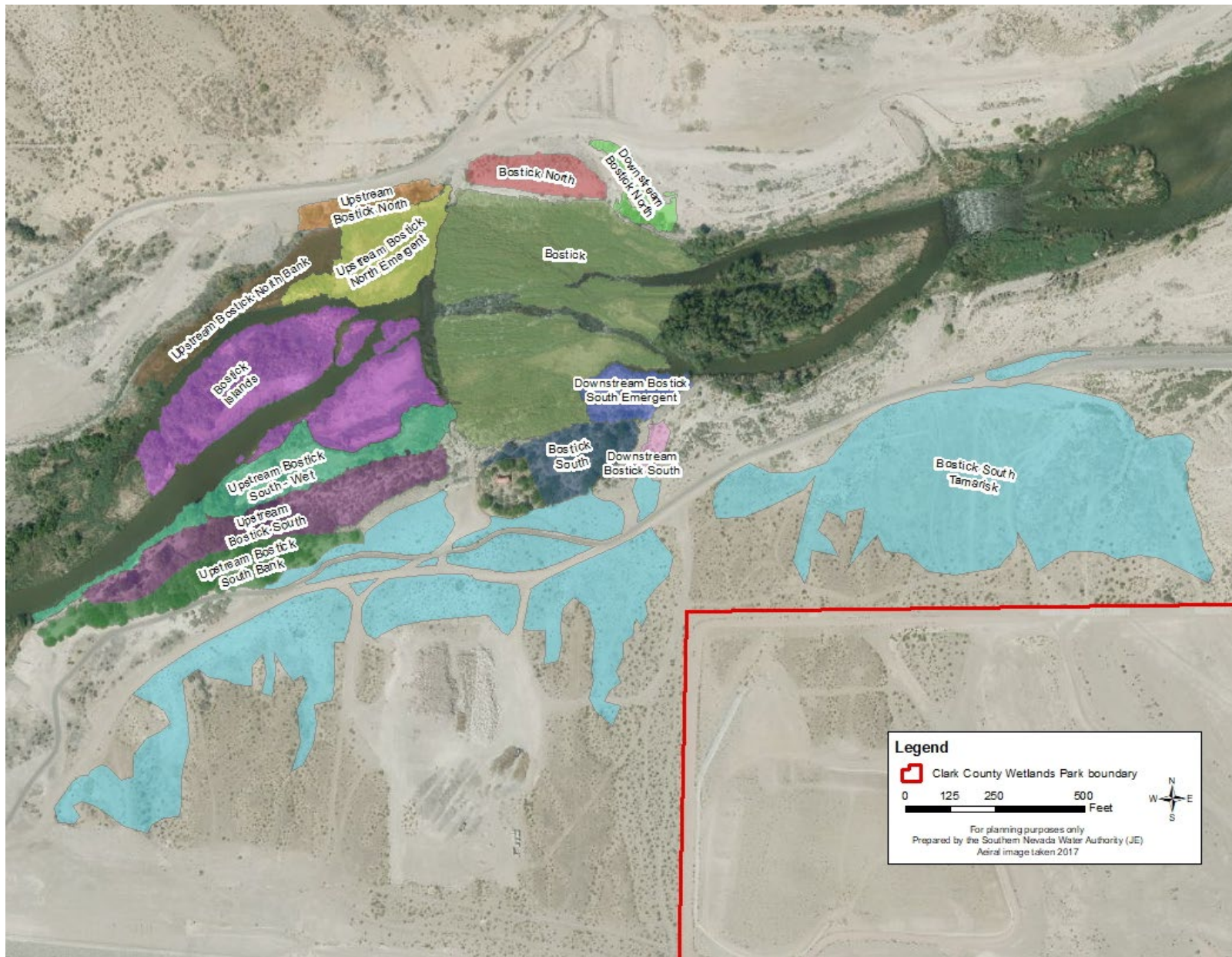


Figure 5. Aerial photograph of 2017 delineated Bostick Weir revegetation sites.



Figure 6. Vegetation at Bostick South Tamarisk lines the Clark County Wetlands Park bike trail.

3.3 Calico Ridge Weir

Only one of the nine revegetation sites at the Calico Ridge Weir was monitored in the field in 2017 (Figure 7), Downstream Calico North (DCN). This site is similar to BN and DBN at the Bostick Weir in many ways. It is also an older site, in its 13th growing season (Table 5), and located on the north side of the Wash just downstream of those two sites. It also has very low plant coverage given the age with just 5-25% total coverage in 2017. While there are few creosote bush on the site, the dominant plant also with 5-25% coverage was honey mesquite just like BN and DBN. Most honey mesquites along the Wash are very large in a matter of a few years. It is assumed that these, like those at BN and DBN, have slower growth due to hard soils and limited access to groundwater.

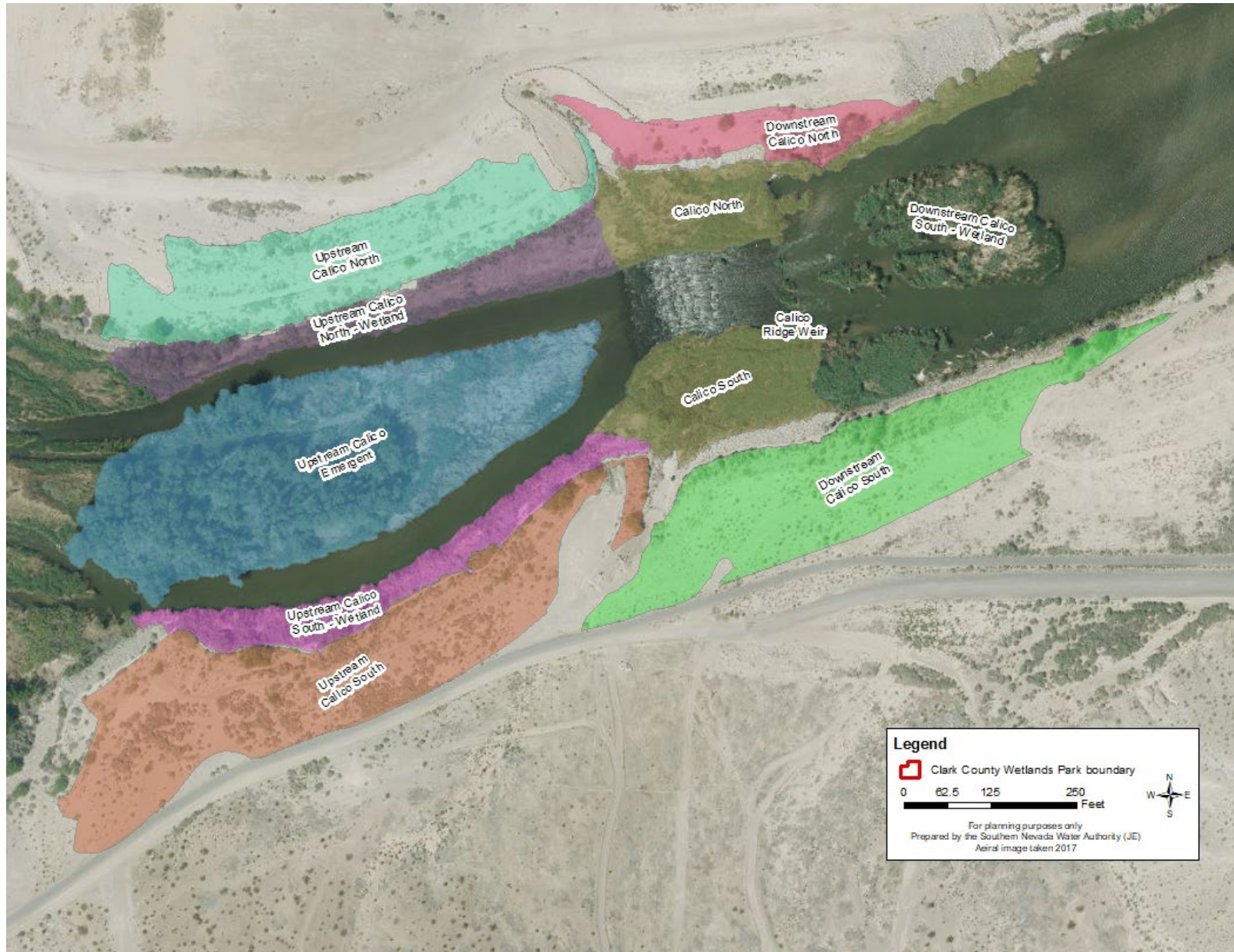


Figure 7. Aerial photograph of 2017 delineated Calico Ridge Weir revegetation sites.

Site Code ¹	Growing Season	Acres	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
C	13	2.07	wet	75-100%	nm	nm	nm
DCN	13	0.65	non-wet	5-25%	0.0%	8	4.02
DCS	13	2.25	non-wet	25-50%	nm	nm	nm
DCS	13	1.58	wet	75-100%	nm	nm	nm
UCE	13	3.63	wet	75-100%	nm	nm	nm
UCN	13	1.89	non-wet	50-75%	nm	nm	nm
UCN	13	1.01	wet	75-100%	nm	nm	nm
UCS	13	2.86	non-wet	50-75%	nm	nm	nm
UCS	13	0.84	wet	75-100%	nm	nm	nm

¹C=Calico, 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. $WPI \leq 2.0$ = 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 5. Vegetation monitoring results for Calico Ridge Weir revegetation sites in 2017.

3.4 Clark County Water Reclamation District

The site located at the CCWRD were monitored using ArcGIS in 2017. Although there are both wetland and non-wetland components to the site (Figure 8; Table 6), the site was planted as one contiguous site and is considered a single site. There is little distinction between the plant species or soils in these two areas. Wetland areas were determined during the Jurisdictional Determination with the Corps by the CCWRD. Therefore, monitoring after the site was planted kept the wetland areas in order to report changes to the Corps for permitting needs. Twenty-nine monitoring areas were created for monitoring but do not distinguish between wetland and non-wetland areas.

Due to ongoing construction occurring at the property, the revegetation site was not accessible during the monitoring season. Shortly after the monitoring year concluded, construction was also completed. Therefore, field monitoring will reconvene in 2018. Aerial imagery and ArcGIS data document that there have been physical changes, as expected, by the construction. Specifically, the southeast corner of the site had access routes created through it. It is unknown how the channelization will impact the groundwater, which was very high prior to the work. ArcGIS measurements of the cover of each of the 29 monitoring areas came up with similar total cover values each of the past two seasons with 84.6% in 2016 and 87.5% in 2017. In 2017, each of the 29 areas had the maximum cover value of 75-100% cover, with most having the 100% cover.



Figure 8. Aerial photograph of 2017 delineated Clark County Water Reclamation District revegetation sites.

Site Code	Growing Season	Acreage	Wetland Status ¹	Total Cover	Noxious Species Cover	Number of Species	WPI ²
CCWRD	8	21.45	non-wet	75-100%	nm	nm	nm
CCWRD	8	5.92	wet	75-100%	nm	nm	nm
TOTAL	8	27.37	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. $WPI \leq 2.0$ = 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 6. Monitoring results for the Clark County Water Reclamation District revegetation site in 2017.

3.5 Cottonwood Cells

All seven of the revegetation sites at the Cottonwood Cells were monitored in the field during the 2017 monitoring (Table 7). The 2016 monitoring report (Eckberg 2018) described the concern of encroachment of Johnsongrass on Cottonwood Cell 1 (CC1) along with the simultaneous decline in cottonwoods (*Populus fremontii*) which, as the name implies, had been the dominant plant on the site since establishment 16 years ago (Figure 9). The National Park Service Exotic Plant Management Team began regular treatment of Johnsongrass on this and other sites in 2016; that treatment continued through 2017. The 2017 monitoring results indicate that the treatment was successful; Johnsongrass declined from 50-75% cover of CC1 in 2016 to just 1-5% cover in 2017. While there was no increase in cottonwoods, they grow much slower than the invasive grass and future monitoring will show if they can recover once the invasive has been removed or if another plant will take its place.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
CC1	16	0.97	wet	50-75%	5.0%	11	2.10
CC2	13	0.53	wet	75-100%	2.5%	7	2.04
CC3	6	1.63	wet	75-100%	2.6%	23	2.47
CC3-2	5	0.40	wet	75-100%	0.1%	11	4.53
CCB	5	0.21	wet	75-100%	0.0%	4	2.02
CCN	6	4.83	non-wet	62.4%	0.3%	23	3.78
CCNS	6	1.83	non-wet	24.3%	0.3%	11	3.94

¹CC1=Cottonwood Cell 1, CC2=Cottonwood Cell 2, CC3=Cottonwood Cell 3, CC3-2=Cottonwood Cell 3-2, CCB=Cottonwood Cell 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 Cell revegetation sites in 2017.

It is expected that the construction of the Historical Lateral Weir expansion will impact all of the sites at the Cottonwood Cells. There will be substantial impact to Cottonwood Cell 3 (CC3) due to the removal of vegetation on the easternmost edge of the site (Figure 10). Parts of Cottonwood Cell North and Cottonwood Cell North Stockpiles were also removed. In addition to physical removal of areas, there is likely to be hydrological impacts to CC1, Cottonwood Cell 2, CC3, and Cottonwood Cell Bank (CCB) due to a large increase in the backwater behind the Historic Lateral Weir. This should allow for greater infiltration of groundwater to both original cottonwood cells as well as other nearby sites. It should also increase the ability for riparian and wetland plants to be established along the bank itself upstream of the Historic Lateral Weir, expanding CCB and providing a substrate for new plantings as well.



Figure 9. The cottonwoods in Cottonwood Cell 1 and Cottonwood Cell 2 are between 35 and 50 feet tall.

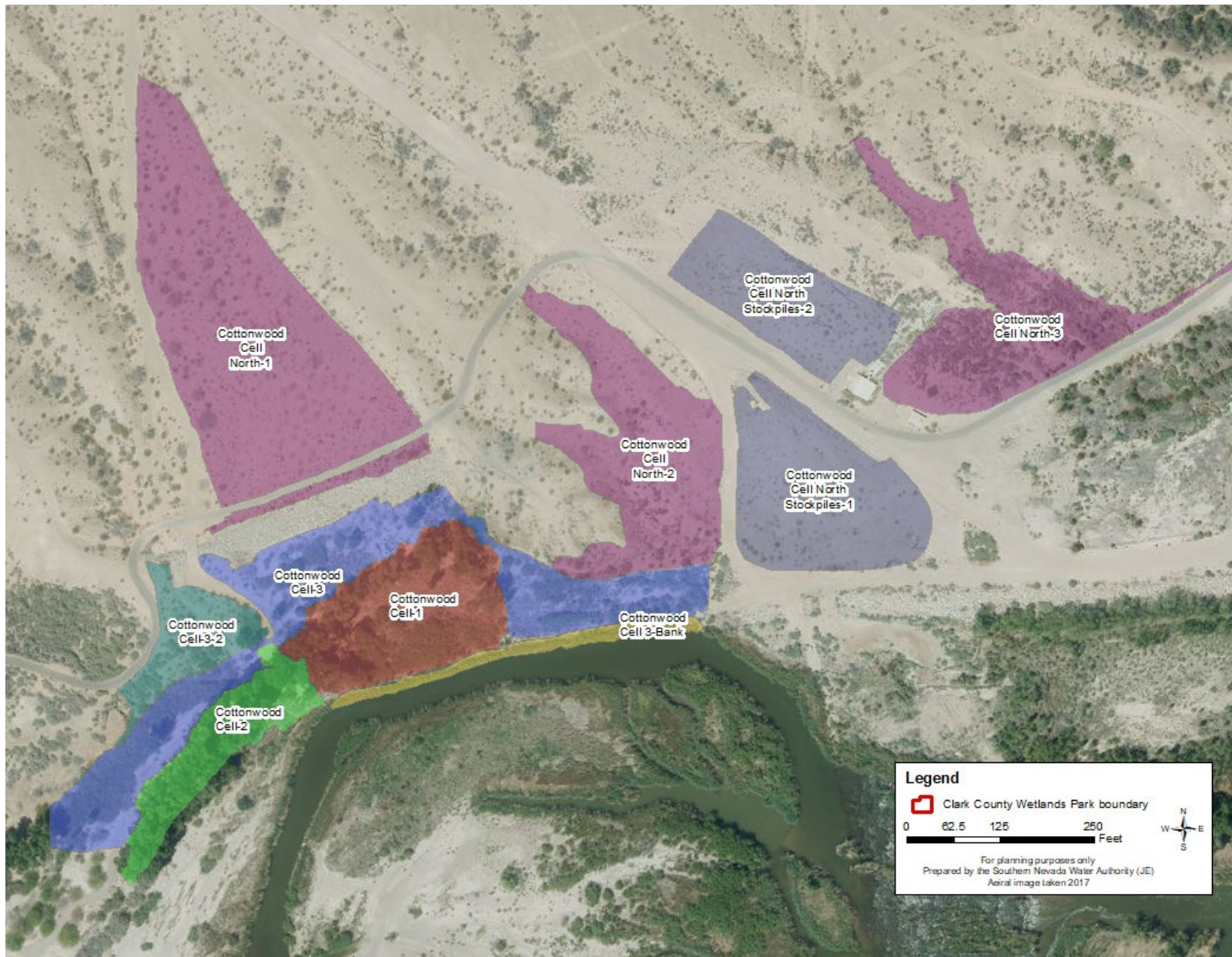


Figure 10. Aerial photograph of 2017 delineated Cottonwood Cell revegetation sites.

3.6 Demonstration Weir

The two sites at the Demonstration Weir have not changed much in terms of species richness and total cover over the past year (Table 8; Figure 11). In 2017, both sites were monitored for total cover using ArcGIS. Upstream Demonstration South – Non-Wetlands (UDS-N) has had the same total cover for the past three growing seasons; 25-50%. This is a pretty dry site on a steep bank. It should be expected that, although there was higher total cover from 2012-2014 (50-75%), the highest cover the site will sustain in the long-term will be around 50%. This is consistent with surrounding areas with similar plants. Upstream Demonstration South – Wetland went up to 75-100% again in 2017 after dipping to 50-75% in 2016. Last year’s dip was the only time since 2006 that the site didn’t have the maximum cover. This is likely due to impacts from the construction of the Three Kids Weir downstream of the sites which created a new barrier of a road and bank protection between the site and the Wash. But as water was able to slowly infiltrate through the soil, the remaining vegetation appears to have begun recovering.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
UDS	15	1.55	non-wet	25-50%	nm	nm	nm
UDS	15	0.49	wet	50-75%	nm	nm	nm

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. $WPI \leq 2.0$ = 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 8. Vegetation monitoring results for Demonstration Weir revegetation sites in 2017.

3.7 Duck Creek Confluence and Upper Narrows Weirs

The first revegetation site established at the Duck Creek Confluence and Upper Narrows Weirs was started soon after the weirs were completed in early 2013 and now has five growing seasons; Duck Creek Upper Narrows Emergent (DCUNE; Figure 12). The remaining 11 sites have been established for either three or four growing seasons. Eight of the 12 sites had the maximum 75-100% total cover in 2017 and two sites had 50-75% cover (Table 9; Figure 13). These 10 sites are considered to be doing very well with high vegetative cover, low noxious weed cover and the actively planted sites all have more species present than actually planted. The two remaining sites, Duck Creek Upper Narrows North Soil Stockpile (DCUNNS) and Duck Creek Upper Narrows South – 2 (DCUNS-2) are not performing as well as expected. DCUNNS was a former stockpile location for rock riprap. As a result, the soils are compacted and not very conducive to plant establishment. While there are some planted plants on the site and a few that established naturally, they do not grow very fast and new plants only occur where scouring broke up the soil.



Figure 11. Aerial photograph of 2017 delineated Demonstration Weir revegetation sites.

DCUNS-2 was planted along with Duck Creek Upper Narrows South Riparian (DCUNSR) during the fall 2014 Green-Up. However, DCUNSR has almost 100% coverage, DCUNS-2 has struggled. This is likely due to DCUNS-2 having soil deposited on it making it a few feet higher in elevation. This can have a substantial impact on plant establishment and survival. Site 108 to the south has very dense vegetation and similar species, and is a few feet lower in elevation. It is expected that the plants on the site will eventually reach groundwater and growth rates will speed up. Perhaps additional irrigation will be necessary and some additional planting. The construction of the Sunrise Mountain Weir to the east of this site will provide an opportunity to have additional irrigation applied with little additional expenditure as well as additional plants planted if necessary.

Duck Creek Upper Narrows – 3 (DCUNS-3) was one of the first locations that velvet ash (*Fraxinus velutina*) had been planted along the Wash in over ten years. Although previous plantings were successful, there was no recruitment despite an abundance of seeds being produced. This species is dioecious which means that both male and female trees are required for viable seed production. Like many dioecious trees, only females are commercially available.



Figure 12. Dense stands of cattails line the banks of the Wash upstream of the Duck Creek Confluence Weir.

However, due to propagation of the species at SNWA's Warm Springs Natural Area in Moapa, NV, ash trees of both sexes are available for planting. After three growing seasons, the trees are doing very well. Assuming that many are males, it may allow for the older female trees, primarily at Pabco and Historic Lateral, to have viable seeds produced as well.

Site Code ¹	Growing Season	Acreeage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DCUNE	5	5.05	wet	75-100%	0.5%	19	1.60
DCUNN	4	13.71	non-wet	50-75%	0.0%	31	4.14
DCUNNR	4	1.39	non-wet	75-100%	0.5%	11	3.99
DCUNNS	4	1.31	non-wet	0-5%	0.1%	7	4.08
DCUNS-1	4	7.86	non-wet	75-100%	2.5%	21	3.24
DCUNS-2	3	10.48	non-wet	25-50%	0.0%	18	4.10
DCUNS-3	3	9.59	non-wet	50-75%	0.5%	13	3.91
DCUNSR	3	2.91	non-wet	75-100%	0.0%	10	4.55
DCCS	3	1.04	wet	75-100%	0.0%	5	1.99
DCCW	4	2.86	wet	75-100%	nm	nm	nm
UDCCI	4	0.90	wet	75-100%	nm	nm	nm
UNW	4	2.39	wet	75-100%	nm	nm	nm

¹ DCUNE=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, 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≤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 9. Vegetation monitoring results for Duck Creek Confluence and Upper Narrows Weirs revegetation sites in 2017.

3.8 DU Wetlands No. 1 Weir

All three revegetation sites associated with the DU Wetlands No. 1 Weir had 75-100% total vegetative cover in 2017 (Table 10). All three sites were established in 2013 and therefore have had five growing seasons. DU Wetlands No. 1 Emergent (Figure 14), an actively planted wetland site, and DU Wetlands No. 1 Weir, a passively created wetland site, have both had the maximum cover of 75-100% in each of their five growing seasons. The third site, DU Wetlands No. 1 South is a non-wetland site and was planted as a Green-Up in the spring of 2013 (Figure 15). This site has gone back and forth between 50-75% total cover and 75-100% total cover. It had the higher cover in its second growing season and again this year in its fifth. The second growing season can be attributed to the ongoing irrigation causing many new plants to establish on the site. The subsequent two years had a decline to 50-75% cover as a result of no longer irrigating the site. This most recent year's uptick in cover is likely due to continued growth of the planted plants. The site is much more even in terms of plant species coverage than most with six of the 13 species having 5-25% cover but none higher than that.

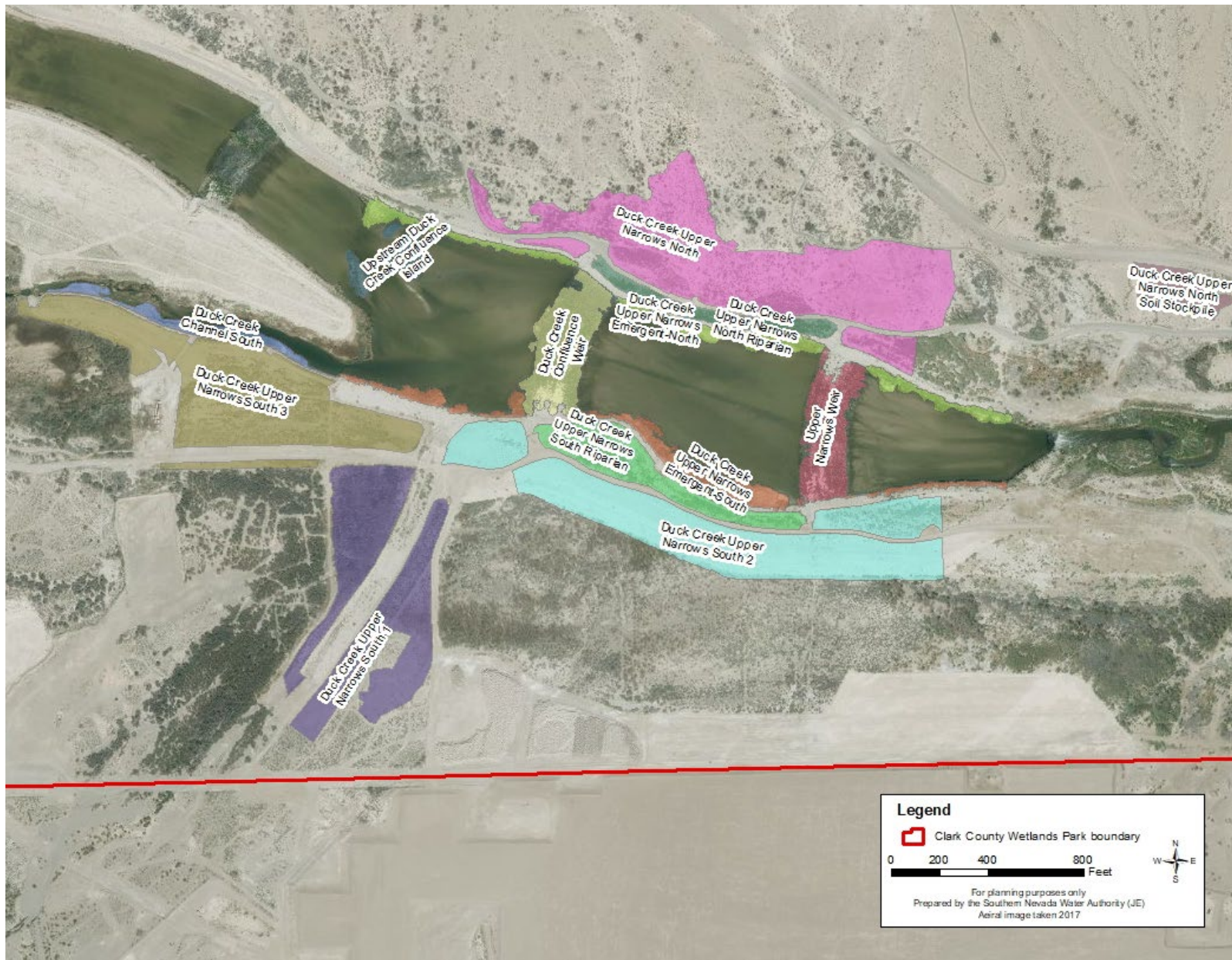


Figure 13. Aerial photograph of 2017 delineated Duck Creek Confluence and Upper Narrows Weirs revegetation sites.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DU1E	5	2.25	wet	75-100%	1.4%	33	1.88
DU1S	5	7.84	non-wet	75-100%	2.6%	13	3.60
DU1W	5	0.53	wet	75-100%	nm	nm	nm

¹ DU1S=DU Wetlands No. 1 South, DU1E=DU Wetlands No. 1 Emergent, 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 2017.



Figure 14. Thirty-three species were identified at the DU Wetlands No. 1 Emergent revegetation site.

3.9 DU Wetlands No. 2 Weir

All four of the revegetation sites at the DU Wetlands No. 2 Weir had the maximum total cover for vegetation in 2017, 75-100% (Table 11; Figure 16). This is despite a substantial decline in acreage for all sites except for the passive wetlands established on the weir itself. The construction

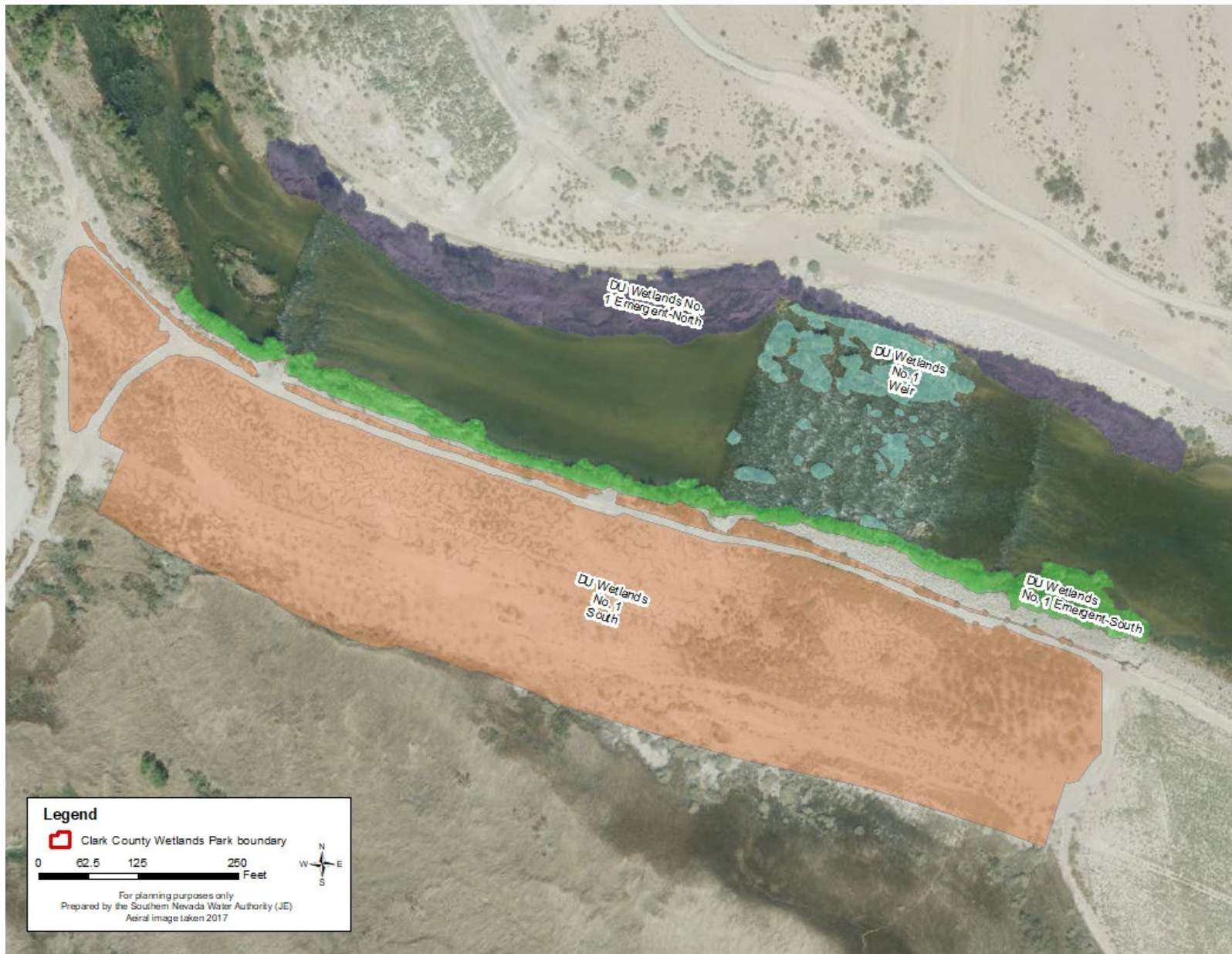


Figure 15. Aerial photograph of 2017 delineated DU Wetlands No. 1 Weir revegetation sites.

of the Tropicana Weir to the north of the DU Wetlands No. 2 Weir required the removal of the northern portion of the three remaining sites. Aerial imagery (Figure 16) shows the diversion channel for the Tropicana Weir project routing Wash flows around the construction area and back into the Wash just upstream of the DU Wetlands No. 2 Weir.

DU Wetlands No. 2 Emergent (DU2E) was reduced from 3.38 acres to 2.18 acres. The dominant species remained Goodding’s willow (*Salix gooddingii*) which increased in cover from 37.5% in 2016 to 48.4% in 2017. It appears that the most substantial loss in terms of plants was southern cattail (*Typha domingensis*) which decreased from 17.8% to 9.5% and sandbar willow (*Salix exigua*) which decreased from 15.0% to 2.5%. The acres lost will likely be restored with the completion of the Tropicana Weir. The main concern is disturbance typically results in invasive weeds and other non-desirable species taking the place of the native species removed. Here at DU2E, common reed increased in cover from 2.5% to 9.5%. Much of this increase was at the northern end of the site where the disturbance took place.

The two non-wetland sites at DU Wetlands No. 2 Weir also decreased in size. DU Wetlands No. 2 South (DU2S; Figure 17) decreased from 4.91 acres in 2016 to 1.53 acres. DU2S also had just 50-75% total cover in 2016. So, some of the acreage removed included areas with less plant cover on it than the rest of the site. The two dominant plants on the site were honey mesquite, a native tree, and bassia (*Bassia hyssopifolia*), a non-native forb that is very aggressive. Both of these species had 25-50% cover in 2017. Bassia had just 5-25% cover in 2016. It is unclear if bassia actually spread on the site or if just the proportion changed due to removal of some of the acreage. DU Wetlands No. 2 North (DU2N) was reduced from 5.03 acres in 2016 to 2.87 acres in 2017. However, there was little change in plant covers and relative dominance of plants.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DU2E	8	2.18	wet	75-100%	1.6%	14	1.94
DU2N	8	2.87	non-wet	75-100%	0.1%	16	3.88
DU2S	8	1.53	non-wet	75-100%	2.5%	14	3.92
DU2W	8	0.69	wet	75-100%	nm	nm	nm

¹DU2N=DU Wetlands No. 2 North, DU2S=DU Wetlands No. 2 South, DU2E=DU Wetlands No. 2 Emergent, 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≤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 11. Vegetation monitoring results for DU Wetlands No. 2 Weir revegetation sites in 2017.

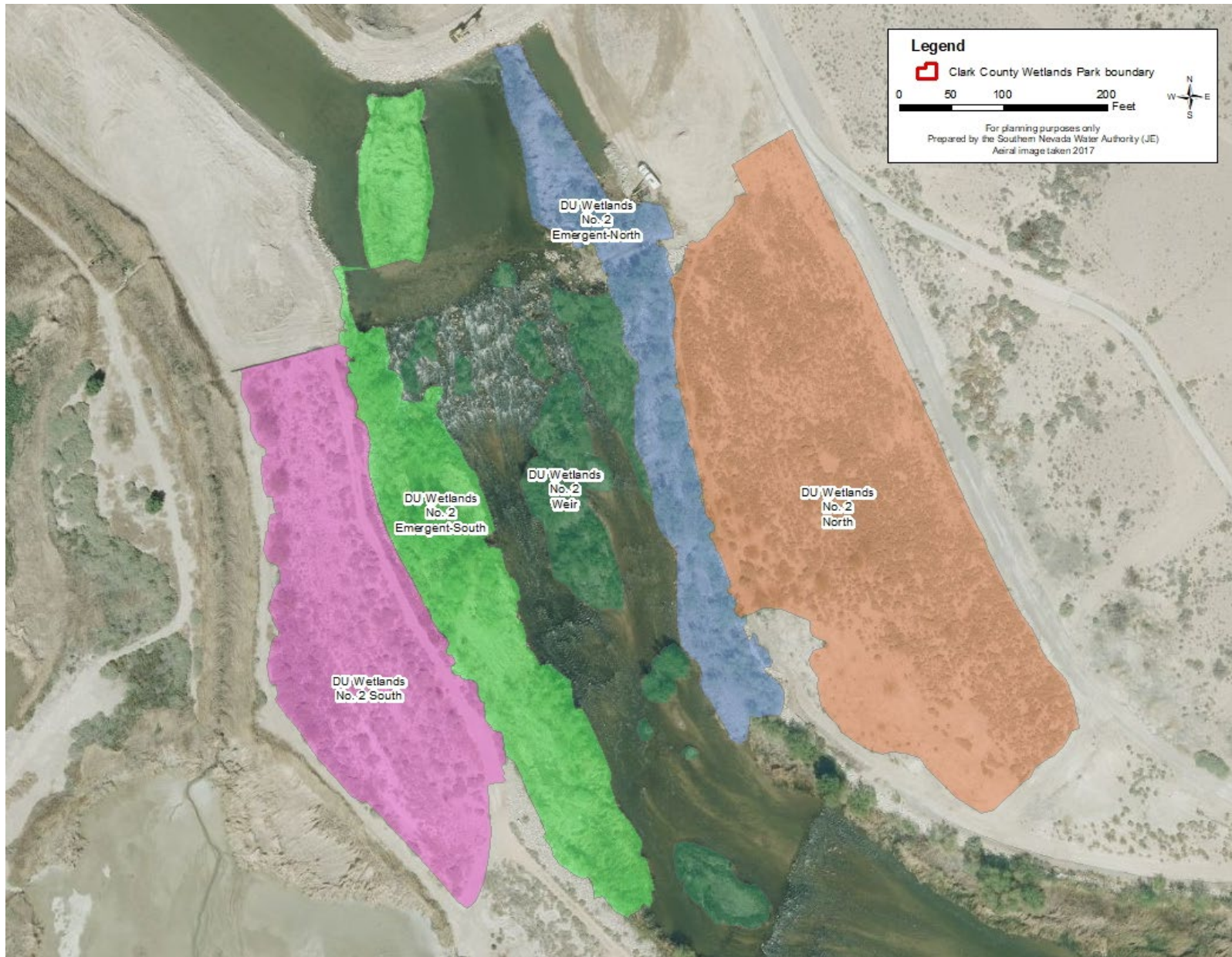


Figure 16. Aerial photograph of 2017 delineated DU Wetlands No. 2 Weir revegetation sites.



Figure 17. DU Wetlands No. 2 South had a diverse mix of vegetation types in 2017.

3.10 Historic Lateral Weir

Eight of the 11 Historic Lateral Weir revegetation sites were monitored in the field in 2017 (Figure 18; Table 12). Some of these sites would not normally be monitored in the field following the set protocol but due to the commencement of construction of the Historic Lateral Weir expansion, it was decided to get more pre-construction information. The expansion of the Historic Lateral Weir is being done to ensure its stability for many more years. The project will substantially increase the size of the weir and as a result much of the area surrounding the project must be removed including prior revegetation sites, both actively and passively created. Three sites will be completely removed; Upstream Historic Lateral Passive Wetland (UHLPW), Historic Lateral Weir (HLW) and Upstream Historic Lateral South (UHLS). Downstream Historic Lateral Passive Wetland (DHLPW) will have the majority of the site removed. Finally, Upstream Historic Lateral South Upper Plateau (UHLSUP), Upstream Historic Lateral Upper Plateau 2 (UHLSUP2), Upstream Historic Lateral South Bank-Wetland (UHLSB-W) and -non-wetland (UHLSB-N) will have large portions removed on the northern ends of the sites (Figure 19). In terms of additional areas to plant, salt cedar will be removed to the northeast of the weir and there will be additional

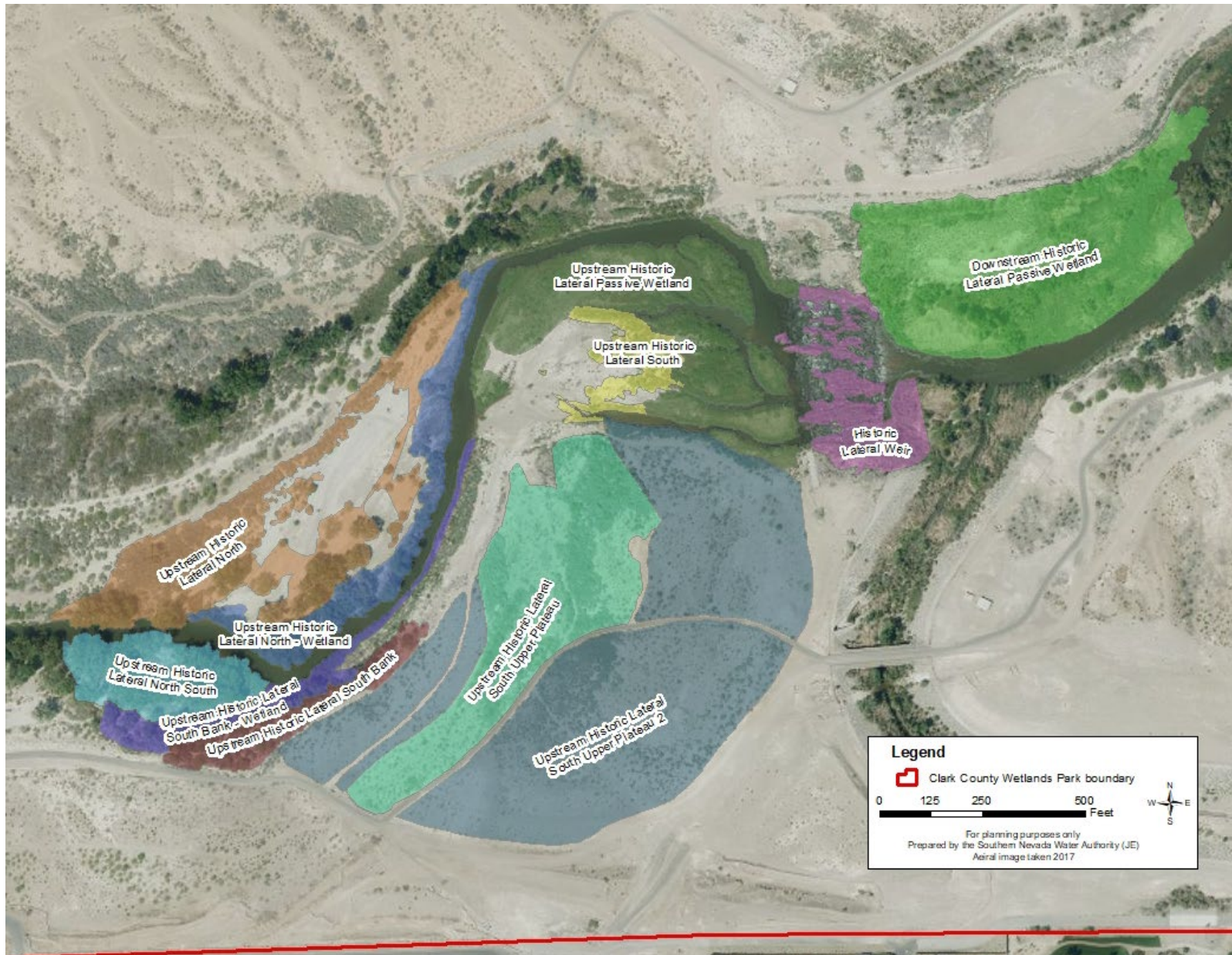


Figure 18. Aerial photograph of 2017 delineated Historic Lateral Weir revegetation sites.

banks which will support riparian vegetation. This project will also incorporate large ditches on the back side of the bank protection, which will allow for riparian vegetation to be established on both sides rather than just the Wash side, as in most other areas.

The backwater behind the Historic Lateral Weir will be much larger once the expansion project is completed. This should alter the hydrology of surrounding revegetation sites both upstream of the weir as well as the Cottonwood Cells and perhaps even sites downstream from the Pabco Road Weir and Site 111.

Seven of the eight sites monitored in the field in 2017 had the same cover as in 2016. The only exception was UHLSUP2 which increased from 50.7% to 58.8%. This is the seventh year of monitoring on the site. For six of the seven years, the total cover has been within the 50 to 62.5% cover range. In its third growing season (2013), the cover spiked to 83.9%. This was mainly due to high cover from fourwing saltbush (*Atriplex canescens* var. *canescens*) on all three of the monitoring areas that make up this site. Cover of this species dropped the following year on two of the three areas from 50-75% in 2013 to just 1-5% in 2014 on one of the monitoring areas. In 2017, that same monitoring area had fourwing saltbush at 5-25% cover and the species covered 40.1% of the total site, making it by far the most dominant species.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DHLPW	17	6.66	wet	75-100%	nm	nm	nm
HLW	17	1.68	wet	75-100%	nm	nm	nm
UHLN	17	4.54	non-wet	75-100%	3.1%	21	2.74
UHLN	17	1.93	wet	75-100%	3.1%	21	2.05
UHLNS	17	1.73	wet	75-100%	2.6%	11	2.05
UHLPW	17	4.49	wet	75-100%	nm	nm	nm
UHLS	17	0.88	wet	50-75%	2.6%	28	2.46
UHLSB	17	1.12	non-wet	75-100%	0.5%	14	3.46
UHLSB	17	1.16	wet	75-100%	2.5%	9	2.06
UHLSUP	10	5.17	non-wet	75-100%	2.5%	15	4.58
UHLSUP2	7	12.42	non-wet	58.8%	1.0%	16	4.60

¹DHLPW=Downstream Historic Lateral Passive Wetlands, HLW=Historic Lateral Weir, UHLN=Upstream Historic Lateral North, UHLNS=Upstream Historic Lateral North South, UHLPW=Upstream Historic Lateral Passive Wetlands, UHLS=Upstream Historic Lateral South, UHLSB=Upstream Historic Lateral South Bank, UHLSS=Upstream Historic Lateral South Stockpile, 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≤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 12. Vegetation monitoring results for Historic Lateral Weir revegetation sites in 2017.



Figure 19. Upstream Historic Lateral South Bank non-wetland (center) and Upstream Historic Lateral South Bank wetland (left) will be impacted by the Historic Lateral Weir expansion project.

3.11 Lower Narrows and Homestead Weirs

All but one of the seven sites at the Lower Narrows and Homestead Weirs were in their sixth growing season in 2017 (Figure 20; Table 13). Lower Narrows Homestead South 2 (LNHS2) was in its fifth growing season. A new site was added to monitoring in 2017, Lower Narrows Homestead South 3. This site was hydroseeded along with the other upland sites but not planted with contained plants. Lower Narrows Homestead North was monitored in the field in 2017. This is one of the largest revegetation sites along the Wash and the largest at Lower Narrows and Homestead. It is the only upland site on the north side of the Wash at Lower Narrows and Homestead and was primarily restored with hydroseeding at the completion of the construction of the two weirs. The field monitoring resulted in 50-75% total cover, up from 25-50% in the prior year when ArcGIS was used to calculate the cover, but down from 2015, the last time field monitoring was done. Being at the base of hills and small mountains to the north and at the end of the drainages from them, this site is subject to the influence of rainfall more so than most upland sites along the Wash. This could result in the high rate of change year to year in plant cover and species composition. The dominant plant on this site throughout all the years it has been monitored is desert saltbush.

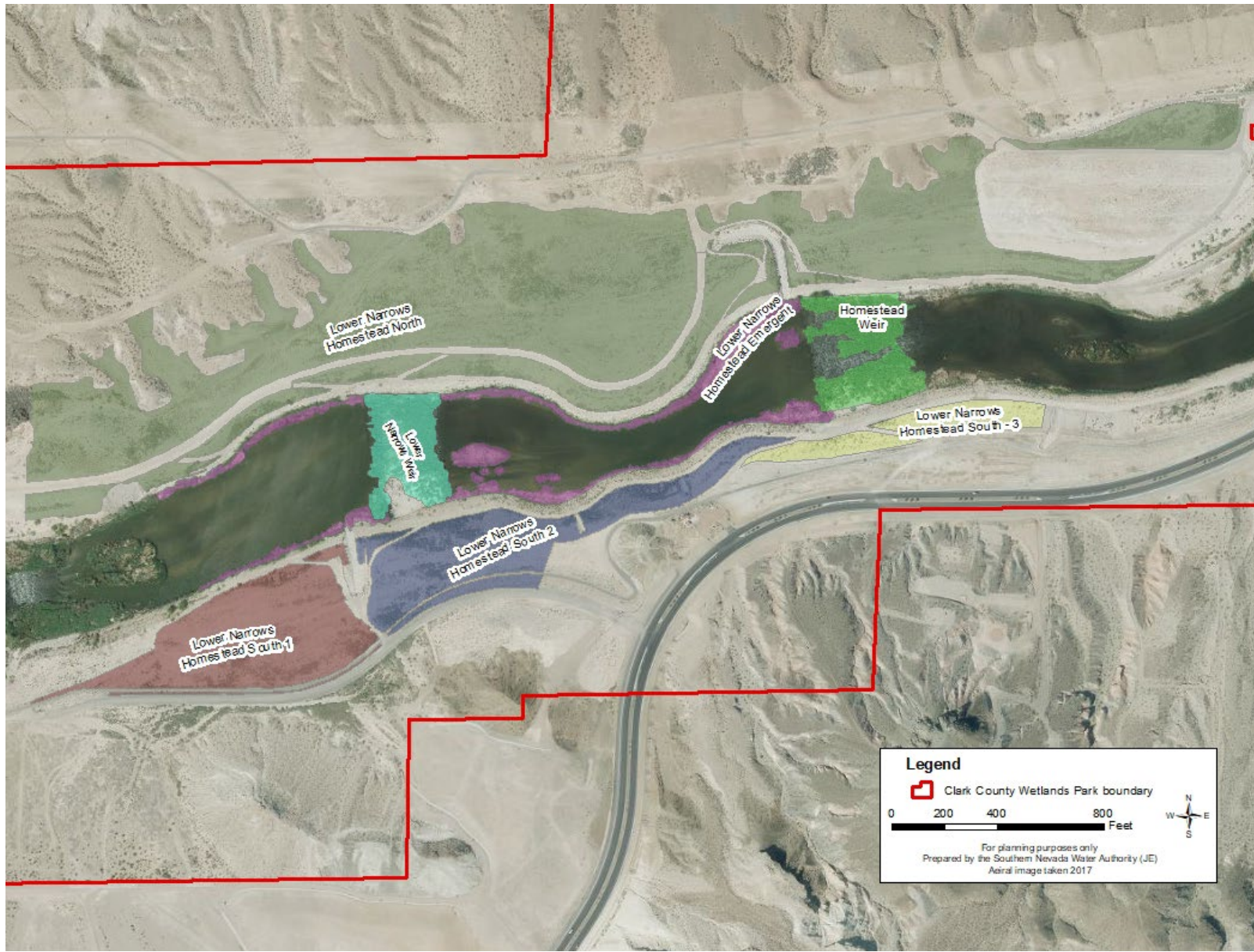


Figure 20. Aerial photograph of 2017 delineated Lower Narrows and Homestead Weirs revegetation sites.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
HW	6	2.99	wet	75-100%	nm	nm	nm
LNW	6	2.48	wet	75-100%	nm	nm	nm
LNHE	6	4.36	wet	75-100%	nm	nm	nm
LNHN	6	40.68	non-wet	50-75%	0.1%	12	3.94
LNHS1	6	7.36	non-wet	25-50%	nm	nm	nm
LNHS2	5	6.58	non-wet	50-75%	nm	nm	nm
LNHS3	6	2.21	non-wet	25-50%	nm	nm	nm

¹HW=Homestead Weir, LNW=Lower Narrows Weir, LNHB-S=Lower Narrows Homestead Bank South, LNHB-N=Lower Homestead Bank North, 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≤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 Lower Narrows and Homestead Weirs revegetation sites in 2017.

3.12 Monson and Visitor Center Weirs

All four of the revegetation sites at the Monson and Visitor Center Weirs had the maximum 75-100% total cover in 2017 (Table 14; Figure 21). The two Downstream Monson North sites were monitored in the field in 2017 while the two Downstream Monson South sites were monitored for total cover using ArcGIS. Downstream Monson North-non-wetland had six species identified on it with quailbush being the dominant species. The total cover has been 75-100% for the past eight growing seasons and quailbush has been the dominant species since 2006. Downstream Monson North-Wetland had eight species identified on it with Goodding's willow being the dominant species. This site has had the maximum total cover every year since monitoring began. However, in 2012 the dominant species were salt cedar and southern cattail. Through aggressive weed control and growth of the Goodding's willow, native species now dominate the site.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DMN	15	3.85	non-wet	75-100%	0.5%	6	3.40
DMN	15	1.21	wet	75-100%	15.0%	8	2.27
DMS	15	2.99	non-wet	75-100%	nm	nm	nm
DMS	15	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 14. Vegetation monitoring results for Monson and Visitor Center Weirs revegetation sites in 2017.

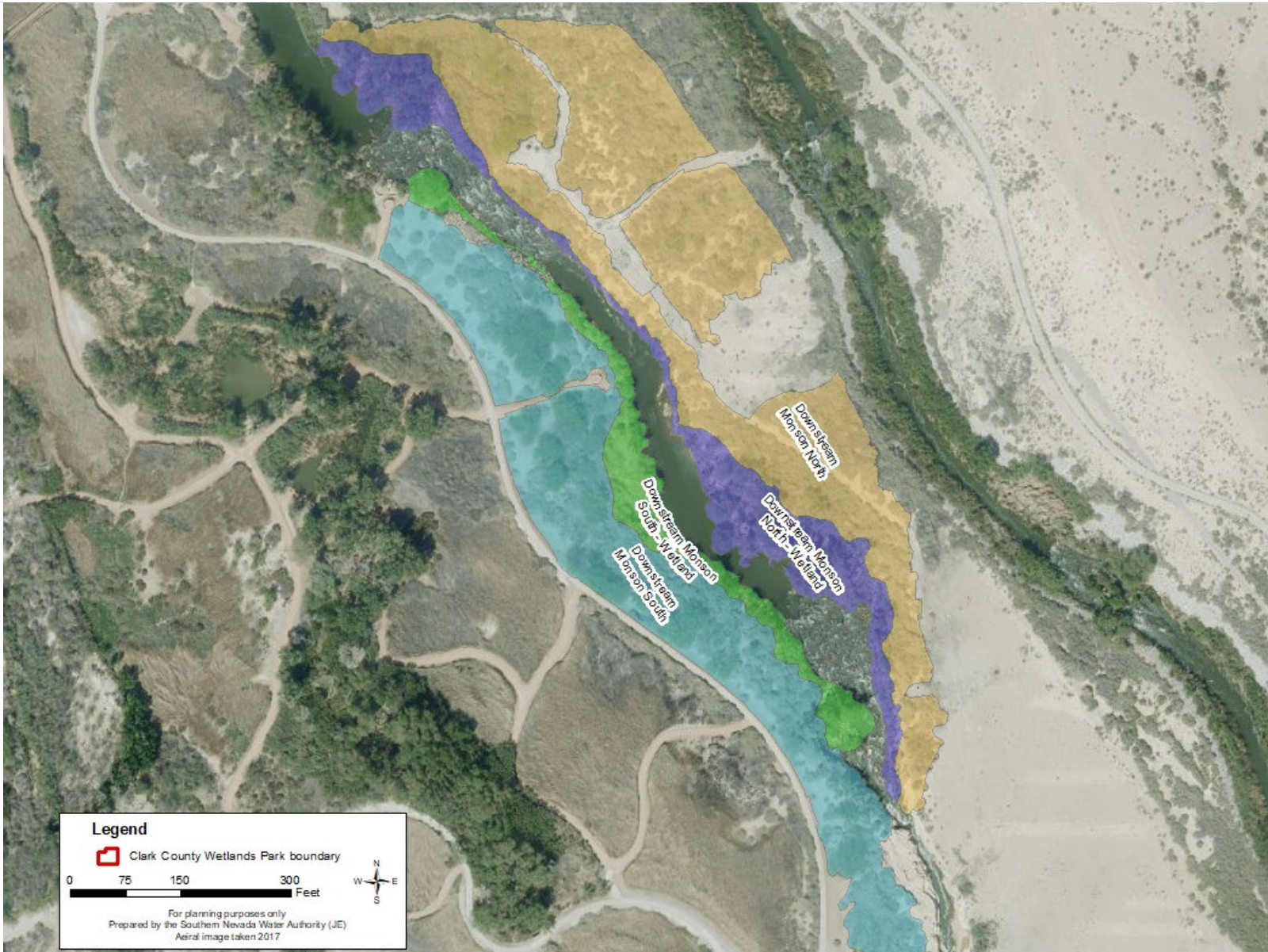


Figure 21. Aerial photograph of 2017 delineated Monson and Visitor Center Weirs revegetation sites.

3.13 Pabco Road Weir

Eight of the 14 revegetation sites associated with the Pabco Road Weir were monitored in the field in 2017 (Table 15). The remaining six had their total cover monitored using ArcGIS. The vegetation at most of the sites at the Pabco Weir is very old and includes vegetation planted at the first Green-Up event in 2001 (Figures 22 and 23). Vegetation along the banks continues to have minor changes as a result of scouring and sedimentation but the majority of the sites, especially on the interior, have not had much change in many years.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DPI	17	1.11	wet	75-100%	nm	nm	nm
DPN	9	9.42	non-wet	75-100%	nm	nm	nm
DPNB	6	0.80	wet	75-100%	1.0%	19	3.25
DPS	17	4.25	wet	75-100%	1.3%	32	2.16
DPSUB	7	0.89	non-wet	5-25%	nm	nm	nm
DPSUP	7	9.86	non-wet	50-75%	1.8%	25	4.09
PN	17	3.34	non-wet	50-75%	nm	nm	nm
PN	17	0.84	wet	75-100%	nm	nm	nm
PS	17	1.20	non-wet	75-100%	0.0%	13	4.09
PS	17	0.39	wet	75-100%	2.5%	16	2.12
UPI	17	0.29	wet	75-100%	nm	nm	nm
UPN	12	2.70	wet	75-100%	3.0%	24	2.28
UPS*	16	4.36	wet	75-100%	14.0%	28	2.38
UPSUP	16	2.18	non-wet	75-100%	2.5%	11	3.18

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, 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

* UPS includes Upstream Pabco South Lower Plateau

nm = this attribute was not monitored

Table 15. Vegetation monitoring results for Pabco Road Weir revegetation sites in 2017.

One of the oldest sites is Downstream Pabco South (DPS) which was primarily planted as part of the first Green-Up event in 2001. For the past ten growing seasons, the site has been dominated by Fremont's cottonwood. In 2017, this riparian tree covered 50-75% of the site despite it being a very diverse site with 32 species documented. All of the other 31 species had less than 5% total cover, with the majority of the species having 0.1% cover. There are two items of concern with this site. First, there appears to be a large infestation of black rats (*Rattus rattus*). This is observable by the high levels of fecal droppings across the ground of the site. Some have been observed during early morning bird surveys. These rodents are known to cause ecological damage by eating bird

eggs as well as competing with other species for resources. Second, there has been a decline in the cover of Goodding's willow on the site. The last two years that DPS was monitored in the field, this tree had 25-50% cover, which has declined to just 1-5% cover in 2017. Future monitoring will determine if this was a one-year incident or a trend.



Figure 22. Mature vegetation covers the majority of the Pabco North non-wetland site.

Planted in 2002, Upstream Pabco South (UPS) is also one of the oldest revegetation sites along the Wash at 16 growing seasons old in 2017. Most of UPS has had impacts from maintenance activities related to the erosion control program after being established. The eastern edge of the site connects to the Pabco Road Weir itself and as vegetation expands into the Wash channel it alters the flow and must be controlled. The only way to get to that vegetation is to remove the inland portion as well. The lower plateau area had its woody vegetation removed in 2015 in preparation for the Sunrise Mountain Weir construction anticipated to be completed in 2018. This reduced the cover of Goodding's willow and Fremont's cottonwood, but the site as a whole is still a functioning riparian/wetland area. The total cover has been 75-100% since 2014 despite the vegetation removal. There were 28 species documented in 2017, compared to 24 in 2015 before the clearing, and 35 a year after the clearing. The removal of the trees opened up space for additional species of shrubs and forbs to establish on the site. The codominant species on the site were sandbar willow and common reed. Sandbar willow still dominates areas not in the lower plateau and common reed is found in all areas but was the most successful in filling the space left by the trees being removed.

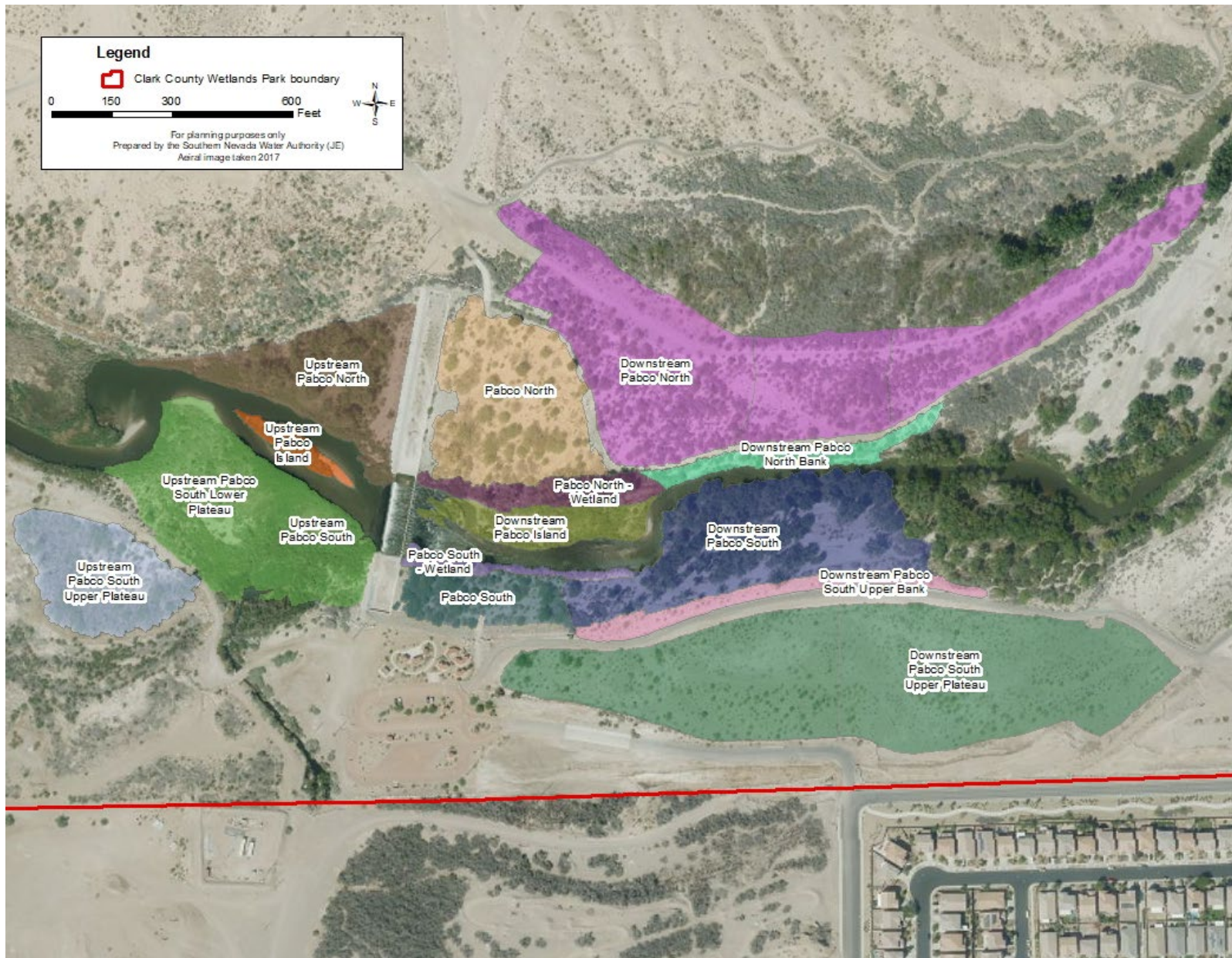


Figure 23. Aerial photograph of 2017 delineated Pabco Road Weir revegetation sites.

3.14 Powerline Crossing Weir

All but two of the Powerline Crossing Weir revegetation sites were monitored in the field in 2017 (Table 16; Figure 24). Powerline Weir 2 (PW2) was not monitored since it is the vegetation that passively established on the weir itself and is too dangerous for field personnel to access. This is PW2's first growing season (Figure 25). There was a previous revegetation site named Powerline Crossing Weir (PCW), which was the vegetation on the weir. However, all of the vegetation was removed in 2016. Since the entire site was removed, it was decided to create a new name for the new passive vegetation (PW2) to be clear that the site is new in terms of any vegetation established there.

Site Code ¹	Growing Season	Acreage	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
DPLNB	11	0.31	wet	75-100%	37.5%	7	2.29
DPLSB	11	0.25	wet	75-100%	15.0%	5	2.26
PLSB	11	0.57	non-wet	50-75%	0.0%	4	2.55
PLW2	1	0.03	wet	75-100%	nm	nm	nm
UPLNB	11	0.64	non-wet	5-25%	nm	nm	nm
UPLNE	11	1.10	wet	75-100%	2.5%	10	2.29
UPLNP	11	4.09	non-wet	50-75%	0.0%	10	3.54
UPLNW	11	0.35	wet	75-100%	0.5%	7	2.03
UPLSB	11	0.87	wet	75-100%	2.5%	10	2.04
UPLSP	11	5.67	non-wet	59.7%	0.2%	10	4.67

¹DPLNB=Downstream Powerline North Bank, DPLSB=Downstream Powerline South Bank, PCW=Powerline Crossing Weir, PLSB=Powerline South Bank, PLW2=Powerline Weir 2, 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. $WPI \leq 2.0$ = 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 Powerline Crossing Weir revegetation sites in 2017.

There are two revegetation sites located downstream of the weir; Downstream Powerline North Bank (DPLNB) and Downstream Powerline South Bank (DPLSB). Both of these sites have had the maximum total cover value for the past four growing seasons of 75-100%. They also are the only two sites with more than 5% cover coming from noxious weeds. These two areas are very difficult to access, especially with tools and equipment necessary for removal. In addition, these two sites are at the lower end of the CCWP boundary. On the outside of the boundary are lands owned by the City of Los Angeles that are dominated by salt cedar, the same species that makes up all of the noxious weed cover on both sites. It is unlikely these trees will be removed in the near future and therefore will remain an issue for these sites and adjacent ones.

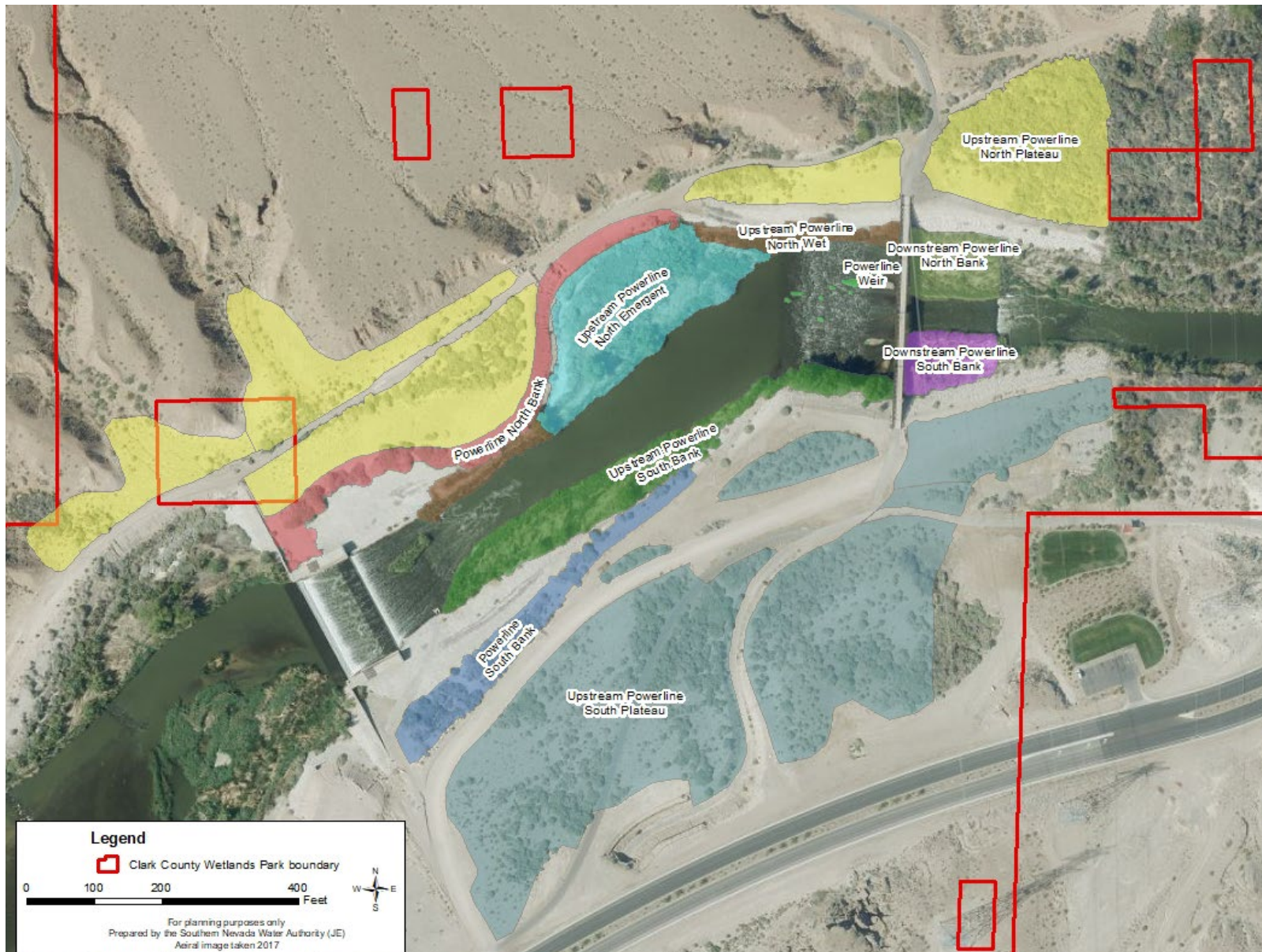


Figure 24. Aerial photograph of 2017 delineated Powerline Crossing Weir revegetation sites.



Figure 25. New vegetation established on the Powerline Crossing Weir in 2017 after being cleared in 2016.

3.15 Rainbow Gardens Weir

Only two of the eight revegetation sites associated with the Rainbow Gardens Weir were monitored in the field in 2017 (Figure 26; Table 17). Upstream Rainbow North Bank (URNB) is an upland site that was hydroseeded in 2010. The bank that it is located on is a very steep bank, and as a result, erosion has taken place regularly and plants have had difficulty establishing there and growing. The dominant plant on the site is quailbush, which was not one of the species planted but does very well in establishing on non-wetland sites. The second site monitored in the field in 2017 was Upstream Rainbow South Bank 2 (URSB2). This site is in its tenth growing season but this is only the second time it was monitored. Most passively created sites are not field monitored, but with the removal of most of Rainbow Islands and the installation of the Three Kids Weir upstream, it was decided that a detailed look would be advised to know of any noxious weeds that might spread from there. As suspected, 50-75% of the site is covered by salt cedar. It is recommended that treatment take place as soon as possible to reduce spread to nearby restoration areas.

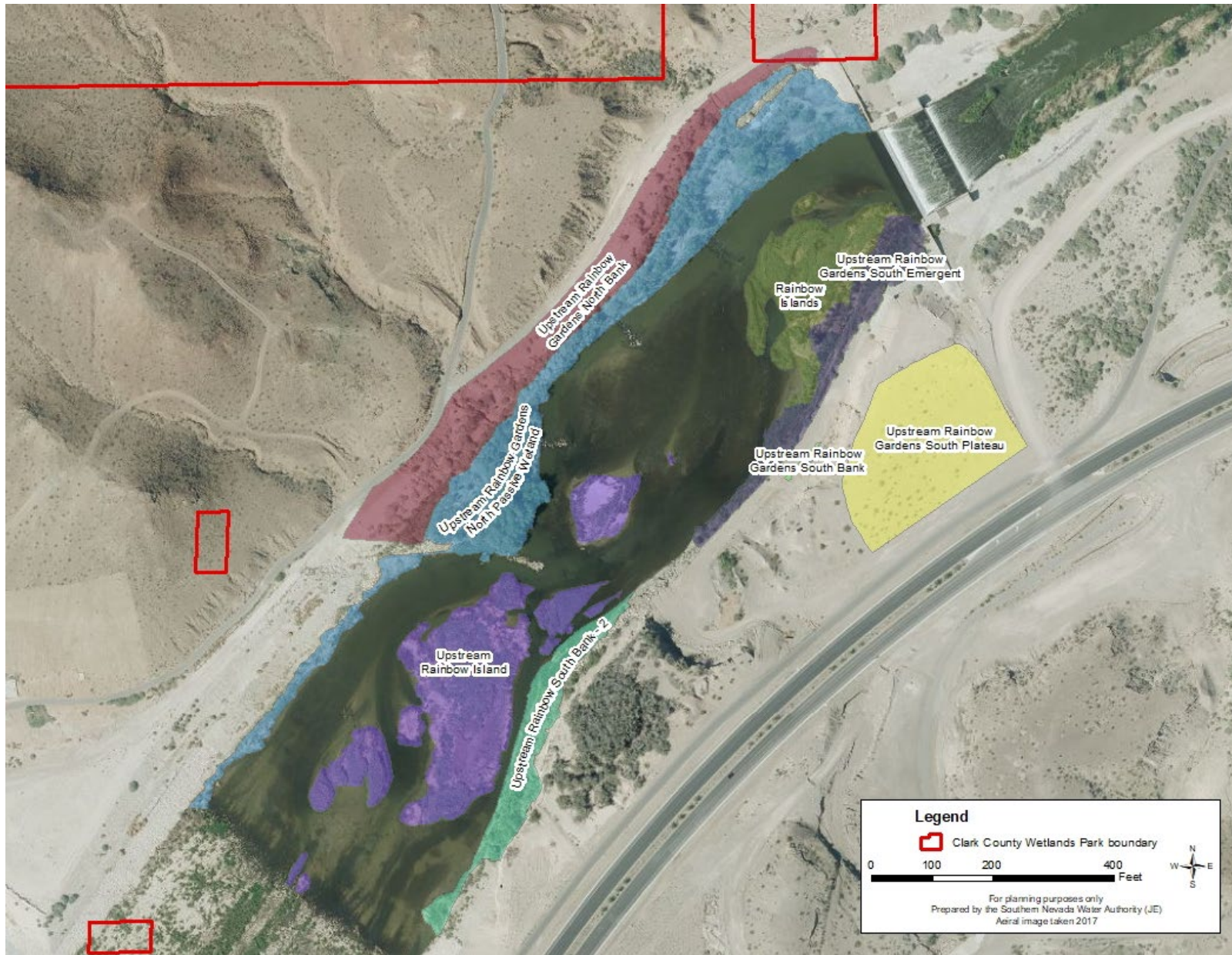


Figure 26. Aerial photograph of 2017 delineated Rainbow Gardens Weir revegetation sites.

Site Code ¹	Growing Season	Acreege	Wetland Status ²	Total Cover	Noxious Species Cover	Number of Species	WPI ³
RI	13	0.87	wet	75-100%	nm	nm	nm
URI	13	1.94	wet	75-100%	nm	nm	nm
URNB	8	1.58	non-wet	5-25%	0.5%	6	3.17
URNPW	13	2.29	wet	75-100%	nm	nm	nm
URSB1	12	0.02	non-wet	50-75%	nm	nm	nm
URSB2	10	0.57	non-wet	75-100%	62.5%	4	2.49
URSE	13	0.66	wet	75-100%	nm	nm	nm
URSP	12	1.39	non-wet	5-25%	nm	nm	nm

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≤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 Rainbow Gardens Weir revegetation sites in 2017.

3.16 Site 108

All of Site 108 was monitored for total cover using ArcGIS in 2017 after 55 monitoring areas were monitored in the field in 2016 (Table 18; Figure 27). Site 108 is the largest revegetation site along the Wash with portions being planted in the spring of 2006 with additional areas planted in the following fall. Sixty-one monitoring areas had their vegetation delineated using ArcGIS to get the total cover of the site as a whole, as well as of into the four separate areas based on their funding source. The total cover of the site increased to 71.8% in 2017 up from 58.1% in 2016 and 64.0% in 2015 when it was also monitored using ArcGIS. This makes 2017 the highest cover ever on the site and while it follows a general increasing trend, 2018 field monitoring will confirm if this is indeed a trend or an outlier year.

Funding Areas	Growing Season ³	Acreege	Wetland Status ¹	Total Cover	Noxious Species Cover	Number of Species	WPI ²
NDEP	11	5.72	non-wet	49.6%	nm	nm	nm
NDSP	11	13.13	non-wet	69.5%	nm	nm	nm
SNPLMA IV	11	10.21	non-wet	67.0%	nm	nm	nm
SNPLMA V	11	26.77	non-wet	45.8%	nm	nm	nm
TOTAL	11	55.83	non-wet	71.8%	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

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 18. Vegetation monitoring results for Site 108 revegetation site in 2017.

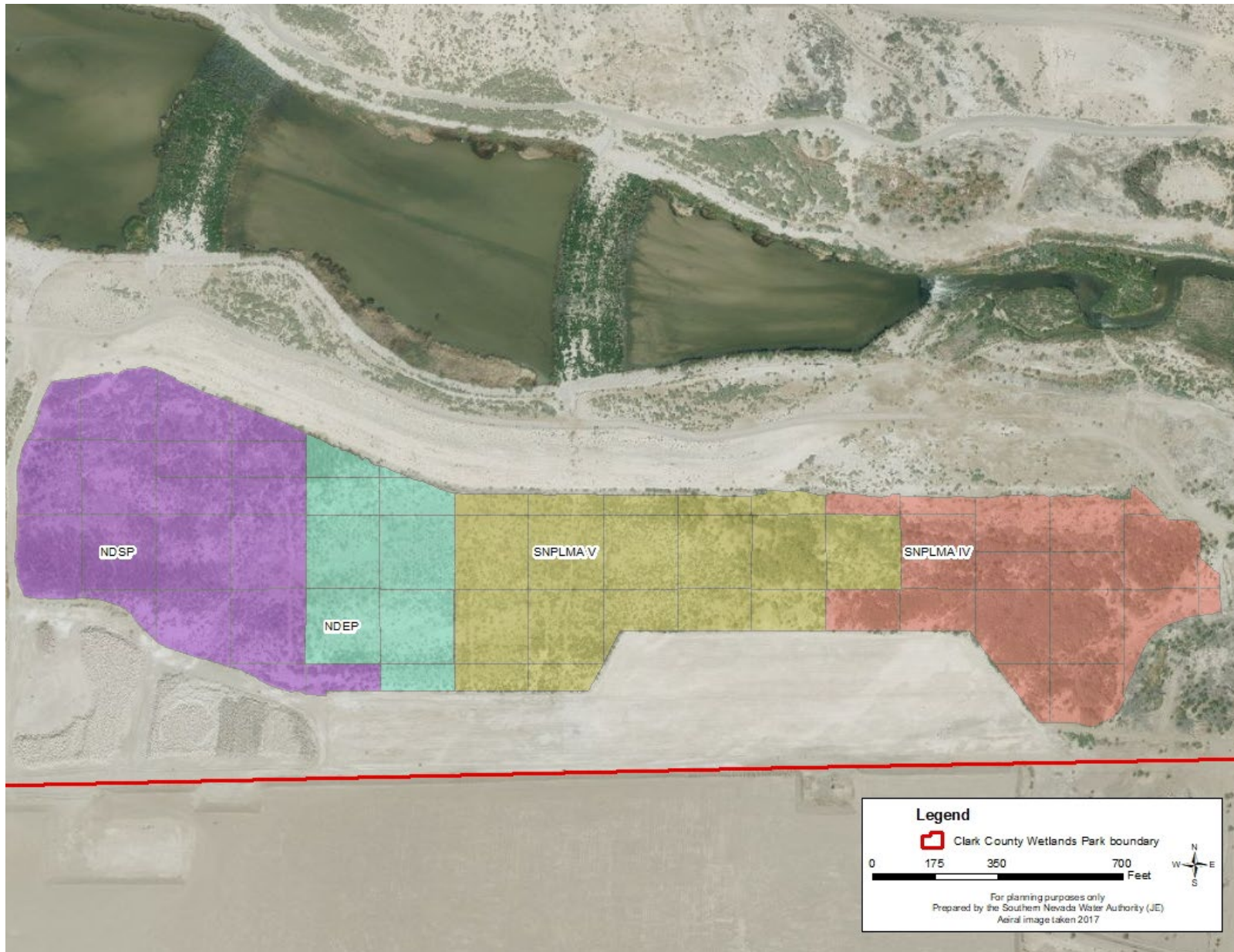


Figure 27. Aerial photograph of Site 108 with 2017 delineations based on funding source.

3.17 Site 111

Site 111 is one of the larger revegetation sites along the Wash, measuring just under 15 acres (Table 19; Figure 28). This site had its 26 monitoring areas monitored for total cover using ArcGIS in 2017 with no field monitoring taking place. The total cover for the site as a whole was 82%, which was second only to the 2012 total cover of 86.9%. This is up from 2016 when the total was 78.9%. There have not been many substantive changes to the site in many years since 2012-2013 when the CCWP trail cut through parts of the northern portion. But the majority of the site has had little to no disturbance allowing natural growth of the plants to occur.

Site Code	Growing Season	Acreage	Wetland Status	Total Cover	Noxious Species Cover	Number of Species	WPI ²
S111	11	14.93	non-wet	82.0%	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 19. Vegetation monitoring results for Site 111 revegetation site in 2017.

3.18 Three Kids Weir

There were eight revegetation sites at the Three Kids Weir in 2017 up from four sites in 2016 (Figure 29; Table 20). One of the new sites was the last Green-Up site planted prior to the 2017 monitoring; Upstream Three Kids South (U3KS; Figure 30). This site is the only upland site associated with this weir on the south side of the Wash. It is very high up off the water table and is adjacent to Galleria Road which can be seen to the south of the site in Figure 29. The 2017 monitoring took place about six months after planting this site. Survivorship monitoring was conducted on container plants with a total of 87% of container plants surviving through the summer months.

The Lower Narrows Homestead Bank – North (LNHB-N) and Lower Narrows Homestead Bank – South (LNHB-S) sites are associated with the Three Kids Weir. This is due to the vegetation planted on these sites is on sediment from the Three Kids Weir construction that was deposited on the bank protection that was previously installed at the Lower Narrows and Homestead Weir project. This unique concept will be replicated in future projects as it has shown to be very successful. First, the cost of removal of soil from the construction site is very high and reuse onsite improves the economics of the project. Second, because the bank protection is adjacent to the Wash itself, it allows for riparian plantings beyond the narrow bank line which is where the majority of the riparian trees are currently located. Both of these sites had 50-75% total cover in 2017. LNHB-N was dominated by alkali sacaton, a grass that thrives in soils that get a regular amount of water. LNHB-S was dominated by fourwing saltbush, which was hydroseeded on the site, with the second most dominant plants being seep willow and sandbar willow.

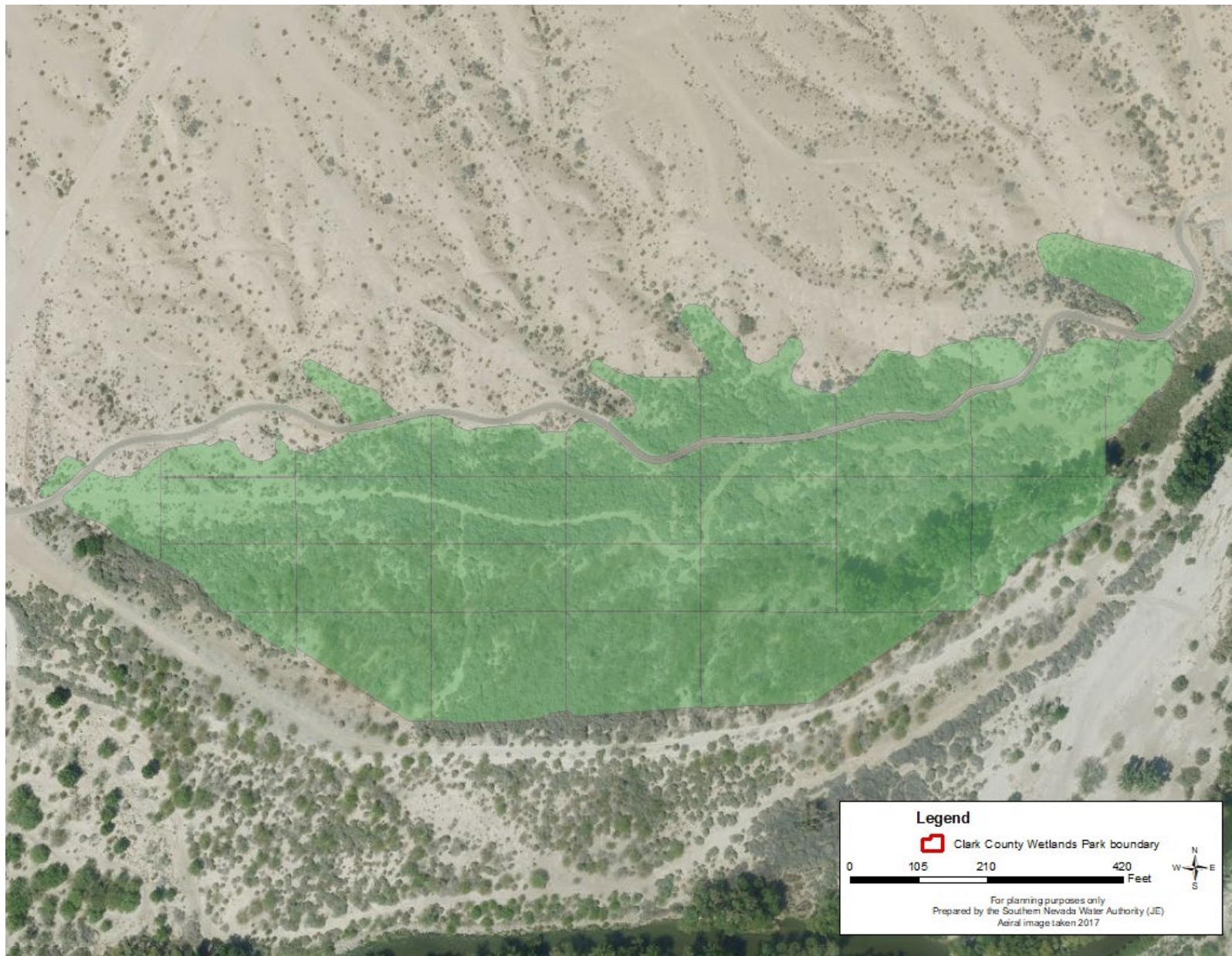


Figure 28. Aerial photograph of the 2017 delineated Site 111 revegetation site.

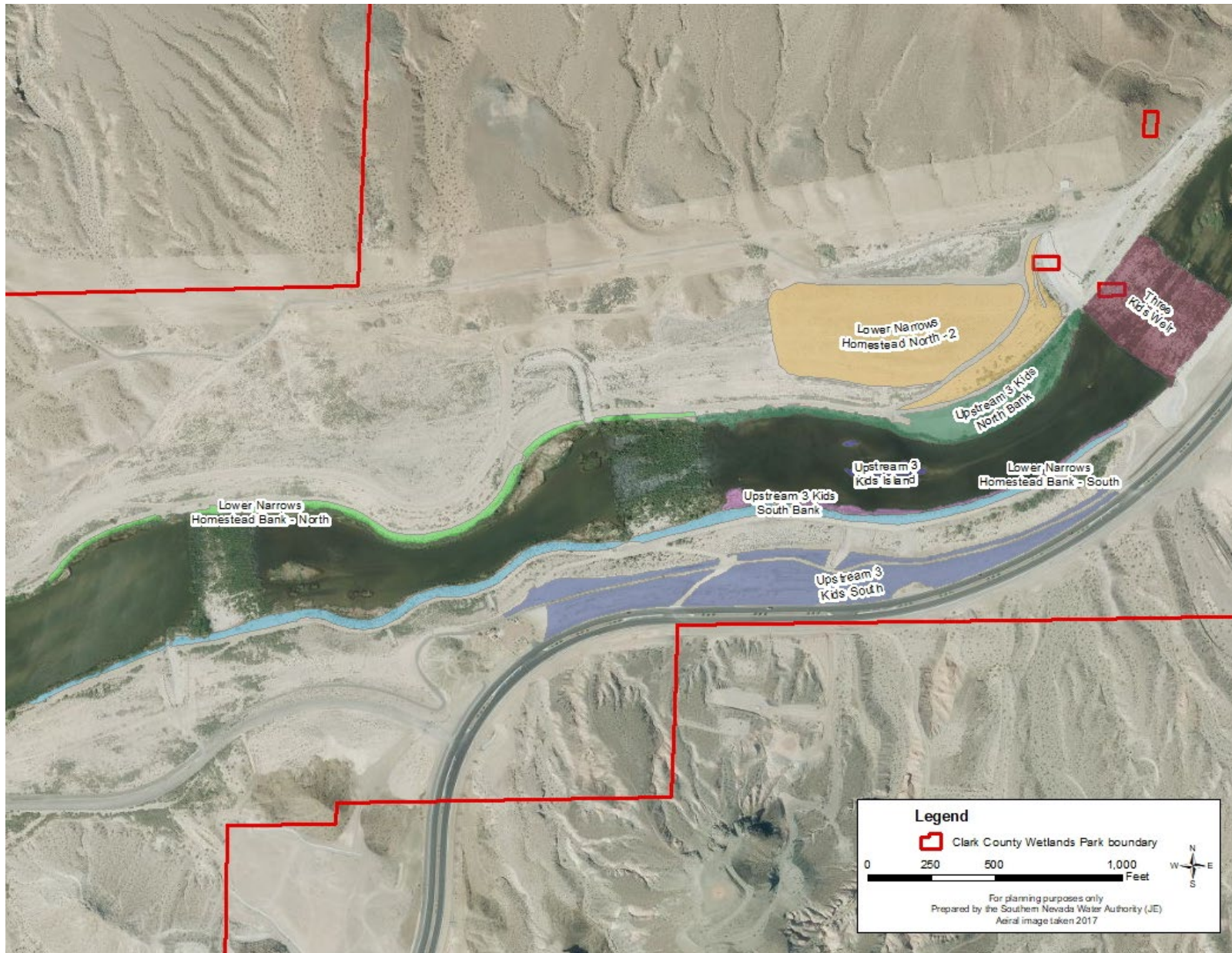


Figure 29. Aerial photograph of 2017 delineated Three Kids Weir revegetation sites.

Site Code	Growing Season	Acreage	Wetland Status	Total Cover	Noxious Species Cover	Number of Species	WPI ²
LNHB-N	2	1.75	wet	50-75%	0.5%	20	2.97
LNHB-S	2	3.24	wet	50-75%	0.5%	14	3.61
LNHN2	1	7.66	non-wet	5-25%	nm	nm	nm
3KW	1	4.04	wet	50-75%	nm	nm	nm
U3KI	1	0.43	wet	75-100%	nm	nm	nm
U3KNB	2	3.24	wet	25-50%	2.5%	26	2.28
U3KSB	2	0.84	wet	50-75%	37.5%	20	2.54
U3KS	1	6.89	non-wet	50-75%	0.1%	25	4.12

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

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 Three Kids Weir revegetation sites in 2017.



Figure 30. The Upstream Three Kids South revegetation site borders the Clark County Wetlands Park bike trail.

3.19 Upper Diversion Weir

Only one of the eight revegetation sites at the Upper Diversion Weir was monitored in the field in 2017 (Table 21; Figure 31). The remaining seven sites had their total cover calculated using ArcGIS. Upper Diversion Island (UDI) was monitored in the field and is broken up into three monitoring areas. The species-specific and total cover values then have their weighted mean calculated based on the acreage of each area. The dominant plant species was quailbush, which had a total cover of 62.5%, with fourwing saltbush slightly less at 50%. While this totals more than 100%, it is due to many individual plants occupying the same vertical space; i.e. one plant is growing on top of another plant.

Site Code	Growing Season	Acreage	Wetland Status	Total Cover	Noxious Species Cover	Number of Species	WPI ²
DUDE	9	4.43	wet	75-100%	nm	nm	nm
DUDN	9	9.74	non-wet	55.6%	nm	nm	nm
DUDS	9	1.44	wet	75-100%	nm	nm	nm
UDI	9	5.06	non-wet	75-100%	7.8%	13	3.62
UDIE	9	0.17	wet	75-100%	nm	nm	nm
UUDE	9	1.04	wet	75-100%	nm	nm	nm
UUDS	9	0.76	non-wet	75-100%	nm	nm	nm
UDIS	9	0.21	non-wet	75-100%	nm	nm	nm

¹DUDE=Downstream Upper Diversion Emergent, DUDN=Downstream Upper Diversion North, DUDS=Downstream Upper Diversion Shelves, UDI=Upper Diversion Island, UDIE=Upper Diversion Island Emergent, UUDE=Upstream Upper Diversion Emergent, UUDS=Upstream Upper Diversion South, UDIS=Upstream Upper Diversion Island 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 21. Vegetation monitoring results for Upper Diversion Weir revegetation sites in 2017.

The only revegetation site in 2017 that had a different value than the previous monitoring year, in which they were monitored in the field, was Downstream Upper Diversion North (DUDN). This site was planted at the fall 2008 Green-Up event. It is a very dry area and annual precipitation can have a significant impact on the annual growth and health of both individual plants and the site as a whole. The total cover decreased from 71.6% in 2016 when it was field monitored to 55.6% in 2017 when measured with ArcGIS.

In January of 2017, the majority of the vegetation in the backwater behind the Upper Diversion Weir, known as Upstream Upper Diversion Emergent (UUDE) was removed (Figure 32). The vegetation had collected a substantial amount of sediment and as a result collected trash during storm events and began to alter the flow path of the Wash. The revegetation site was reduced from 3.65 to 1.04 acres with the remaining area consisting of the vegetation along the outer edge of the backwater pond.

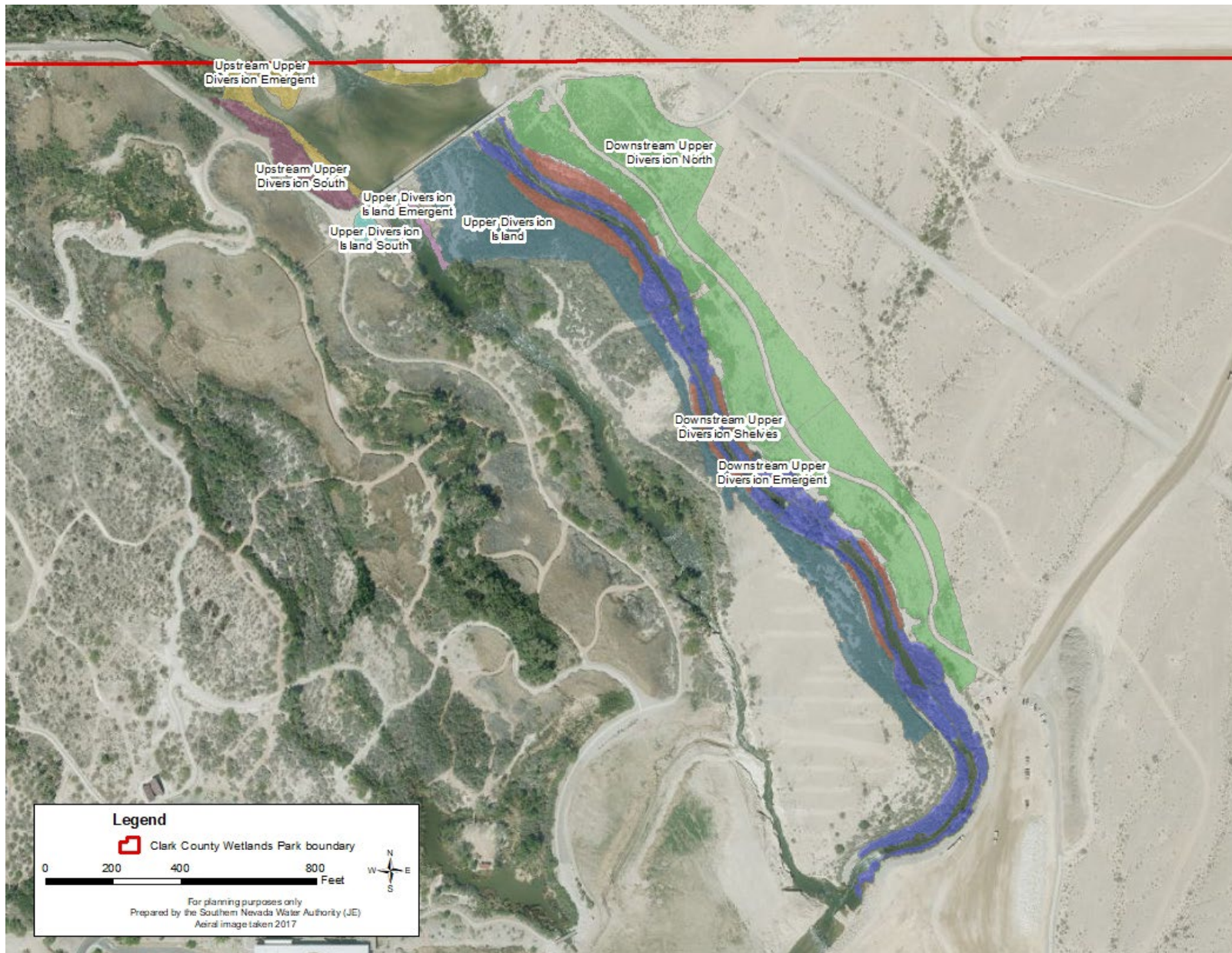


Figure 31. Aerial photograph of 2017 delineated Upper Diversion Weir revegetation sites.



Figure 32. Before (top) and after (bottom) photographs of clearing of vegetation upstream of the Upper Diversion Weir and bridge.

4.0 CONCLUSIONS

The status of revegetation sites along the Wash in 2017 demonstrates success in terms of growing plant cover, plant survivorship, reduction of noxious weeds, and overall ecological health. Of the 133 total sites monitored, (S108, S111, and CCWRD are considered one site each), 96 (72.2%)

had the same cover as they did in 2016, 13 (9.8%) increased in cover, and 16 (12.0%) decreased in cover. The remaining 8 (6.0%) sites were first monitored in 2017, including sites at the Three Kids, Archery and Silver Bowl, Lower Narrows and Homestead, and Powerline Crossing Weirs. ArcGIS was used to measure the total cover for 62 (46.6%) of the sites.

While there are many possible explanations for changes in plant cover on revegetation sites both as a whole and for individual species, one likely explanation for the relatively high number of sites declining in total cover in 2017 is the weather. The year 2017 ranked as the warmest year on record for Las Vegas with an average temperature of 72.3 degrees according to the National Weather Service (Brean 2018). In addition, the Las Vegas Valley had its driest fall ever finishing the year with 109 straight days without precipitation being registered at McCarran Airport. The total rainfall for the year was nearly half of the average at just 2.38 inches. Most of the precipitation for 2017 come in January and February which would have had little to no impact on the plants along the Wash.

5.0 RECOMENDATIONS

As with individual sites and even individual species, single year increases or declines are not of major concern to a large restoration project such as that occurring along the Wash. Annual monitoring, such as described in this report, for the vegetation along the Wash provides many years of data to compare and contrast. As a result, it is known that there are no major negative trends in terms of plant cover, noxious weed encroachment, survivorship, etc. in the Wash revegetation program that would require changes in management. Instead, there are improvements that can be made such as species diversity, accessibility improvements, enhancements to positively impact wildlife and other activities that can further increase the benefit of the successful Wash revegetation program.

The final weirs had their construction completed in 2018. Major revegetation activities will continue on these sites through 2020. Both project wide and site-specific plans need to be developed for long-term maintenance as well as improvements or enhancements to the sites. This needs to include planting of new plants to increase vegetation type and structure diversity and therefore provide additional habitat for wildlife. Earthwork will also be needed in some areas to provide substrate needed for additional plantings and potentially construct surface water under riparian tree habitat to attract specific species such as the southwestern willow flycatcher.

6.0 LITERATURE CITED

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