

# las vegas wash coordination committee

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## Las Vegas Wash Vegetation Monitoring Report, 2015



**December 2016**



**Las Vegas Wash  
Vegetation Monitoring Report, 2015**

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

Prepared for:

**Las Vegas Wash Coordination Committee**

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## **ABSTRACT**

Revegetation projects have been conducted along the Las Vegas Wash for over 15 years to meet the goals of the Las Vegas Wash Coordination Committee. In the fall of 2015, when monitoring for this report took place, approximately 424 acres of revegetation at 270 monitoring areas along the Las Vegas Wash were established. Sites ranging in age from 1 to 15 growing seasons had total cover, noxious species cover, species richness, and the wetland prevalence index documented. Survivorship was calculated for the two most recently established sites with an average of 62% of the planted plants surviving until monitoring. Overall, most revegetation sites either increased in cover or remained constant since 2014; only 17% of the sites decreased in cover. Most mature sites have stabilized and cover does not change much between growing seasons.

## ACKNOWLEDGEMENTS

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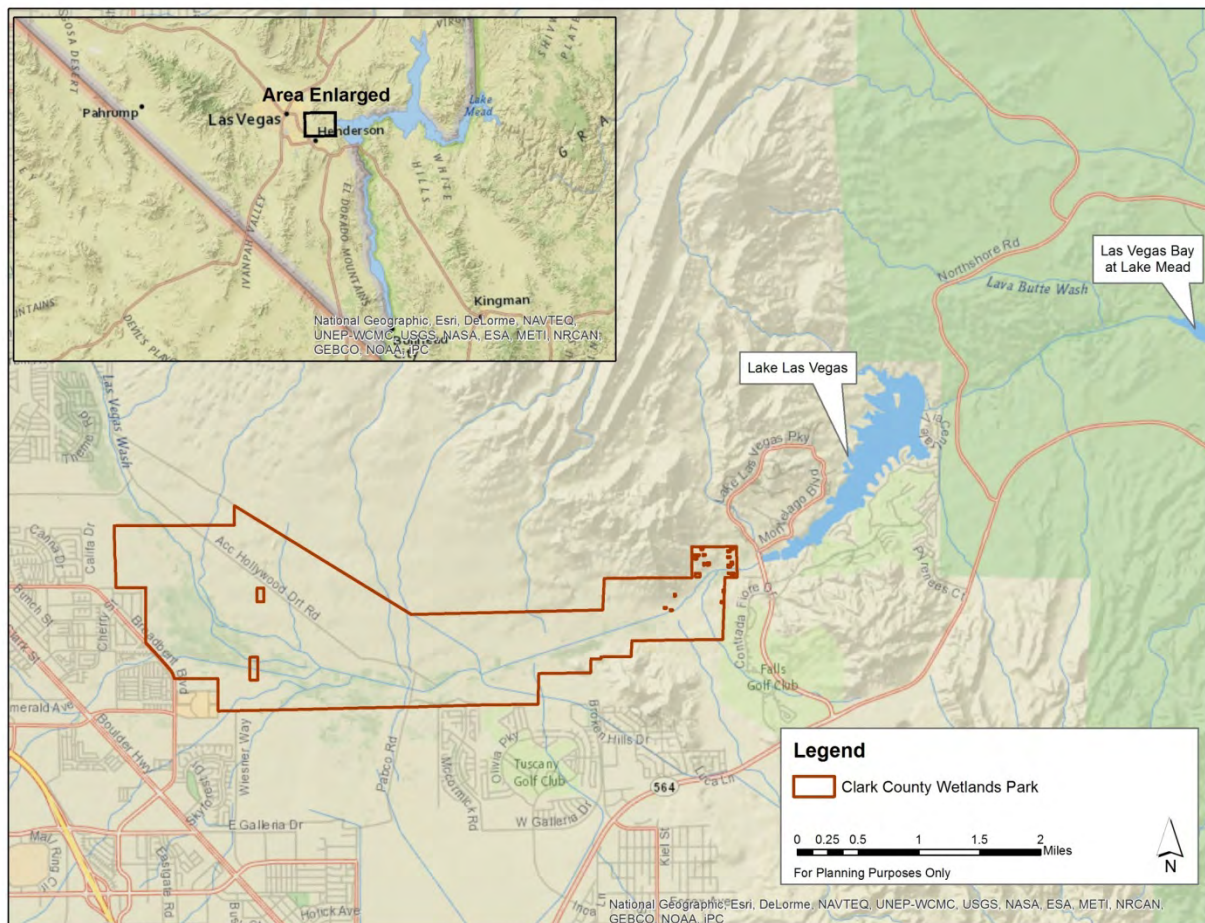
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## 1.0 INTRODUCTION

### 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 29-member multi-stakeholder group consisting of federal, state, and local agencies, the university, private businesses, an environmental group, 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 are 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 revegetation program is a critical component of the overall plan to stabilize and enhance the Wash. Plants help prevent erosion because their roots bind loose soil particles on the surface and in deep subsurface horizons, thereby acting as soil anchors during scouring events (i.e., floods). In addition, revegetation benefits a variety of wildlife species that occur along the Wash and potentially provide habitat for species formerly found to reestablish there. Because the Wash was not historically a riverine system, it does not have an abundance of source plants native to these conditions. Moreover, during its transitional period, 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 2015 data as part of a comprehensive vegetation monitoring program. Vegetation monitoring results from 2002 through 2014 have been previously documented (SNWA 2005, Eckberg and Shanahan 2008, Eckberg 2015); 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 407 acres were monitored in 2015. 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). The exception being the Clark County Water Reclamation District (CCWRD) revegetation sites, which are located just north of the CCWP (Figure 2).

## 1.3 Need for Revegetation and Vegetation Monitoring

Revegetation projects along the Wash are conducted for a few important reasons. Revegetation is a compensatory mitigation requirement for the 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 United States. 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 stormwater general 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 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, projects are also required by federal and state grants received by SNWA 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 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 Lands Management Act (SNPLMA IV, SNPLMA V, and SNPLMA VI); however, the majority of these grants have only provided funds for the implementation of 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**

As mentioned above, the majority of revegetation sites along the Wash are related to erosion control structure construction activities. This results in most site revegetation efforts being planned in conjunction with the construction of erosion control structures. Included in the design are species and procedures for hydroseeding. This is the initial step in revegetation, which doubles as erosion control and restoration, is the final step in the construction process. 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.

##### **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 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. 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. Other invasive species that are found on sites and require constant monitoring are tall whitetop, silver-leaf nightshade, red brome, Malta star-thistle and Johnsongrass. Without removal, the native species would not be able to grow, germinate, and



become self-sustaining. Considerable effort, therefore, is given to continually survey sites for encroachment, identify the invasive species, and plan 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 and quailbush can grow so vigorously that they outcompete native species that are trying to establish. 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 species-rich environment.

#### **1.5.4 Irrigation**

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 these 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**

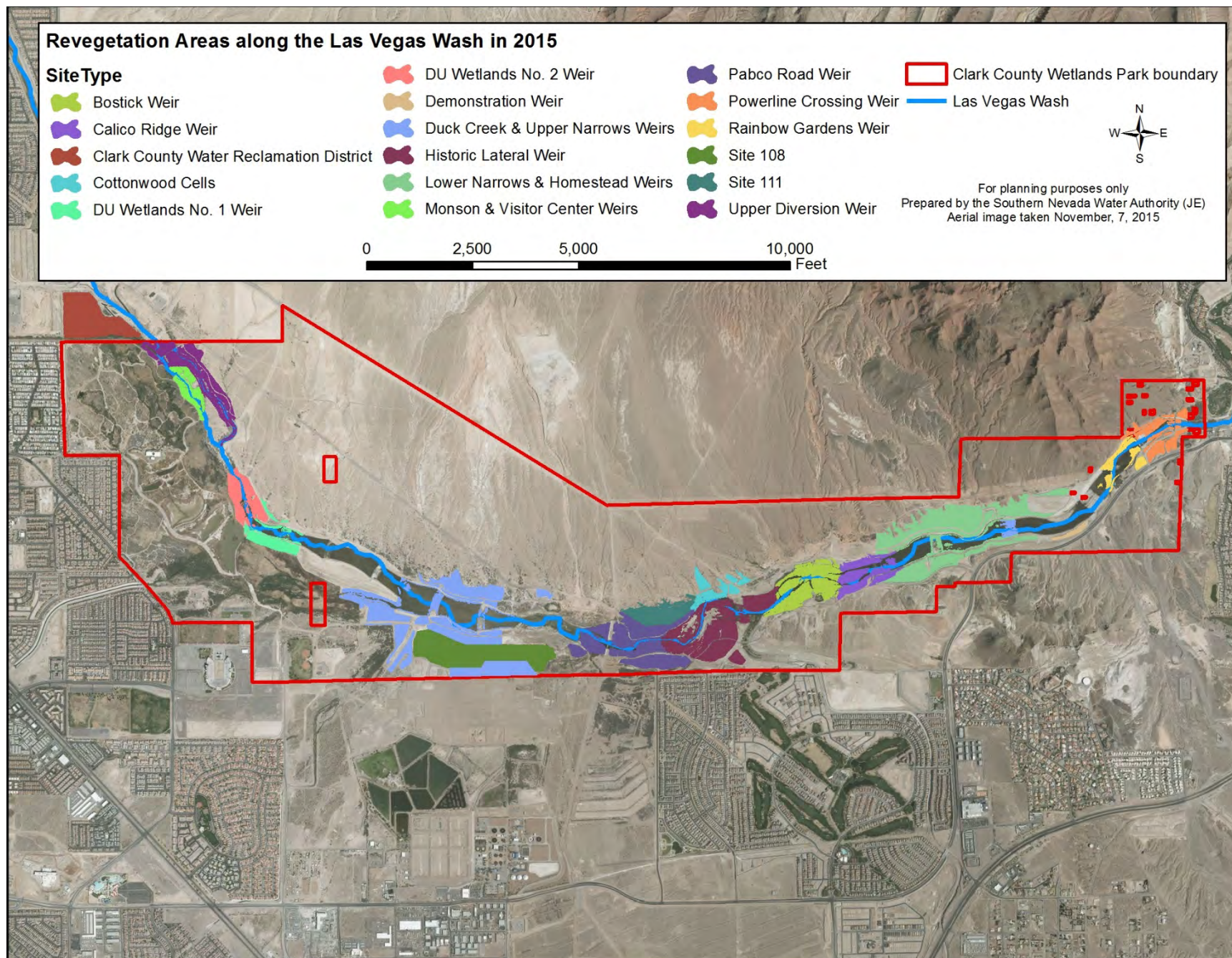
On revegetation sites, fences are installed to reduce the damage caused by rabbits to newly planted material. Some sites have had a single fence placed around the entire site while others have had smaller fences around the plants themselves. Both must be continually inspected for damage, have repairs made, and adjustments made to the spacing of the fences (so that plant growth is not reduced).

## **2.0 MATERIALS AND METHODS**

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Monitoring was conducted between August and October 2015, and the methods followed the same guidelines. As of August 2015, there were 47 wetland and 53 non-wetland revegetation sites. Many of the non-wetland sites were broken up into multiple monitoring areas (Table 1).

ArcGIS was used to monitor 45 of the 100 total revegetation sites in 2015 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



**Figure 2. Location of the 2015 Las Vegas Wash revegetation sites and the Clark County Wetlands Park boundary.**



laid out in the 2008 Las Vegas Wash Vegetation Monitoring Report (Eckberg and Shanahan 2009). All species documented during vegetation monitoring were crosschecked using the Integrated Taxonomic Information System (ITIS; [www.itis.gov](http://www.itis.gov)) to ensure that the scientific name is currently valid. Each plant species is assigned a Wetland Indicator Status by the National Wetland Plant List (Lichvar 2013) which is also updated annually.

### 3.0 RESULTS AND DISCUSSION

The following subsections describe monitoring results for each site and for groupings of sites. From 2014 to 2015, the number of areas monitored decreased by 12, while the acreage increased by 23.4 (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 Duck Creek Confluence and Upper Narrows Weirs. These areas were planted as volunteer events in the fall of 2014 and spring of 2015. Second, there were existing passively created areas along the wash that had not previously been captured in monitoring.

Major Site	Acreage		No. of Monitoring Areas	
	2014	2015	2014	2015
Bostick Weir	26.0	26.4	14	14
Calico Ridge Weir	15.1	16.6	10	10
CCWRD	28.9	28.3	29	29
Cottonwood Cells	10.3	10.4	10	10
Demonstration Weir	2.2	2.0	2	2
Duck Creek Confluence and Upper Narrows Weirs	27.4	52.0	6	11
DU Wetlands No. 1 Weir	8.7	10.3	3	4
DU Wetlands No. 2 Weir	12.7	14.0	4	5
Historic Lateral Weir	42.1	44.8	13	14
Lower Narrows and Homestead Weirs	58.0	65.5	6	8
Monson and Visitor Center Weirs	8.9	8.8	4	4
Pabco Road Weir	39.5	41.8	18	20
Powerline Crossing Weir	13.6	14.2	16	18
Rainbow Gardens Weir	10.4	7.3	6	7
Site-108	40.6	40.9	59	64
Site-111	14.9	14.9	24	26
Upper Diversion Weir	24.5	25.5	24	24
<b>TOTAL</b>	<b>383.8</b>	<b>423.7</b>	<b>248</b>	<b>270</b>

**Table 1. Change in cumulative acreage monitored and number of monitoring areas from 2014 to 2015.**

Cumulatively, there have been 64.5 acres of wetlands created above those required by mitigation permits (Table 2); including, 3.64 acres associated with the Cottonwood Cells, which were fully funded by grants from the BOR and the Clark County Water Reclamation District (CCWRD) which had its permit held by the property owners. Federally funded projects such as these are not eligible for use as mitigation of wetlands impacted in accordance with permits issued by the Corps.

Mitigation Project	Mitigation Permit Number	Mitigation Required (acres)	Wetland Area Created (acres)
Bostick Weir	200125114	7.88	18.72
Calico Ridge Weir	200450004	3.8	8.87
Clark County Water Reclamation District	SPK-2009-00227-SG	6.79	6.67°
Cottonwood Cells	N/A	-	3.70*
Demonstration Weir	199825148	0.9	0.49
Duck Creek Confluence and Upper Narrows Weirs	SPK-2009-00042	1.33	7.65
DU Wetlands No. 1 Weir	SPK-2010-00285-SG	1.22	2.47
DU Wetlands No. 2 Weir	2007-1961-SG	0.05	4.03
Historic Lateral Weir	199825148	4.9	19.53
Lower Narrows and Homestead Weirs	SPK-2008-01417-SG	6.25	11.05
Monson and Visitor Center Weirs	200250111	4.81	1.95
Pabco Road Weir	199725375	2.2	14.94
Powerline Crossing Weir	200450454	4.87	3.25
Rainbow Gardens Weir	200250054	1	4.35
Upper Diversion Weir	200550514	0.01	9.90
Bank Protection Projects	-	7.06	-
<b>TOTAL</b>		<b>53.07</b>	<b>117.57</b>

° Permit held by Clark County Water Reclamation District and not eligible for Wash wetland mitigation

\* Federally funded revegetation not eligible for wetland mitigation

**Table 2. Mitigation requirements and wetland areas established as of November 2015.**

### 3.1 Bostick Weir

There are 13 monitoring areas associated with the Bostick Weir (Figure 3; Table 3). In 2015, eight of these sites were monitored for total cover in the field; the remaining five were monitored using ArcGIS. Eleven of the 13 sites at the Bostick Weir had the same total vegetative cover as in 2014. Most of these sites have also had the same total cover for many growing seasons. Bostick North has had fluctuations in its cover over the past few growing seasons; 25-50% in 2013, 50-75% in 2014, and now 5-25% in 2015. The two species that have also been fluctuating are creosote bush and honey mesquite. These species both are well adapted to local conditions and can add leaves in wet years and lose leaves in dry years. The weather conditions of the year and even season can greatly influence the vegetative cover on a site and likely explains the fluctuations.

There are not many noxious weeds found on Bostick Weir sites. This may show that quick site remediation efforts involving replanting native plants and removing weeds once identified allows

native plants to mature and dominate the area without additional actions. To further this effort, 12 acres to the south of the existing sites that was dominated by tamarisk was revegetated after monitoring concluded in 2015. This should further reduce the encroachment of noxious weeds and reduce site remediation efforts even further.

Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
B	12	8.03	wet	75-100%	nm	nm	nm
BI	12	4.75	wet	75-100%	nm	nm	nm
BN	12	0.84	non-wet	5-25%	0.0%	9	4.89
BS	11	1.20	non-wet	75-100%	0.0%	13	4.00
DBN	12	0.48	non-wet	25-50%	0.0%	8	4.94
DBS	11	0.21	non-wet	75-100%	0.0%	5	4.89
DBSE	11	0.80	wet	75-100%	nm	nm	nm
UBN	12	0.55	non-wet	75-100%	nm	nm	nm
UBNB	11	1.26	wet	75-100%	nm	nm	nm
UBNE	11	1.79	wet	75-100%	2.5%	4	2.02
UBS	12	2.50	non-wet	75-100%	0.5%	25	
UBS	12	2.09	wet	75-100%	0.5%	18	2.28
UBSB	11	1.86	non-wet	75-100%	0.5%	8	4.00

<sup>1</sup>B=Bostick, BI=Bostick Islands, BN=Bostick North, BS=Bostick South, 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

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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

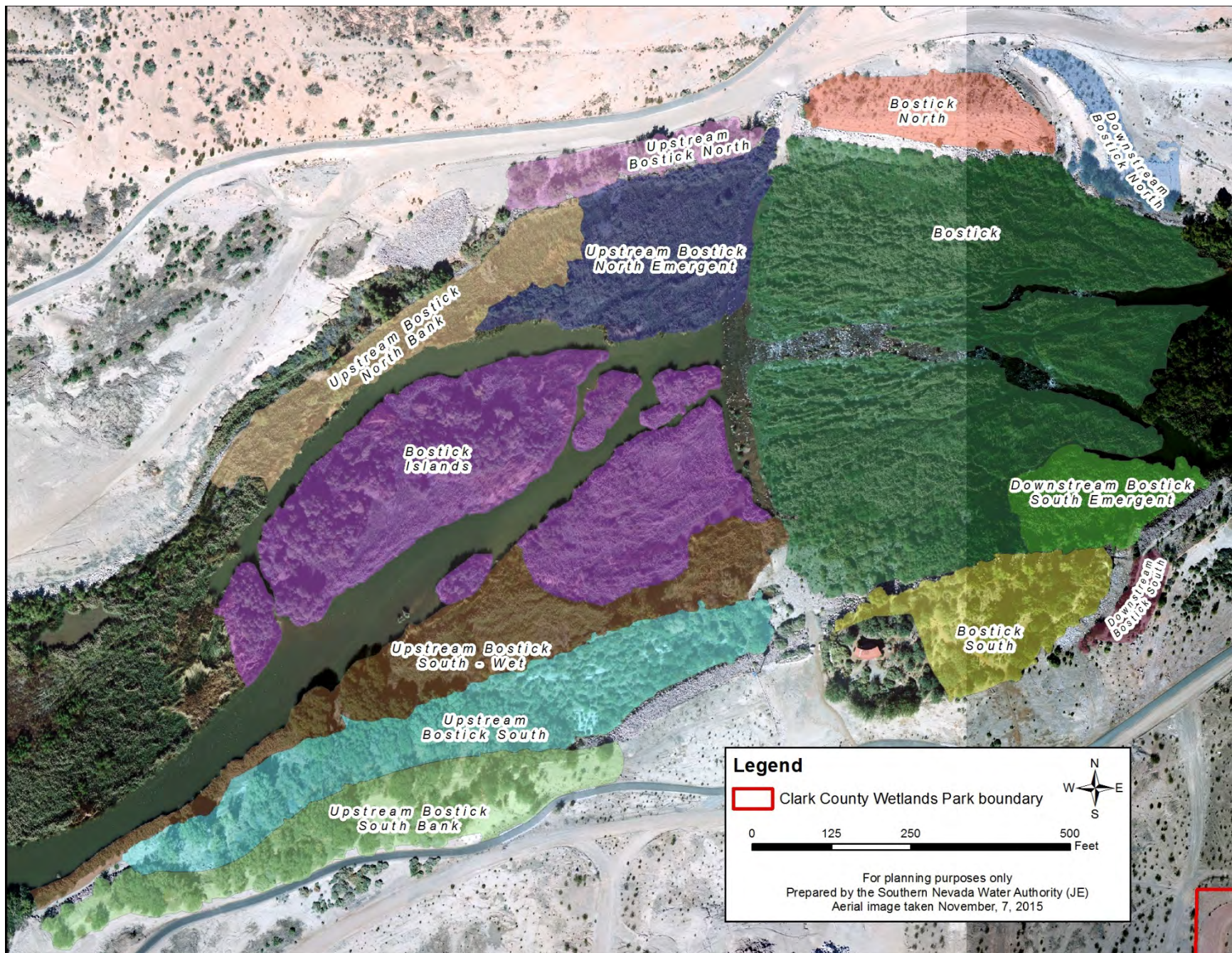
nm = this attribute was not monitored

**Table 3. Vegetation monitoring results for Bostick Weir revegetation sites in 2015.**



**Figure 3. Creosote bush dominate the Upstream Bostick North revegetation site in 2015.**





**Figure 4. Aerial photograph of 2015 delineated Bostick Weir revegetation sites.**



### 3.2 Calico Ridge Weir

In 2014, at the Calico Ridge Weir, four of the nine revegetation sites had their total cover measured using ArcGIS and five were monitored in the field (Table 4; Figure 5). Three sites increased in total cover while the remaining six sites had the same cover as 2014. The three sites that increased in total cover are all non-wetland sites. Typically wetland sites this mature (11 growing seasons) have met the maximum total cover value for many years. These non-wetland sites; Downstream Calico South - Non-wetland, Upstream Calico North – Non-wetland, and Upstream Calico South – Non-wetland are equal to or above their highest ever recorded total cover. But none have reached the maximum cover value; 75-100%.

Like Bostick Weir, very little site remediation is necessary. No site had more than 0.5% noxious weed cover. Therefore, these sites are visited infrequently during the year. Also like the Bostick Weir sites, the 12 acres of tamarisk removed and revegetated is just to the south of the sites on the south side of the Wash. This should remove much of the remaining source of noxious weeds entering the site. Substantial work was done on Upstream Calico Emergent site which is essentially an island in the Wash in 2015. There was a channel cut through the center of the island which is intended to allow flows to pass through the site and not force storm flows to go towards the banks on either side of it. The impact to total cover was negligible. Species level impacts will be monitored in 2016.

Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
C	11	2.06	wet	75-100%	nm	nm	nm
DCN	11	0.65	non-wet	25-50%	0.5%	7	4.91
DCS	11	2.24	non-wet	50-75%	0.5%	21	4.76
DCS	11	1.32	wet	75-100%	nm	nm	nm
UCE	11	3.60	wet	75-100%	nm	nm	nm
UCN	11	1.99	non-wet	50-75%	0.5%	15	4.32
UCN	11	1.01	wet	75-100%	nm	nm	nm
UCS	11	2.86	non-wet	75-100%	0.1%	14	4.69
UCS	11	0.88	wet	75-100%	nm	nm	nm

<sup>1</sup>C=Calico, DCN=Downstream Calico North, DCS=Downstream Calico South, UCE=Upstream Calico Emergent, UCN=Upstream Calico North, UCS=Upstream Calico South

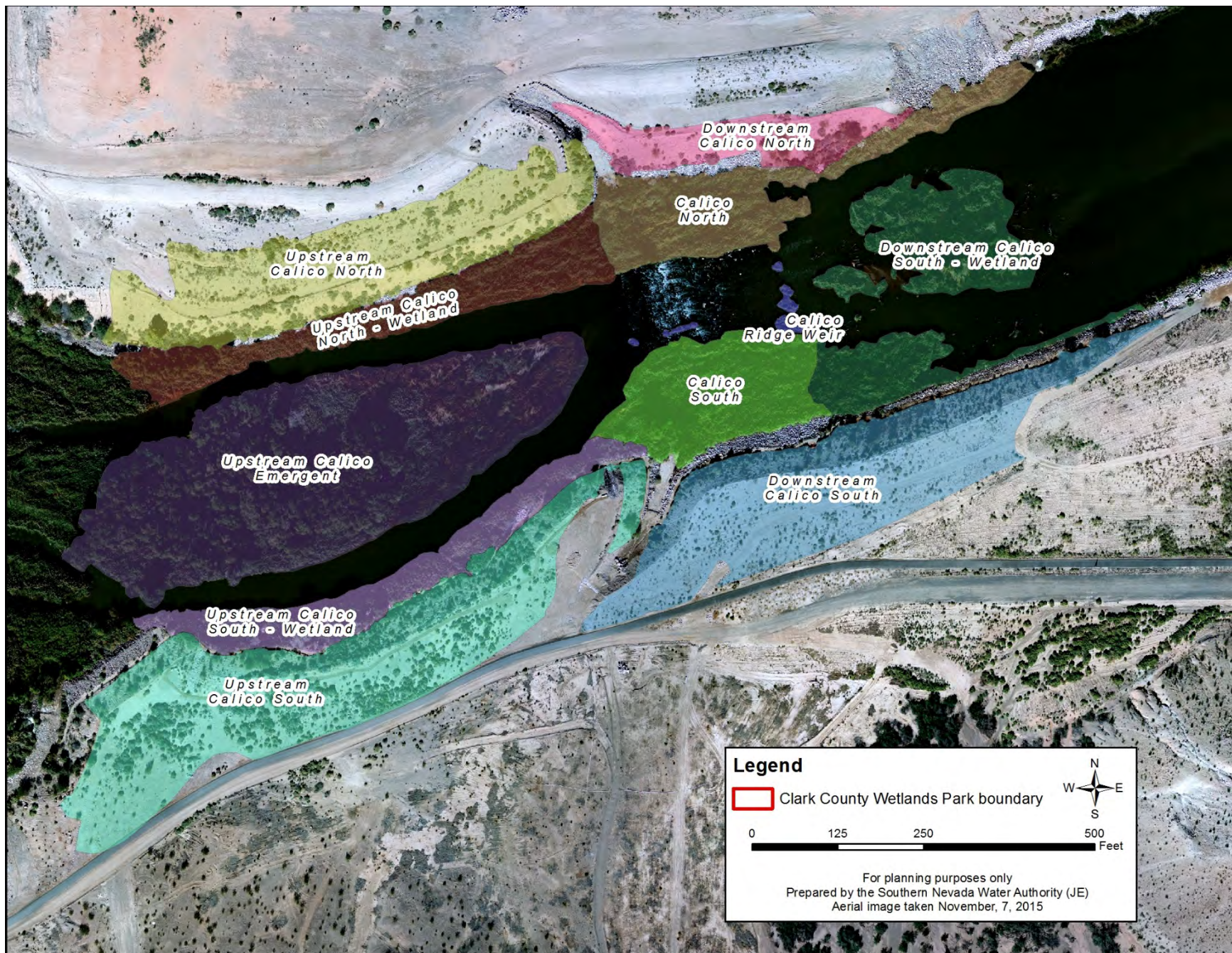
<sup>2</sup>Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

<sup>3</sup>Wetland 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 Calico Ridge Weir revegetation sites in 2015.**





**Figure 5. Aerial photograph of 2015 delineated Calico Ridge Weir revegetation sites.**





**Figure 6. Desert saltbush and cat-claw acacia are prominent in the Upstream Calico North non-wetland revegetation site in 2015.**

### **3.3 Clark County Water Reclamation District**

The site located at the CCWRD was monitored in 2015, its sixth year, in the field after exclusively using ArcGIS in 2014 (Figure 7; Table 5). It is made up of 29 semi-equivalent monitoring areas in terms of size categorized into wetland and non-wetland. The site as a whole as well as the separate wetland and non-wetland components all had lower total cover in 2015 as compared to 2014. This is likely due to the use of ArcGIS in 2014. There are many areas that are difficult to maneuver around in within this site as well as densely vegetated in some parts of monitoring areas while less dense in others. This makes it difficult in the field to make accurate assessments of the total cover. That being said, most areas were very similar to the measurements of ArcGIS as well as the previous in field measurements in 2013.

Soon after 2015 monitoring concluded, a major construction project commence on the CCWRD property adjacent to this revegetation site. The Wash channel will be lined through the CCWRD property. There are known immediate impacts due to having to clear some vegetation to make room for construction. There are also likely unknown impacts such as how the lining will impact groundwater levels and flooding impacts. It is unknown if the project will allow for field monitoring in 2016 to determine the impacts.

The percentage of cover in terms of noxious weeds has increased over the past few growing seasons. It is now over 10% of the site as a whole and over 13% in the wetland monitoring areas. The increase can mostly be attributed to the increase in tamarisk on the site. There is still a stand of tamarisk on the southern border of the site along Monson channel, kept in place for security concerns. In addition, up to the time of the 2015 monitoring there was a stand of tamarisk to the





**Figure 7. Aerial photograph of the 2015 delineated Clark County Water Reclamation District revegetation sites.**



west of the revegetation site as well. This stand was removed as part of the current construction project. These two stands likely resulted in the reestablishment of tamarisk on the site which dominated the site prior to 2010. As noted in previous reports, the shallow groundwater table as well as often the presence of surface water makes this site easy for self-germination of all types of plants.

Site Code	Growing Season	Acreage	Wetland Status <sup>1</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>2</sup>
CCWRD	6	21.64	non-wet	74.6%	8.8%	23	3.43
CCWRD	6	6.67	wet	70.2%	13.2%	15	3.25
TOTAL	6	28.31	both	73.4%	10.4%	24	3.39

<sup>1</sup>Wetland 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

<sup>2</sup>Wetland 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 the Clark County Water Reclamation District revegetation site in 2015.**



**Figure 8. Erosion reveals how shallow the groundwater is at the Clark County Water Reclamation District revegetation site in 2015.**

### 3.4 Cottonwood Cells

There are seven revegetation sites associated with the Cottonwood Cells (Table 6; Figure 9). All seven sites were monitored in the field in 2015. The two original cottonwood cells (Cottonwood Cell 1 and Cottonwood Cell 2) were planted in 2002 and 2005, respectively, and are relatively mature, whereas the remaining five sites planted in 2012 are still relatively young. Contrary to their name, the five newer sites are not dominated by cottonwood trees; they were named due to their proximity to the original two cells.

Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
CC1	14	0.97	wet	75-100%	38.0%	11	2.63
CC2	11	0.53	wet	75-100%	0.1%	9	2.97
CC3	4	1.62	wet	50-75%	16.5%	39	2.96
CC3-2	3	0.39	wet	75-100%	0.0%	14	4.42
CCB	3	0.19	wet	75-100%	0.7%	24	1.82
CCN	4	4.83	non-wet	50-75%	0.1%	24	4.26
CCNS	4	1.83	non-wet	27.3%	0.1%	13	3.94

<sup>1</sup>CC1=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

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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. Vegetation monitoring results for Cottonwood Cell revegetation sites in 2015.**

Cottonwood Cell 1 has had a substantial increase in the amount of noxious weeds on the site and marks one of the most infested sites along the Wash at 38% (Table 6). The vast majority of this noxious weed cover comes from Johnsongrass (*Sorghum halepense*). This invasive grass has taken over much of the area left bare from dead and dying cottonwoods over the past few years as a result of disease and beaver herbivory. This grass was not found on the site at all prior to 2014 (though no field monitoring took place in 2013). This is close to after the decline in total cover of cottonwoods which were 75-100% in 2010, 50-75% in 2012, and 25-50% in both 2014 and 2015.

Both Cottonwood Cell North (CCN) and Cottonwood Cell North Stockpiles (CCNS) had substantial declines in total cover between 2014 and 2015. This was a result of large scale vegetation clearing of the sites in preparation for the Historic Lateral Weir Expansion project scheduled to begin in 2017. CCN declined by over 25% and more than half of the species found in 2014 were not found in 2015. Similarly, there was a two-thirds decline in total cover on CCNS and a 50% decline in species richness from 2014 to 2015. The Historic Lateral Weir Expansion project was originally planned for 2016. With the delay, there is likelihood that some plant cover will return but much may be removed again as the project comes closed to commencement.



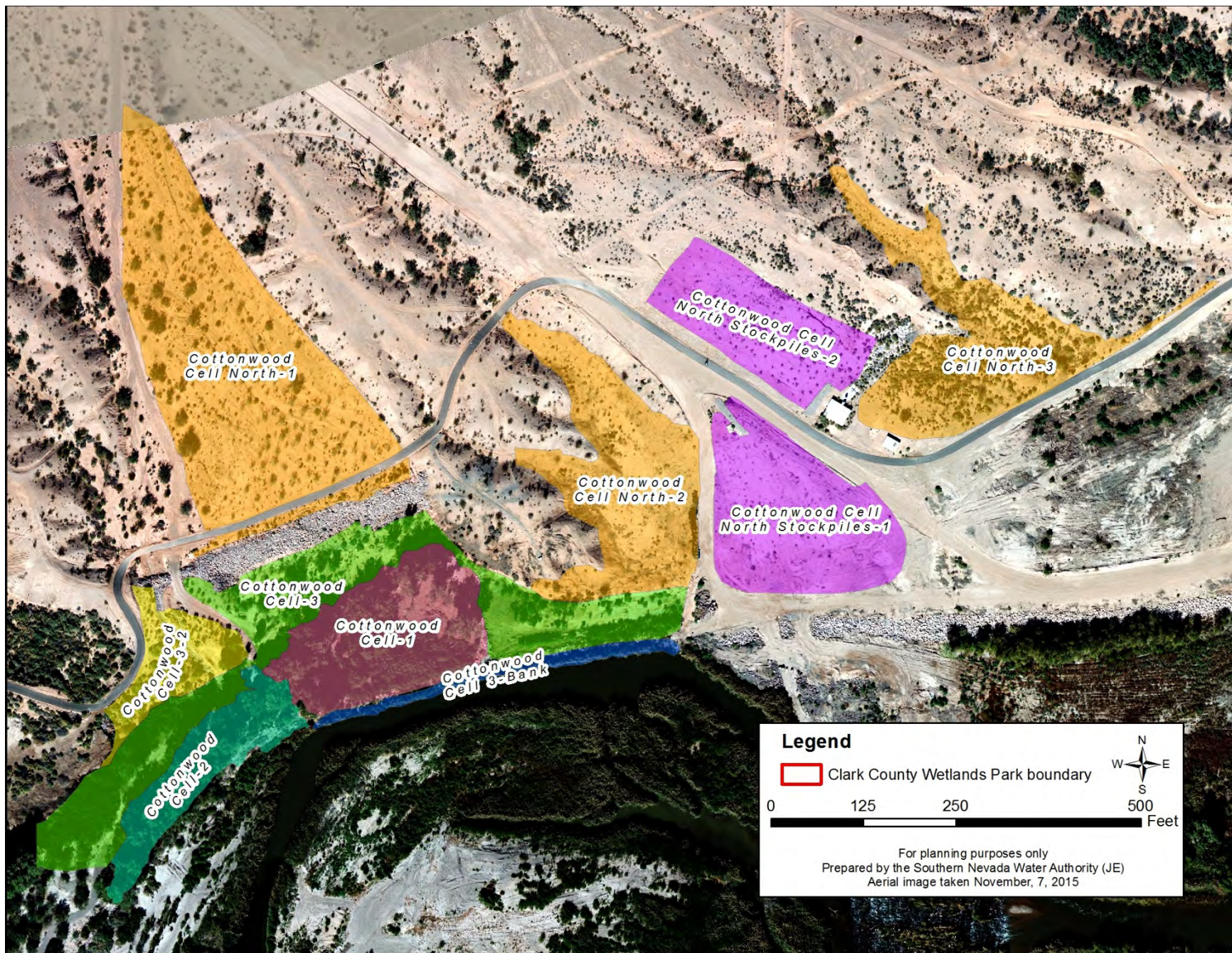


Figure 9. Aerial photograph of 2015 delineated Cottonwood Cell revegetation sites.





**Figure 10. Queen butterflies feeding on seep willow at Cottonwood Cell 3 in 2015.**

### 3.5 Demonstration Weir

The two revegetation sites at the Demonstration Weir are very different in their 13<sup>th</sup> growing season in 2015 (Table 7: Figure 11) than they were when they were originally established in 2003. Upstream Demonstration South – Wetland was planted along the banks of the Wash in 2003 with the non-wetland site planted adjacent to it. With the completion of the Three Kids Weir, what remained of the damaged Demonstration Weir was inundated and a new bank was established and an access road was constructed between the revegetation sites and the Wash channel. This allows for greater access to the sites but limits the plant's access to water. Larger trees, such as Goodding's willow, should have root systems large enough to not be effected.

Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
UDS	13	1.55	non-wet	25-50%	0.0%	7	4.75
UDS	13	0.49	wet	75-100%	2.5%	8	2.72

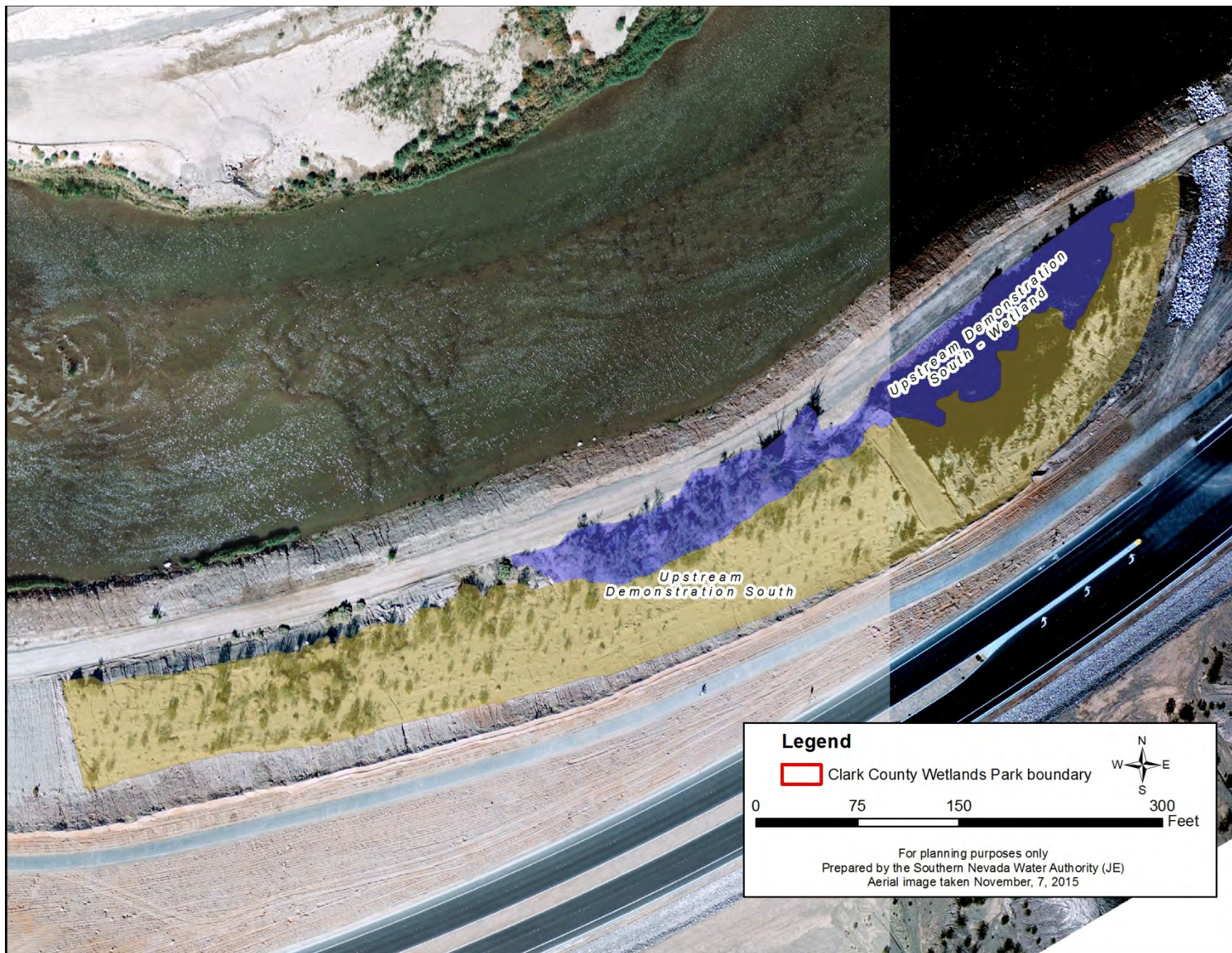
<sup>1</sup>UDS=Upstream Demonstration South

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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 the Demonstration Weir revegetation sites in 2015.**





**Figure 11. Aerial photograph of 2015 delineated Demonstration Weir revegetation sites.**



### 3.6 Duck Creek Confluence and Upper Narrows Weirs

The Duck Creek Confluence and Upper Narrows Weirs were completed in early 2013. As of 2015 monitoring, there were ten revegetation sites associated with the Duck Creek and Upper Narrows Weirs (Figure 13; Table 8). This is five more sites than in 2014. Two of these new sites were actively planted in the fall of 2014 and spring of 2015 (Duck Creek Upper Narrows South – 2[DCUNS2], and Duck Creek Upper Narrows South – 3[DCUNS3]). The remaining three sites are passively established wetland sites that are on the weirs themselves or islands formed due to deposited sediment in the Wash channel as a result of slowed flows upstream of the weirs. These three sites were monitored using ArcGIS, so they do not include species specific information.

The two newest actively planted sites are on pace with most Wash revegetation sites in terms of species richness and total cover. Survivorship however, was lower than average on both sites. DCUNS2 had 72.3% survivorship and DCUNS3 had 51.7%. The average for most sites in the past years was closer to 80%. It is difficult to determine what the cause of the low survivorship is, the majority of plants found to be dead during monitoring were not able to be identified. This is common during survivorship measuring since most distinguishing characteristics are no longer visible. But the plants were found in basins dug for plants and often had drip irrigation emitters nearby. Despite the concern with survivorship, those that made it to monitoring time were growing well and there are few noxious weeds to be concerned with (Table 8). Therefore further monitoring will be needed to ensure ultimate success of these sites.

Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
DCUNE	3	3.59	wet	75-100%	1.4%	25	1.41
DCUNN	2	13.70	non-wet	25-50%	0.5%	24	0.52
DCUNNR	2	1.39	non-wet	75-100%	0.1%	14	0.09
DCUNNS	2	1.31	non-wet	0-5%	0.5%	9	0.91
DCUNS-1	2	7.86	non-wet	50-75%	0.0%	22	0.57
DCUNS-2	1	10.48	non-wet	25-50%	0.0%	27	0.13
DCUNS-3	1	9.59	non-wet	50-75%	0.5%	19	0.91
DCCW	2	2.33	wet	75-100%	nm	nm	nm
UDCCI	2	0.68	wet	75-100%	nm	nm	nm
UNW	2	1.05	wet	75-100%	nm	nm	nm

<sup>1</sup> 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, DCCW=Duck Creek Confluence Weir, UDCCI=Upstream Duck Creek Confluence Channel, UNW=Upper Narrows Weir

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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 Duck Creek Confluence and Upper Narrows Weirs revegetation sites in 2015.**



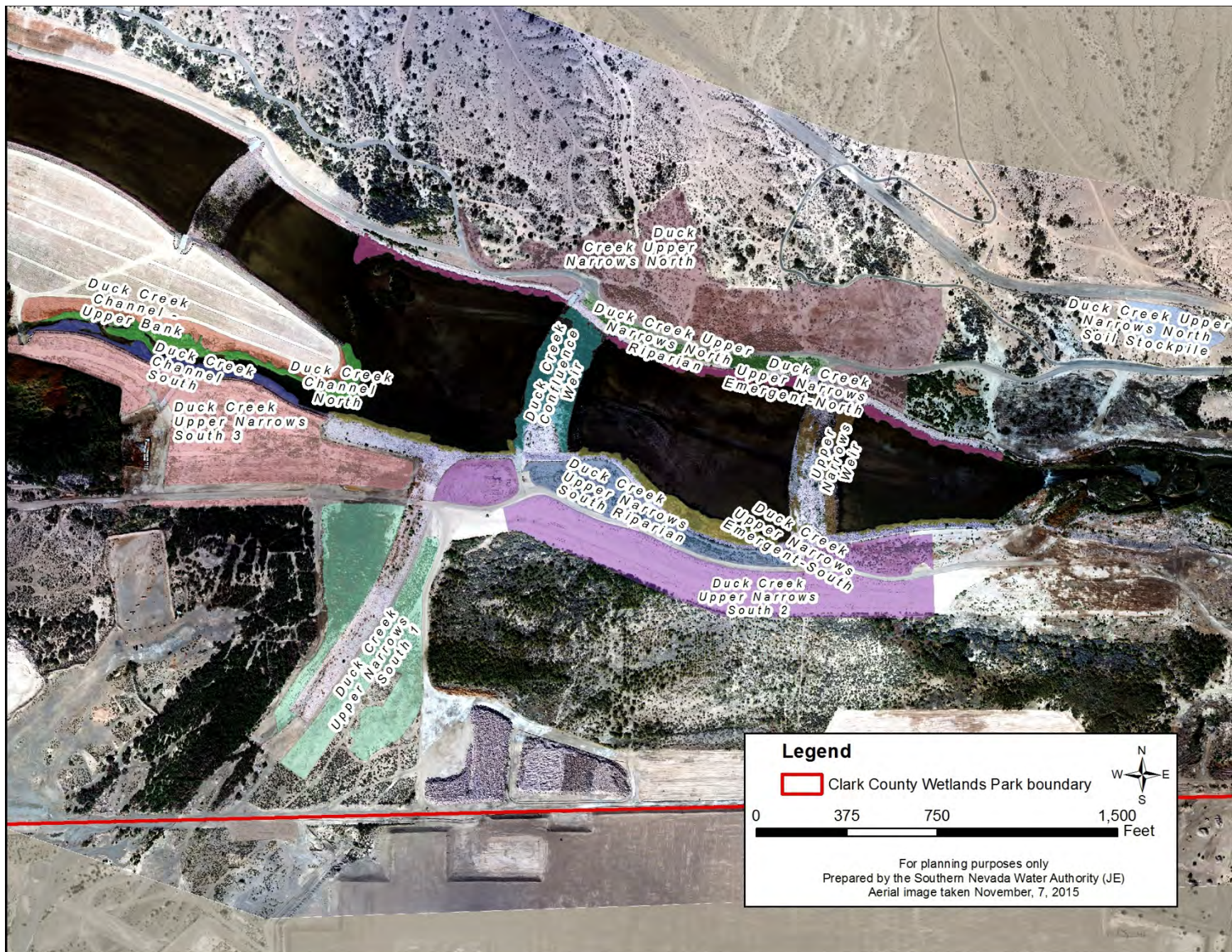


Figure 12. Aerial photograph of 2015 delineated Duck Creek Confluence and Upper Narrows Weirs revegetation sites.



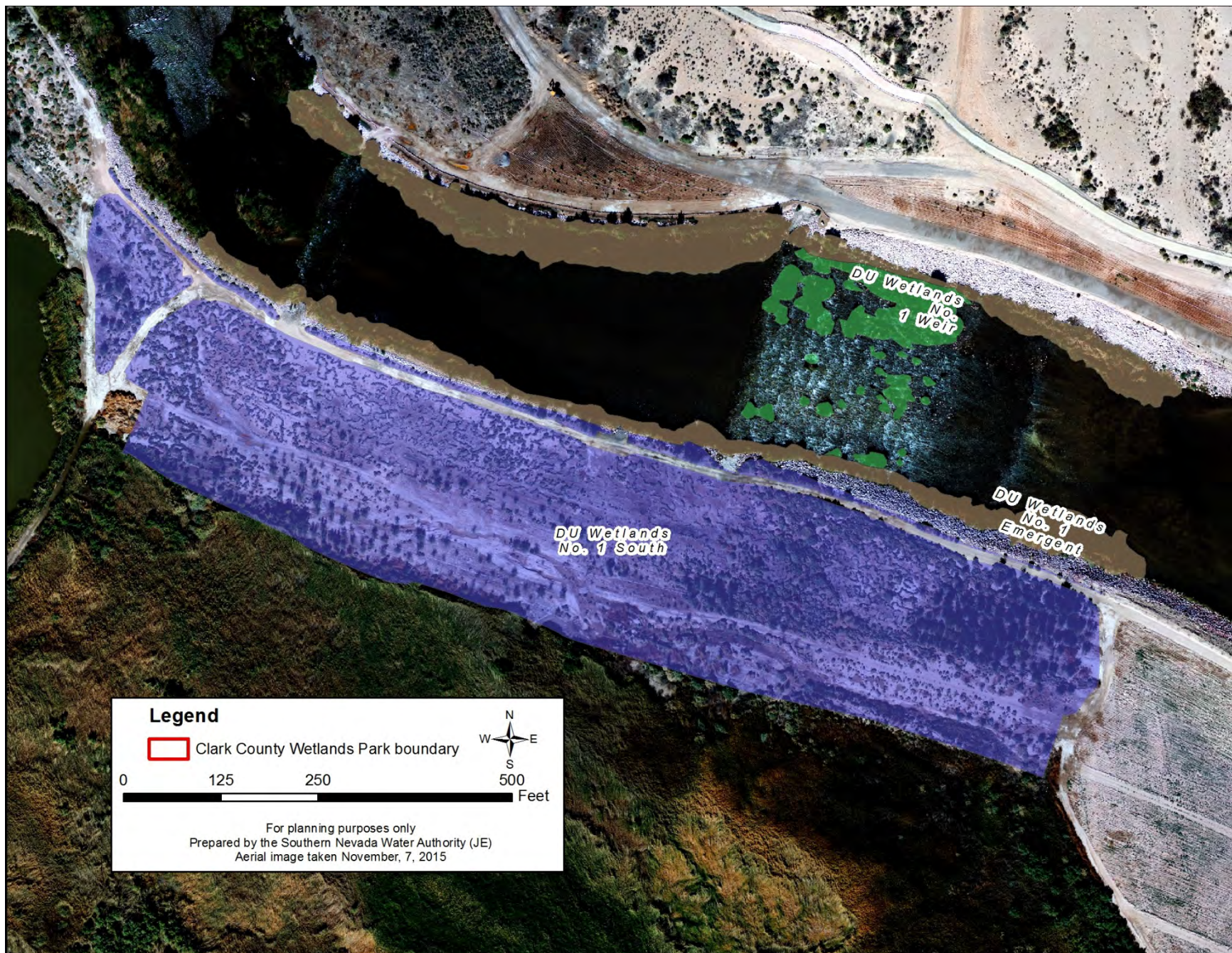


**Figure 13. Established vegetation at the Duck Creek Upper Narrows South 2 revegetation site along the banks of the Duck Creek Channel in 2015.**

### **3.7 DU Wetlands No. 1 Weir**

The DU Wetlands No. 1 Weir was completed in early 2013 and the revegetation sites were planted soon thereafter. The actively planted DU Wetlands No. 1 Emergent (DU1E) was planted through the winter months and DU Wetlands No. 1 South (DU1S) was planted with a Green-Up in March of 2013. The third site associated with this weir is the passive wetlands that established on the Weir itself, DU Wetlands No. 1 Weir. This passive site had its first monitoring in 2015, using ArcGIS to measure the 0.5 acres of wetland vegetation which had 75-100% total cover. The active site also had 75-100% total cover but was monitored in the field to include species specific information. DU1E had 35 species documented on it, just one less than in 2014. Although the species richness was similar, there were four species found in 2015 that were not found in previous monitoring. One of these new species, was new for the Wash as a whole as well, Shoestring acacia (*Acacia stenophylla*). This is a common landscape plant that is native to Australia. DU1S, the lone non-wetland site at this weir, was mistakenly not monitored in the field despite only being in its third growing season. Its total cover was monitored using ArcGIS and will be monitored in the field in 2016.





**Figure 14. Aerial photograph of 2014 delineated DU Wetlands No. 1 Weir revegetation sites.**



Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
DU1E	3	1.97	wet	75-100%	3.5%	35	1.84
DU1S	3	7.83	non-wet	75-100%	nm	nm	nm
DU1W	3	0.50	wet	75-100%	nm	nm	nm

<sup>1</sup> DU1S=DU Wetlands No. 1 South, DU1E=DU Wetlands No. 1 Emergent, DU1W=DU Wetlands No. 1 Weir

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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 DU Wetlands No. 1 Weir revegetation sites in 2015.**



**Figure 15. Mature riparian vegetation along the banks of the Wash at the DU Wetlands No. 1 North revegetation site in 2015.**

### 3.8 DU Wetlands No. 2 Weir

The four sites at the DU Wetlands No. 2 Weir were all in their sixth growing season at the time of monitoring in 2015 (Figures 17 and 18; Table 10). None of the sites were monitored in the field in 2015, including DU Wetlands No. 2 Weir (DU2W) which was monitored for the first time in 2015. DU2W is a passively created wetland site built up on the weir itself. All of the sites had the maximum cover value of 75-100% based on measurements using ArcGIS. Much of the northern portions of DU2S and DU2E are within the boundaries of the upcoming Tropicana Outfall Weir scheduled to begin construction in 2016. Wetland plants will be identified for potential transplanting prior to removal. Field monitoring in 2016 will give a better understanding of the impact and potential mitigation.

Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
DU2E	6	3.37	wet	75-100%	nm	nm	nm
DU2N	6	5.03	non-wet	75-100%	nm	nm	nm
DU2S	6	4.91	non-wet	75-100%	nm	nm	nm
DU2W	6	0.66	wet	75-100%	nm	nm	nm

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

<sup>2</sup>Wetland 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

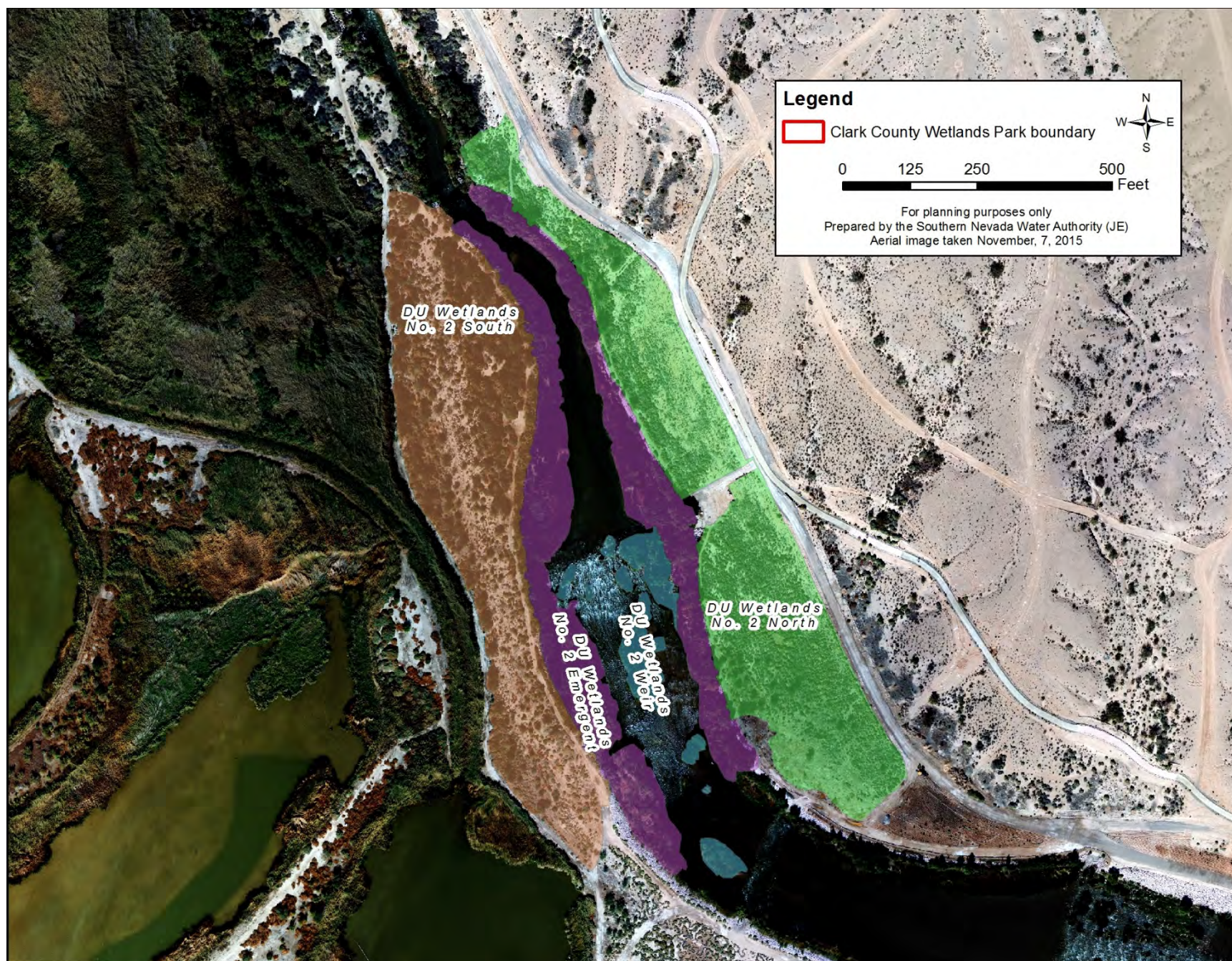
<sup>3</sup>Wetland Prevalence Index (WPI) value.  $WPI \leq 2.0$  = wetland,  $2.0 < WPI < 2.5$  = likely wetland,  $2.5 \leq WPI < 3.5$  = may be wetland,  $3.5 \leq WPI < 4.0$  = not likely a wetland, and  $WPI \geq 4.0$  = upland  
nm = this attribute was not monitored

**Table 10. Vegetation monitoring results for the DU Wetlands No. 2 Weir revegetation sites in 2015.**

### 3.9 Historic Lateral Weir

Three of the 12 revegetation sites at the Historic Lateral Weir were monitored in the field in 2015 (Table 11; Figure 17). Because most of the sites are 15 years old, they are almost always monitored in the field on alternating years based on the monitoring criteria. In addition, because of their age, most of the sites also have the maximum total cover value of 75-100%. Only two of the younger sites have lower total cover values. Upstream Historic Lateral Soil Stockpile had just 5-25% coverage, which has been the same for the previous four growing seasons. This site was a mitigation planting for an area used as a stockpile for rock. Because of this, the soils are extremely compacted and it is much further from surface or ground water than most sites. It is not expected to have any significant increase in plant cover. Upstream Historic Lateral South Upper Plateau 2 has had 50-75% total cover the past two growing seasons. Much of this site is very dry and once irrigation ceased after two growing seasons, there was a normal decline in plant cover. Being in its fifth growing season, it is likely to increase in total cover as the plants continue to mature. The Historic Lateral Weir wetland site was monitored for the first time in 2015. This is the passive wetland vegetation that has established on the weir itself. Because of its location, it is unsafe to physically access the site to get plant specific information. Therefore, it will likely only be monitored using ArcGIS as it was this year.





**Figure 16. Aerial photograph of 2015 delineated DU Wetlands No. 2 Weir revegetation sites.**



Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
DHLPW	15	6.69	wet	75-100%	0.5%	18	0.00
HLW	15	1.55	wet	75-100%	nm	nm	nm
UHLN	15	4.53	non-wet	75-100%	3.6%	33	2.74
UHLN	15	1.98	wet	75-100%	3.0%	13	2.08
UHLNS	15	1.76	wet	75-100%	nm	nm	nm
UHLPW	15	4.62	wet	75-100%	nm	nm	nm
UHLS	15	1.76	wet	75-100%	nm	nm	nm
UHLSB	15	1.12	non-wet	75-100%	nm	nm	nm
UHLSB	15	1.17	wet	75-100%	nm	nm	nm
UHLSS	5	2.06	non-wet	1-5%	nm	nm	nm
UHLSUP	8	5.17	non-wet	50-75%	nm	nm	nm
UHLSUP2	5	12.41	non-wet	50-75%	nm	nm	nm

<sup>1</sup>DHLPW=Downstream Historic Lateral Passive Wetlands, UHLN=Upstream Historic Lateral North, UHLNS=Upstream Historic Lateral North South, UHLS=Upstream Historic Lateral South, UHLPW=Upstream Historic Lateral Passive Wetlands, 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

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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 the Historic Lateral Weir revegetation sites in 2015.**



**Figure 17. Upstream Historic Lateral North - Wetland has very dense riparian and wetland vegetation in 2015.**



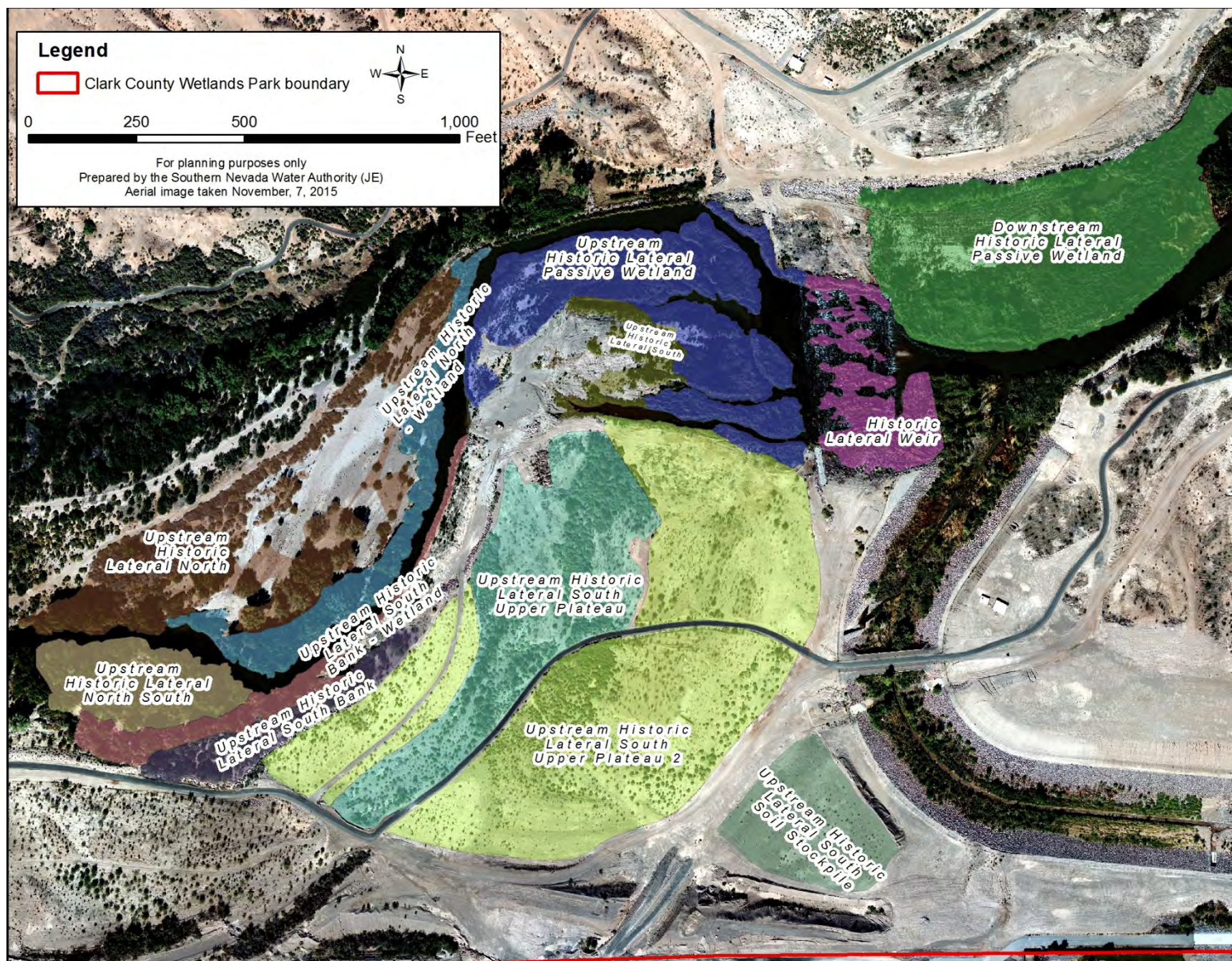


Figure 18. Aerial photograph of 2015 delineated Historic Lateral Weir revegetation sites.



### 3.10 Lower Narrows and Homestead Weirs

Four of the revegetation sites at the Lower Narrows and Homestead Weirs (Table XX; Figure XX) were actively planted while two are passive wetlands. The two passive wetlands are new to monitoring in 2015. Lower Narrows Weir and Homestead Weir (Figure XX) are the passive wetlands that self-established on the two weirs themselves. They were monitored using ArcGIS in 2015 and will likely always been monitored remotely as they are difficult and unsafe to access by foot to get plant specific information.

Although most of the revegetation sites at the Lower Narrows and Homestead Weirs are four growing seasons old, there is still additional areas to be planted. The rip-rap banks were covered with soil fill from the construction of the Three Kids Weir, just downstream. These areas were planted in 2016 and will be monitored next year. In addition, there is an additional upland area east of the Well's trailhead that was used as a staging area for equipment used in the Three Kids Weir construction. This area will be planted in 2017.

This part of the Wash was one of the most incised and as a result, the upland areas are 30 or more feet off the floodplain of the Wash. This results in the areas being very dry and will likely not see very high plant cover. Both Lower Narrows Homestead South 1 and 2 have 50-75% total cover with the vast majority of it coming from a single species, four-wing saltbush (*Atriplex canescens* var. *canescens*). Some additional plantings will take place in 2016 and 2017 to increase diversity on the sites. With the harsh conditions better understood, appropriate plant material will be more likely to succeed.

Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
LNW	4	1.79	wet	75-100%	nm	nm	nm
HW	4	4.47	wet	75-100%	nm	nm	nm
LNHE	4	4.79	wet	75-100%	1.7%	36	1.61
LNHN	4	40.52	non-wet	75-100%	0.0%	12	3.93
LNHS1	4	7.31	non-wet	50-75%	0.0%	8	4.97
LNHS2	3	6.58	non-wet	50-75%	0.0%	9	4.95

<sup>1</sup>LNHE=Lower Narrows Homestead Emergent, LNHN=Lower Narrows Homestead North, LNHS1=Lower Narrows Homestead South 1, LNHS2=Lower Narrows Homestead South 2

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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 Lower Narrows and Homestead Weirs revegetation sites in 2015.**



**Figure 19.** The Homestead Weir had nearly four and a half acres of vegetation established on it in 2015.

### 3.11 Monson and Visitor Center Weirs

None of the four revegetation sites at the Monson and Visitor Center Weirs were monitored in the field in 2015 (Table 13; Figures 23 and 24). In 2015, these sites were in their thirteenth growing season and therefore do not change in many respects on an annual basis without flooding, or some man-made impacts. In 2016, there was increased sediment deposition and flooding along the Upper Diversion Bridge upstream of these sites. As a result work will be done to return designed flows to the Wash and Eastern Bypass Channel in 2016. In addition, work is being done on the Clark County Water Reclamation District property also upstream of these sites. The work being done on that property will also alter flow patterns. Future monitoring will hopefully show any impacts to these and other revegetation sites.

Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
DMN	13	3.85	non-wet	75-100%	nm	nm	nm
DMN	13	1.22	wet	75-100%	nm	nm	nm
DMS	13	2.99	non-wet	75-100%	nm	nm	nm
DMS	13	0.73	wet	75-100%	nm	nm	nm

<sup>1</sup>DMN=Downstream Monson North, DMS=Downstream Monson South

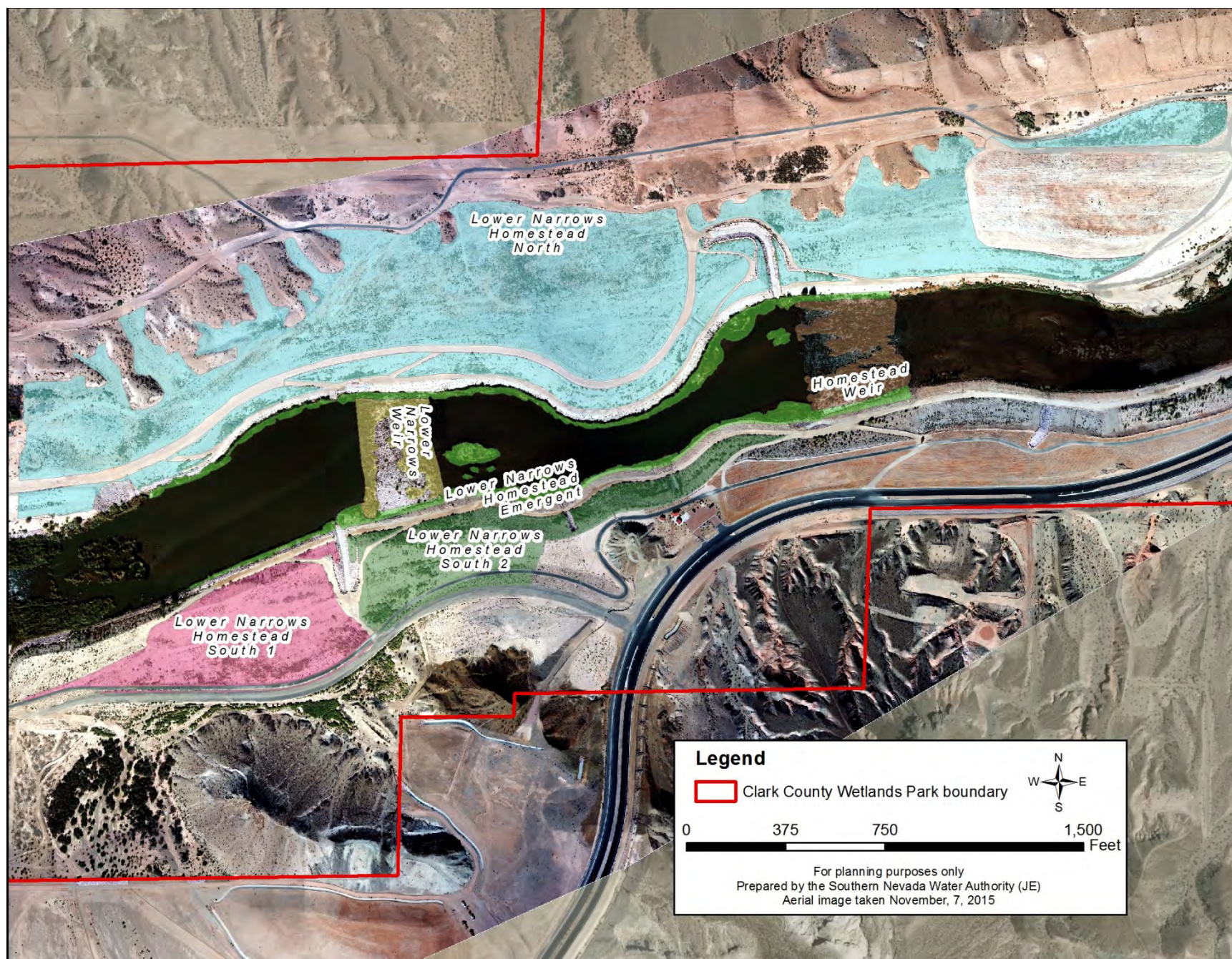
<sup>2</sup>Wetland status resulting from a JD (i.e., jurisdictional determination) conducted according to the Corps' 1987 Wetland Delineation Manual. "wet" = wetland and "non-wet" = non-wetland

<sup>3</sup>Wetland 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

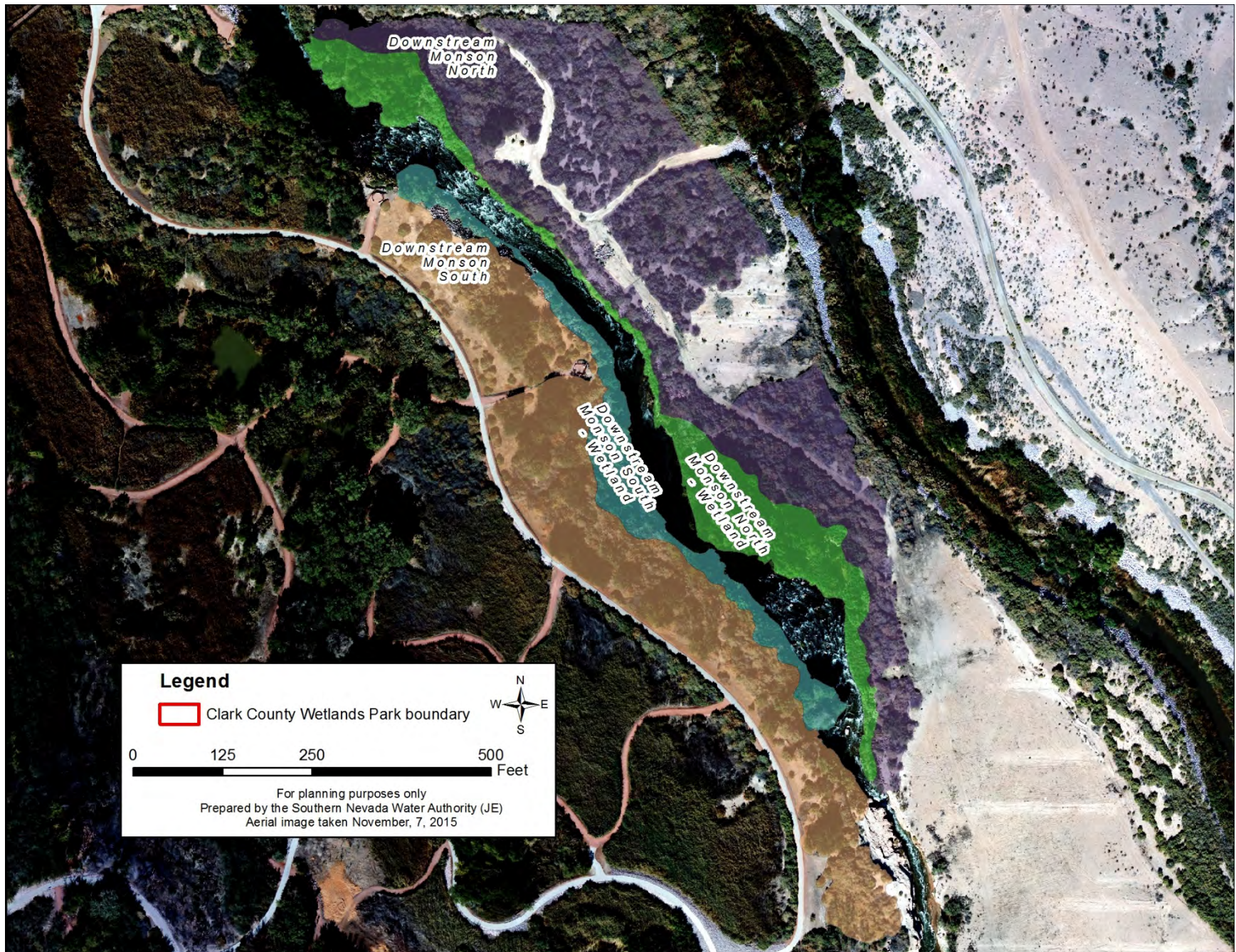
**Table 13.** Vegetation monitoring results for the Monson and Visitor Center Weirs revegetation sites in 2015.





**Figure 20. Aerial photograph of 2015 delineated Lower Narrows and Homestead Weirs revegetation sites.**





**Figure 21. Aerial photograph of 2015 delineated Monson and Visitor Center Weirs revegetation sites.**



### 3.12 Pabco Road Weir

Many of the oldest revegetation sites along the Wash are near the Pabco Road Weir (Figures 25 and 26; Table 14). There are fourteen sites associated with this weir. Two of the sites are new in 2016 in terms of monitoring but are as old as the oldest revegetation sites, 15 growing seasons. Downstream Pabco Island and Upstream Pabco Island are passively created wetland sites that grew as a result of sedimentation upstream and downstream of the weir. Attempts have been made to remove the islands due to the altering flows impacting bank protection of the Wash, but they often return. Their cover was determined using ArcGIS.

In 2014, the majority of Upstream Pabco South Lower Plateau, part of Upstream Pabco South, was removed in preparation of the construction of the Sunrise Mountain Weir as well as to improve flows over the Pabco Road Weir. Due to the delay in the project, much of the vegetation has returned although the trees have not reached their previous height. Also in 2014, a bike trail was completed to the south of many revegetation sites. It was feared that this would increase trash and vandalism on the sites. Although it did result in much more visitation from the public, there has not been a substantial increase in trash as a result of more people frequenting the sites.

Only three of the fourteen sites did not have the maximum total cover value in 2015 of 75-100%. These are three of the younger sites, Downstream Pabco North planted in 2009, and Downstream Pabco South Upper Plateau and Downstream Pabco South Upper Bank, both planted in 2011. These sites are also the furthest from the Wash of all the sites at Pabco Road Weir which explains their lower total cover. However, their total cover is still very high and stable, which are criteria for calling them successful revegetation sites.



**Figure 22. Mature cottonwood trees fill the Downstream Pabco South revegetation site in 2015.**



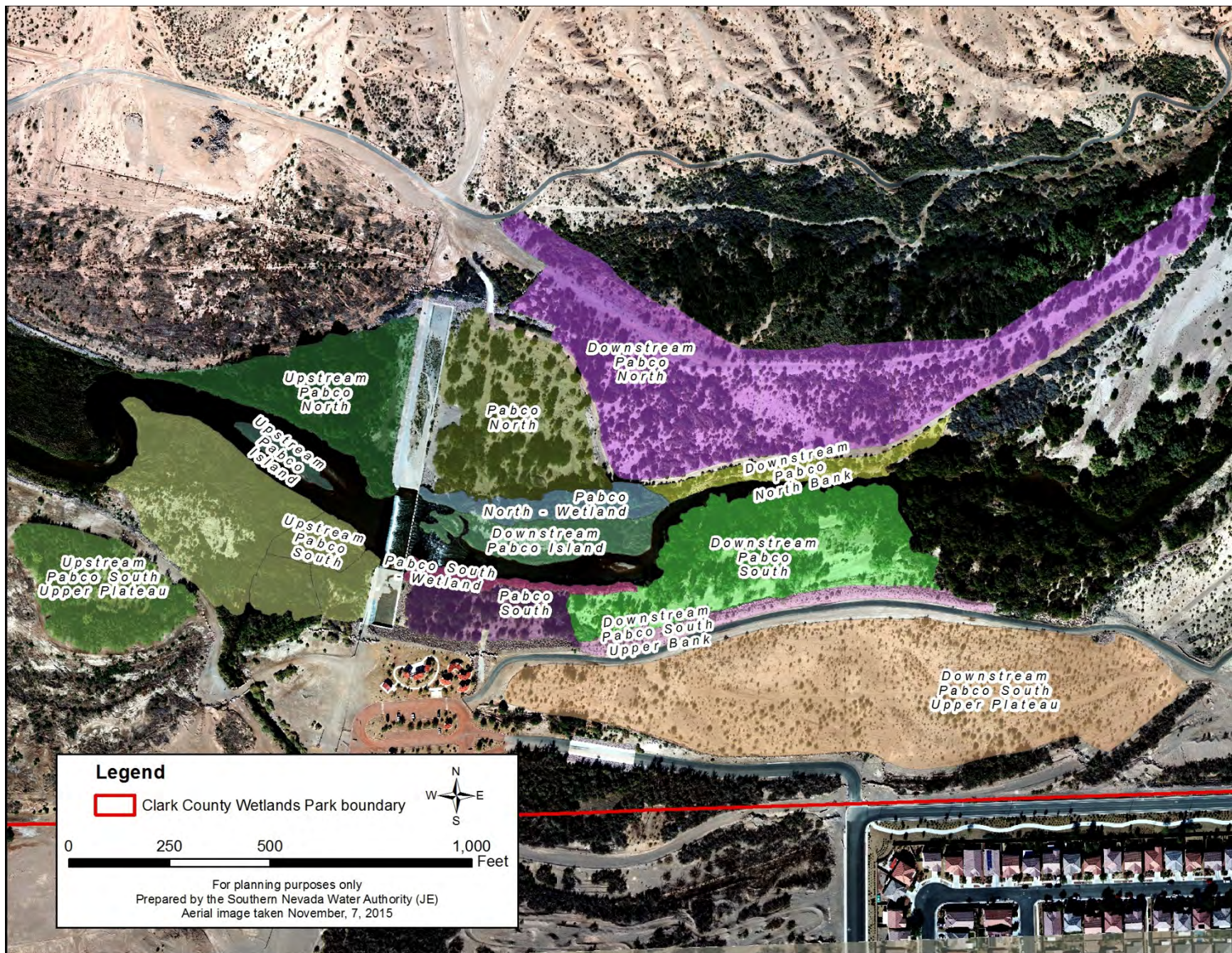


Figure 23. Aerial photograph of 2015 delineated Pabco Road Weir revegetation sites.



Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
DPI	15	1.09	wet	75-100%	nm	nm	nm
DPN	7	9.41	non-wet	75.1%	0.0%	19	4.43
DPNB	4	0.76	wet	75-100%	0.2%	32	3.82
DPS	15	4.28	wet	75-100%	2.5%	19	2.60
DPSUB	5	0.89	non-wet	25-50%	nm	nm	nm
DPSUP	5	9.86	non-wet	50-75%	1.4%	25	4.40
PN	15	3.34	non-wet	50-75%	nm	nm	nm
PN	15	0.84	wet	75-100%	nm	nm	nm
PS	15	1.19	non-wet	75-100%	nm	nm	nm
PS	15	0.39	wet	75-100%	nm	nm	nm
UPI	15	0.29	wet	75-100%	nm	nm	nm
UPN	10	2.71	wet	75-100%	5.5%	25	2.16
UPS*	14	4.58	wet	75-100%	4.3%	35	2.20
UPSUP	14	2.17	non-wet	75-100%	0.5%	10	3.29

<sup>1</sup>PN=Pabco North, PS=Pabco South, UPS=Upstream Pabco South, UPN=Upstream Pabco North, UPSUP=Upstream Pabco South Upper Plateau, DPS=Downstream Pabco South, DPN=Downstream Pabco North, DPSUP=Downstream Pabco South Upper Plateau, DPNB=Downstream Pabco North Bank

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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 14. Vegetation monitoring results for Pabco Road Weir revegetation sites in 2015.**

### 3.13 Powerline Crossing Weir

In their ninth growing season, nine of the ten revegetation sites at the Powerline Crossing Weir were monitored in the field for all plant attributes in 2015 (Figure 27; Table 15). The exception was Powerline Crossing Weir, a passively created wetland that formed on the weir itself. This area is not accessible to obtain species data. All of the wetland sites had the maximum cover value of 75-100%, which was the same as 2014. The four non-wetland sites either stayed the same as in 2015 or increased in total cover. Most of the sites at Powerline Crossing Weir have reached their maturity and don't have substantial changes on an annual basis. The exception in 2015 was Upstream Powerline South Plateau. This non-wetland site is broken up into four monitoring areas with the total site cover being made up of a weighted average of the four parts. The 2014 cover, measured by ArcGIS, was 45.4%. This was down from 2013 where it was 57.6%, which was derived from in-field observations. In 2015, the total cover substantially increased to 71.8%. This can almost completely be attributed to an equally large increase in the cover of four-wing saltbush (*Atriplex canescens* var. *canescens*). Four-wing saltbush is the dominant plant on most of the non-wetland sites at this weir.



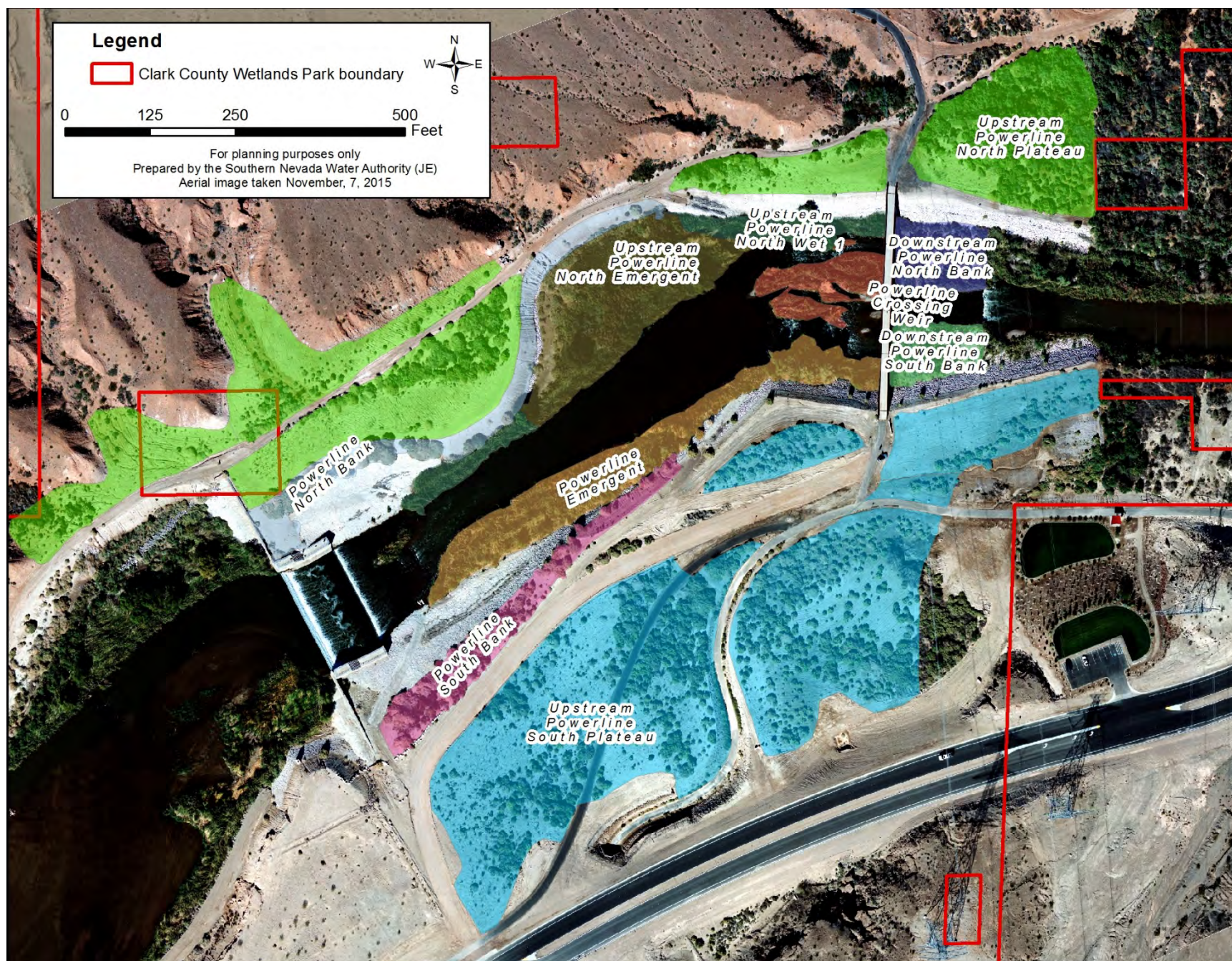


Figure 24. Aerial photograph of 2015 delineated Powerline Crossing Weir revegetation sites.



Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
DPLNB	9	0.31	wet	75-100%	15.0%	12	2.58
DPLSB	9	0.25	wet	75-100%	15.0%	10	2.32
PCW	9	0.29	wet	75-100%	nm	nm	nm
PLSB	9	0.56	non-wet	75-100%	0.0%	4	2.21
UPLNB	9	0.64	non-wet	5-25%	0.0%	4	3.03
UPLNE	9	1.08	wet	75-100%	2.5%	11	2.58
UPLNP	9	4.09	non-wet	54.0%	0.1%	14	3.46
UPLNW	9	0.40	wet	75-100%	0.4%	9	2.01
UPLSB	9	0.92	wet	75-100%	2.5%	11	2.05
UPLSP	9	5.61	non-wet	71.8%	0.0%	7	4.71

<sup>1</sup>DPLNB=Downstream Powerline North Bank, DPLSB=Downstream Powerline South Bank, UPLNW=Upstream Powerline North Wetland, UPLNP=Upstream Powerline North Plateau, UPLSP=Upstream Powerline South Plateau, UPLNE=Upstream Powerline North Emergent, UPLSB=Upstream Powerline South Bank, PLSB=Powerline South Bank, UPLNB=Upstream Powerline North Bank

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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 15. Vegetation monitoring results for Powerline Crossing Weir revegetation sites in 2015.**



**Figure 25. Riparian and wetland revegetation sites at the Powerline Crossing Weir have varied structure in 2015.**



### 3.14 Rainbow Gardens Weir

Only one of the seven revegetation sites at the Rainbow Gardens Weir (Table XX; Figure XX) was monitored in the field in 2015, Upstream Rainbow North Bank. This site was hydroseeded in the spring of 2010 and had 25-50% total cover in both 2014 and 2015. Substantial removal of vegetation took place in 2015 on a number of wetland sites including Rainbow Islands and Upstream Rainbow South Emergent. These are captured in the acreages but not in plant specific information as the total cover, derived from ArcGIS did not change from the previous year. The activity resulted in not having physical access to the sites during the monitoring time frame. Rainbow Islands was reduced from 3.69 acres in 2014 to 0.58 acres in 2015.

There was one additional revegetation site added to monitoring in 2015 at Rainbow Gardens Weir; Upstream Rainbow Island. This area was formerly part of the north bank of the Wash. When the recently completed Three Kids Weir, upstream of the Rainbow Gardens Weir, was completed, it widened the Wash channel and the new flows created this island which has since filled in with wetland vegetation.

Site Code <sup>1</sup>	Growing Season	Acreage	Wetland Status <sup>2</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>3</sup>
RI	11	0.58	wet	75-100%	nm	nm	nm
URI	11	1.21	wet	75-100%	nm	nm	nm
URNB	6	1.58	non-wet	25-50%	0.5%	6	3.94
URNPW	11	1.96	wet	75-100%	nm	nm	nm
URSB	10	0.02	non-wet	75-100%	nm	nm	nm
URSE	11	0.60	wet	75-100%	nm	nm	nm
URSP	10	1.39	non-wet	5-25%	nm	nm	nm

<sup>1</sup>RI=Rainbow Islands, URI=Upstream Rainbow Island, URNB=Upstream Rainbow North Bank, URNPW=Upstream Rainbow North Passive Wetlands, URSB=Upstream Rainbow South Bank, URSE=Upstream Rainbow South Emergent, URSP= Upstream Rainbow South Plateau

<sup>2</sup>Wetland 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

<sup>3</sup>Wetland 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 Rainbow Gardens Weir revegetation sites in 2015.**



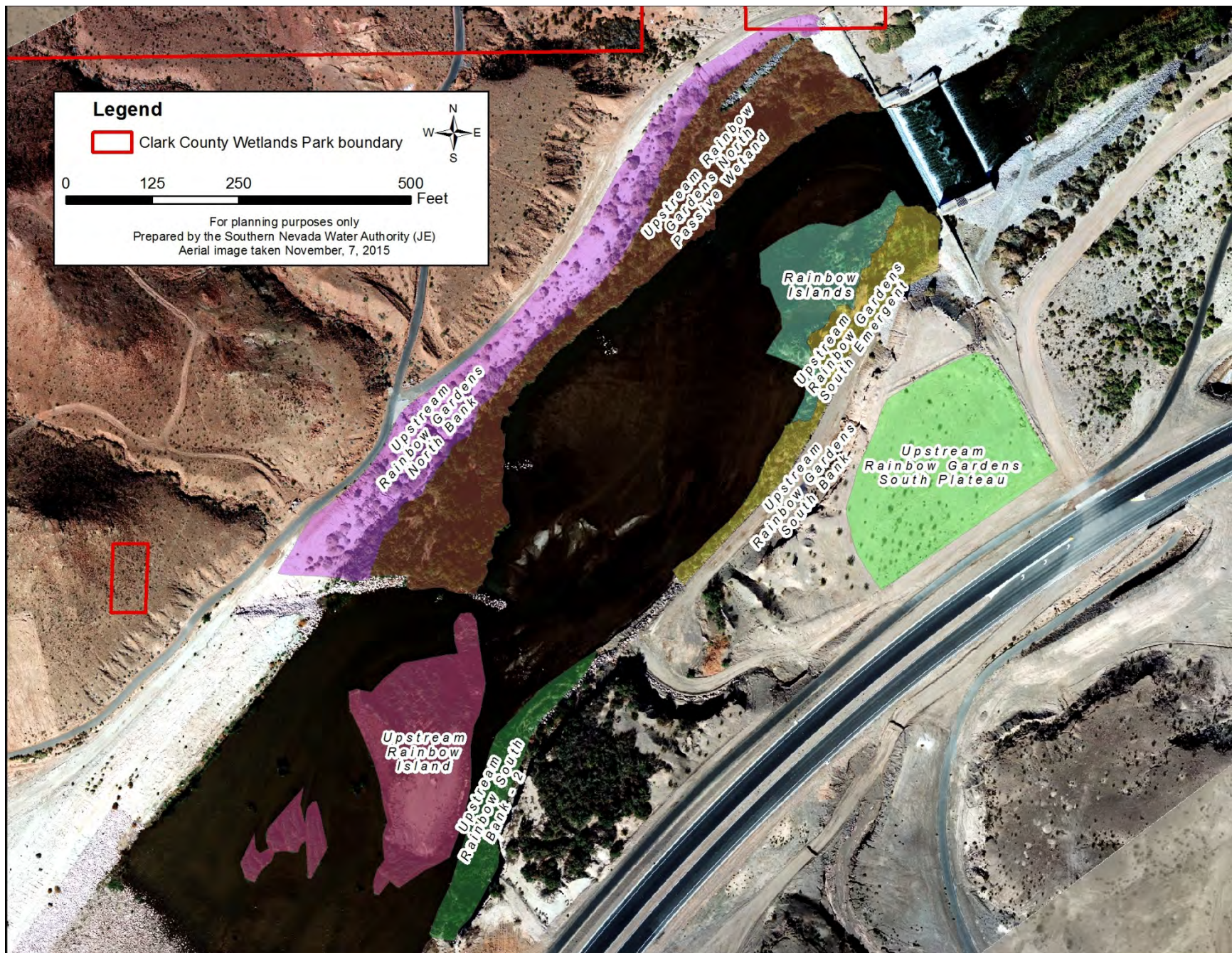


Figure 26. Aerial photograph of 2015 delineated Rainbow Gardens Weir revegetation sites.



### 3.15 Site 108

All of Site 108 was monitored for total cover using ArcGIS in 2015. (Figure 31). There were 59 monitoring areas throughout the 40-acre site with the total cover being a weighted average of each monitoring area's cover based on acreage. The total cover in 2015 was similar to that of 2014, which was derived using field observations, down 0.4% from 64.4% to 64%.

Funding Areas	Growing Season <sup>3</sup>	Acreage	Wetland Status <sup>1</sup>	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>2</sup>
NDEP	9	5.72	non-wet	54.6%	nm	nm	nm
NDSP	9	12.57	non-wet	76.4%	nm	nm	nm
SNPLMA IV	8 – 9	9.89	non-wet	65.1%	nm	nm	nm
SNPLMA V	8 – 9	11.84	non-wet	52.9%	nm	nm	nm
TOTAL	8 – 9	40.90	non-wet	64.0%	nm	nm	nm

<sup>1</sup>Wetland 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

<sup>2</sup>Wetland 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

<sup>3</sup>Portions 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 17. Vegetation monitoring results for Site 108 revegetation site in 2015.**

### 3.16 Site 111

Site 111, in its ninth growing season, was monitored for total cover using ArcGIS in 2015. The nearly 15 acre site is very mature (Table XX; Figure XX). The total cover has not changed very much for many years. The 2015 total cover was only 0.2% less than that of 2014; 75.5% and 75.7% respectively. This further validates the accuracy of both field and ArcGIS methods for determining the total vegetative cover of sites when they consistently achieve very similar results.

Site Code	Growing Season	Acreage	Wetland Status	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>2</sup>
S111	9	14.93	non-wet	75.5%	nm	nm	nm

<sup>1</sup>Wetland 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

<sup>2</sup>Wetland 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 Site 111 revegetation site in 2015.**



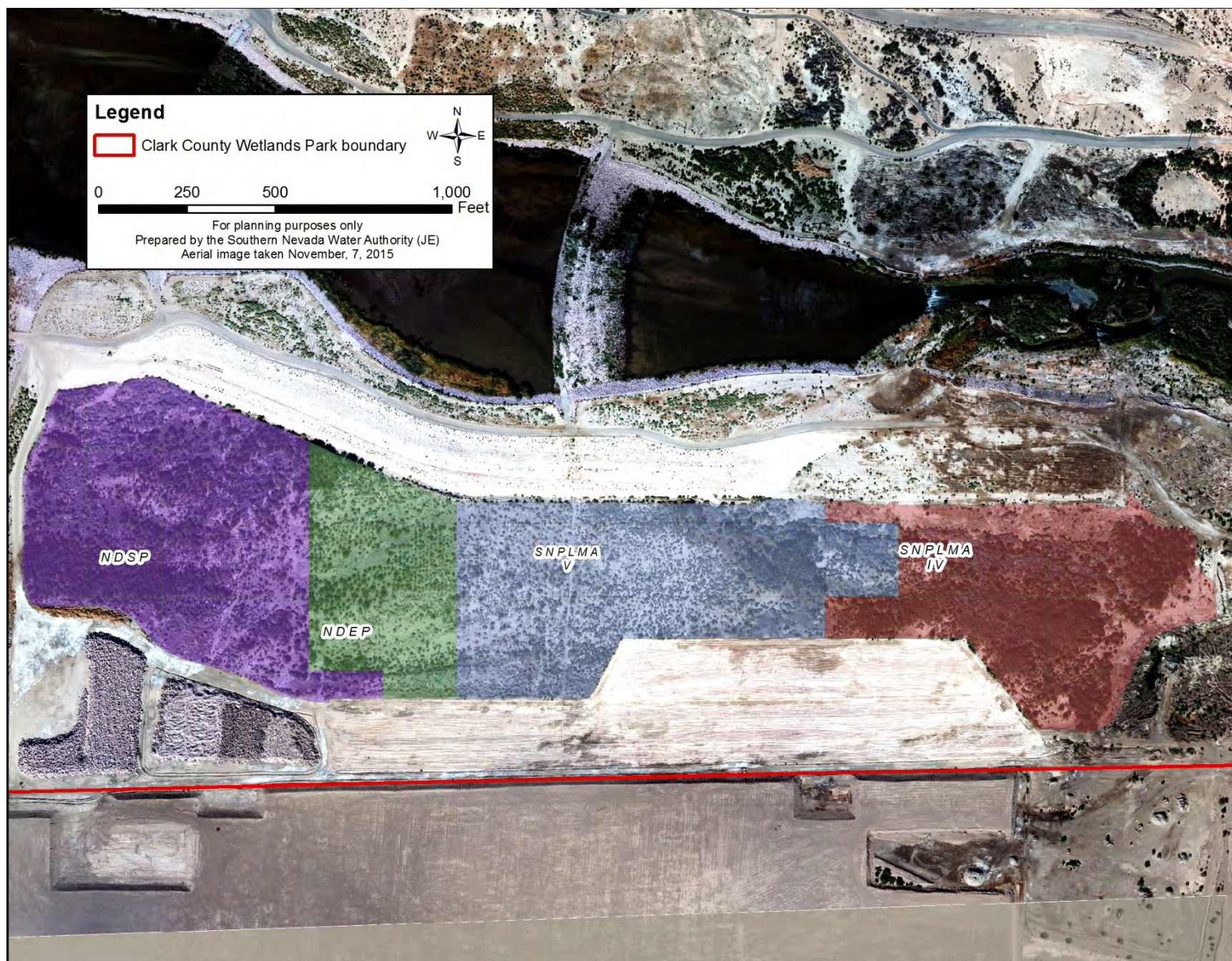
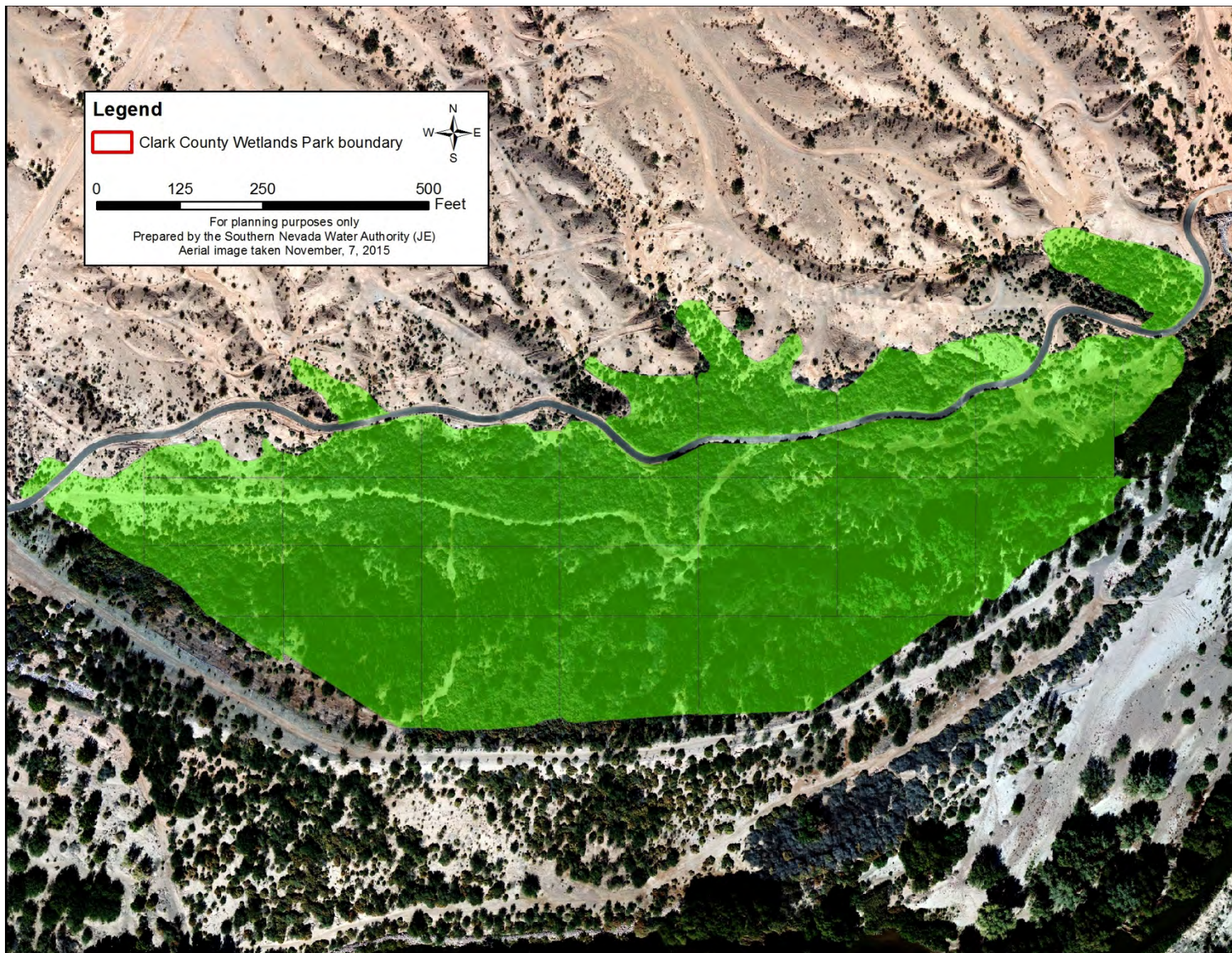


Figure 27. Aerial photograph of Site 108 with 2015 delineations based on funding source.





**Figure 28. Aerial photograph of the 2015 delineated Site 111 revegetation site.**



### 3.17 Upper Diversion Weir

All eight revegetation sites at the Upper Diversion Weir were in their seventh growing season in 2015 (Table 19; Figure 35) and all monitored for total vegetative cover using ArcGIS. All of the sites, with the exception of two of the three monitoring areas of Downstream Upper Diversion North (DUDN), had the maximum total cover value of 75-100%. All of the revegetation sites at Upper Diversion had the same total cover as in 2014 with the slight difference in DUDN which was 0.1% higher. Each monitoring area within DUDN had the same total cover but because of minor changes in the size of the sites, the weighted average resulted in a minor change.

Site Code	Growing Season	Acreage	Wetland Status	Total Cover	Noxious Species Cover	Number of Species	WPI <sup>2</sup>
DUDE	7	4.63	wet	75-100%	nm	nm	nm
DUDN	7	9.60	non-wet	71.7%	nm	nm	nm
DUDS	7	1.42	wet	75-100%	nm	nm	nm
UDI	7	5.05	non-wet	75-100%	nm	nm	nm
UDIE	7	0.20	wet	75-100%	nm	nm	nm
UUDE	7	3.65	wet	75-100%	nm	nm	nm
UUDS	7	0.76	non-wet	75-100%	nm	nm	nm
UDIS	7	0.22	non-wet	75-100%	nm	nm	nm

<sup>1</sup>DUDE=Downstream Upper Diversion Emergent, DUDN=Downstream Upper Diversion North, DUDS=Downstream Upper Diversion Shelves, UDI=Upper Diversion Island, UUDE=Upstream Upper Diversion Emergent, UDIE=Upper Diversion Island Emergent, UUDE=Upstream Upper Diversion Emergent, UDIS=Upstream Upper Diversion Island South

<sup>1</sup>Wetland 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

<sup>2</sup>Wetland 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 19. Vegetation monitoring results for Upper Diversion Weir revegetation sites in 2015.**

## 4.0 CONCLUSIONS

The status of revegetation sites along the Wash in 2014 demonstrates success in terms of growing plant cover, plant survivorship, reduction of noxious weeds, and overall ecological health. Of the 112 total sites monitored in 2014 and 2015, (S108, S111, and CCWRD are considered one site each), 69 (61.6%) had the same cover in both years, 10 (8.9%) increased in cover, and 19 (17.0%) decreased in cover. The remaining 14 (12.5%) sites were first monitored in 2015, many of which were passively created wetlands that existed prior to 2015 but were not monitored for vegetative cover prior to this year.



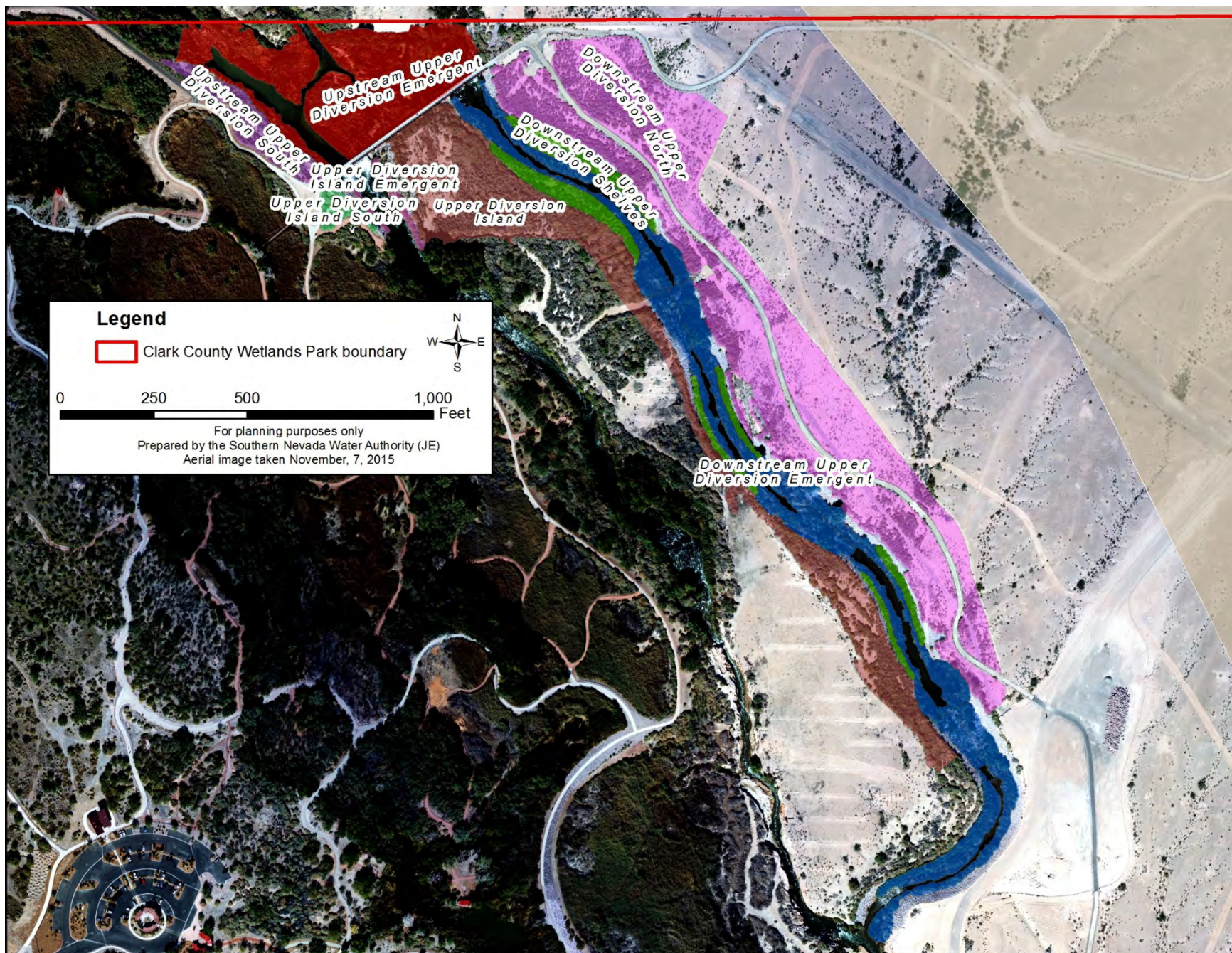


Figure 29. Aerial photograph of 2015 delineated Upper Diversion Weir revegetation sites.



## 5.0 LITERATURE CITED

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