# First Year Annual Report (2000) for the Kingman Marsh Vegetation Monitoring Project


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***First Year Annual Report (2000) for the Kingman Marsh Vegetation Monitoring Project***

The Kingman Marsh Vegetation Monitoring Project (KMVMP) being conducted in partnership between the USGS Patuxent Wildlife Research Center (PWRC) and the University of Maryland Biological Resources Engineering Department (U. of Md.) with assistance from the National Park Service (NPS) and the U.S. Army Corps of Engineers (COE) is on schedule. This First Year Annual Report is being prepared for the COE as one of the task elements of the KMVMP being funded by the COE. The KMVMP is a 5-year effort and is being supported by direct funding from the COE, direct and in-kind funding by PWRC and in-kind support by U. of Md. Such total project funding amounts to $600,000.

Details concerning the project concept and much of the methodology may be found in the peer-reviewed Study Plan included as Appendix A and the Scope of Work provided to the COE. This Annual Report will cover results from the first year of fieldwork (2000) for the task elements dealing with (1) vegetation, (2) seed bank, and (3) soils. The goals of this work include evaluating the marsh over time in terms of resemblance to reference wetlands and to Kenilworth Marsh which had been similarly reconstructed 7 years prior in 1993 (Syphax and Hammerschlag 1995). The primary question to be addressed is whether the marsh reconstruction has been successful. Evaluation of the subject elements may also establish which wetland components need additional attention in subsequent restoration projects. It is expected that elements of what we have learned from this project may serve as a model for subsequent projects.

***1. Vegetation***

The vegetation cover component of the KMVMP was designed to address three sampling periods in each of the five study years (2000-2004): roughly mid-May, mid-July and mid-September to capture seasonal differences. Since the reconstruction phase of work at Kingman was still very much in earnest during May 2000 (in fact much of the sediment was not yet in place!!!), that sampling period could not be conducted.

For the July sampling period at Kingman a comprehensive but not complete set of transects was used. Transect locations had been determined by a random location selection method based upon the project plan. As it turned out the reconstruction did not actually complete the plan and even in July the final portions of the reconstruction effort were still ongoing. Thus one transect location in Area 1 (Cell 1) at Kingman was not planted since the target sediment level was not achieved there and this transect had to be relocated for the rest of the study (Transect 8). Approximate locations of the Kingman Marsh Area 1 transects are provided in Map 1 (See “allmaps.ppt” after References). Three transects at the far northern portion of Area 1 were planned but were not sampled in July because the site was not yet reconstructed. However, these transect locations have been installed for the course of the study starting in 2001 (Transects 11 and 12, planted, and Transect U3, unplanted). Only one planted transect (#11) at this northern end was sampled in September. Thus, 12 belt transects (each 35 meters by 1 meter) in planted portions and 3 in unplanted portions were ultimately established in Area 1. Three planted transects were established in the smaller Area 2 (Cell 2) portion of Kingman (Map 2).

Three comparison wetlands were also monitored in 2000: Kenilworth Marsh, Dueling Creek, and Patuxent Marsh. Three transects were read in Mass Fill 1 (MF1) and five in Mass Fill 2 (MF 2) of Kenilworth Marsh – all of which were pre-established having been used before for the Kenilworth Marsh studies (Map 3). These transects provide a reference for a similarly reconstructed (1993- seven years prior to Kingman) urban freshwater tidal marsh in the Anacostia and were of the same configuration as used for the Kingman Marsh monitoring. Three transects were utilized at Dueling Creek, the last remaining section of freshwater tidal marsh in the Anacostia (Map 4). One transect was from prior work in conjunction with the Kenilworth study effort, two were newly established. As a reference site, six transects were located within the similar nearby Patuxent freshwater tidal wetland near the Route 4 bridge (Map 4).

GPS was used to locate the start point of each transect; transect orientation was recorded as a compass direction from the start point. The start and end points of each transect have also been staked and marked in the field using 1" diameter gray plastic poles pushed well into the marsh sediment so that the aerial portion extends vertically about 6'.

Browsing pressure from the resident goose and other waterfowl population on the newly planted vegetation was so intense that it became necessary to install protective goose fencing. As a result, 4' high fencing was installed in approximately 30' by 50' corrals. Although the exclusionary fencing worked pretty well, there were still portions of the marsh that suffered browse damage either because they had been somewhat browsed and not replanted before fencing, some fence sections collapsed from weather and others were even knocked down by geese, while in some instances geese or mallards did fly into the planted areas. Notes were taken as to where browse was evident but in some cases the situation may also involve stress or setback and the browse impact that is there is just not that obvious/measurable. Recently (May, 2001) all the transects and their sectors have been surveyed for relative elevations which we will try to tie into benchmarks for absolute elevations.

In order to characterize the initial plant colonization at Kingman from the vegetation data, species abundance, cover, frequency of occurrence, and diversity will be calculated for each transect. Other factors considered for each species will include native or introduced, annual or perennial, and the wetland indicator status. These results will be combined to compare planted to unplanted areas within Kingman Lake and the different wetland sites. Repeated measures analysis of variance will be used to determine any significant differences in species abundance, richness, diversity, etc. between wetlands, between treatments, and for different sampling times. Repeated measures analysis of variance will be used to determine significant differences between biomass of individual species as well as total biomass of planted and unplanted sites, between sites, and for different years. While this report will not include statistical analyses of data that would determine, for example, any important difference between sites, we will present data summaries concerning the vegetation and make several observations accordingly. The statistical work is being performed but could not be ready in the time frame for this report and in fact probably will be more revealing when used in combination with the Year 2 data.

### *1A. Species Lists and Cover*

Lists of species (Appendix B) were compiled and compared in several ways (Table 1) for Kingman Marsh and the comparison wetlands, Kenilworth (MF 1 and MF 2), Dueling and Patuxent (PAX). At Kingman Marsh a total of 95 species was detected using the eighteen 35 meter long and 1 meter wide (belt) transects from Area 1 and Area 2 (Appendix B1 Transects and Table 1) during the two sampling periods (July and September) in 2000. Thirty-one additional species were found during walk-throughs of the marsh in non-transect areas (Appendix B1 Non-transects). Altogether 126 species were noted for the whole marsh (Appendix B1 Whole Marsh). The whole marsh relates to all of Areas 1 and 2 aside from the southern portion of Area 1 which the National Park Service has preferred to remain exempt from human interference and study. Kingman Marsh was compared to the comparison wetlands using only transect data as the common basis. While data was collected for planted and unplanted portions of Area 1, since Area 2 had no unplanted areas per se the best comparisons would be using the data from the planted portions of Area 1. In this way Kingman Area 1 had 71 species, Kingman Area 2 had 52 species, Kenilworth MF1 had 27 species, Kenilworth MF 2 had 29 species, Dueling had 29 species and Patuxent had 41 species (Table1). The plant species were compared in other ways in this Table and will be discussed in other portions of this report.

Since Kingman Marsh Area 2 (KL2) was the smaller of the two reconstructed Kingman sites (~5 acres), it was reconstructed first and planted in June. Kingman Marsh Area 1 (KL1, ~ 30 acres) was not reconstructed or planted until July. Thus, it should not be surprising to find that in the middle of July when the 3 transects were read at KL2 the total vegetation cover was close to 50% (Fig. 1; See "klcvr.jnb" after References for Figures 1-7). Of this only about 11% was provided by 3 of the 7 seven planted species: *Pontederia cordata* (PONCOR, pickerelweed), *Schoenoplectus tabernaemontani* (SCHTAB, softstem bulrush) and *Sagittaria latifolia* (SAGLAT, broadleaf arrowhead). The remaining 39% was contributed by pioneer volunteer species led by the low-growing *Ludwigia palustris* (LUDPAL, marsh seedbox) and *Eleocharis obtusa* (ELEOBT, blunt spikerush). Recall that the planted vegetation were placed on 2ft. centers and were about 3-6'' tall when planted (pulled from flats). By September, however, there was over 125% vegetation cover (since more than one stratum) with but 1% "No Cover" (unvegetated) and with the 3 planted species supplying about 56% of the cover total.

In comparison the planted portion of Area 1 (KL1) had almost 75% "No Cover" (25% cover) in July with no species contributing more than 6% cover while the 3 mentioned planted species (PONCOR, SCHTAB and SAGLAT) plus the planted *Peltandra virginica* (PELVIR, green arrow arum) combined for 6% cover (Fig 2). By September the no cover (uncovered) area reduced to about 22% and ten species had more than 3% cover with five including PONCOR and SCHTAB each yielding more than 6% cover. Other important species were LUDPAL (11%), *Cyperus erythrorhizos* (CYPERY, redroot flatsedge)(10%) and *Salix nigra* (SALNIG, black willow)(9%). Two sites in Area 1 were deliberately not planted, theoretically as a means to determine what the contribution to vegetation cover was made by volunteer species. Unfortunately, the sites may not prove to be typical pending elevation determinations since one seemed higher than mid-marsh and

**Table 1**
**Summary of Plant Species Characteristics**
**Kingman and Comparison Wetlands**
**2000**

| | KINGMAN OVERVIEW Areas 1 & 2 Combined | | | KINGMAN AND COMPARISON WETLANDS TRANSECT DATA | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Kingman | | | Kenilworth | | Dueling Creek | Patuxent |
| | | | | Area 1 | | Area 2 | MF1 | MF2 | | |
| | Transects | Non-Transect[1] | Whole Marsh | Planted | Unplanted | | | | | |
| **Total No. Species** | 95 | 31 | 126 | 71 | 61 | 52 | 27 | 29 | 29 | 41 |
| **Origin** | | | | | | | | | | |
| Native (%) | 82 | 48 | 74 | 84 | 80 | 80 | 92 | 90 | 86 | 98 |
| Introduced (%) | 18 | 52 | 26 | 16 | 20 | 20 | 8 | 10 | 14 | 3 |
| **Duration** | | | | | | | | | | |
| Perennial (%) | 54 | 61 | 56 | 54 | 54 | 54 | 81 | 76 | 82 | 73 |
| Annual (%) | 27 | 23 | 26 | 25 | 28 | 22 | 12 | 17 | 11 | 13 |
| Annual/Perennial (%) | 16 | 3 | 13 | 18 | 15 | 18 | 8 | 7 | 7 | 15 |
| Biennial (%) | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other Combinations (%) | 3 | 10 | 5 | 3 | 3 | 6 | 0 | 0 | 0 | 0 |
| **Habit** | | | | | | | | | | |
| Forb/Herb (%) | 61 | 48 | 58 | 56 | 59 | 58 | 44 | 52 | 45 | 66 |
| Graminoid (%) | 32 | 19 | 29 | 35 | 36 | 38 | 37 | 38 | 34 | 22 |
| Vine (%) | 3 | 6 | 4 | 4 | 0 | 0 | 15 | 3 | 17 | 10 |
| Shrub/Subshrub (%) | 0 | 6 | 2 | 0 | 0 | 0 | 4 | 3 | 0 | 2 |
| Tree (%) | 4 | 19 | 8 | 4 | 5 | 4 | 0 | 3 | 3 | 0 |
| **NWI Indicator Status** | | | | | | | | | | |
| FACW or wetter (%) | 70 | 39 | 62 | 74 | 70 | 80 | 96 | 97 | 93 | 93 |
| Other (%) | 30 | 61 | 38 | 26 | 30 | 20 | 4 | 3 | 7 | 8 |

[1] Based only on species found in the marsh, but not in the transects.

the other appeared lower than mid-marsh. In July, 68% of the higher-elevation site was unvegetated, with LUDPAL providing about 20% cover (Fig. 3). SALNIG and *Lythrum salicaria* (LYTSAL, purple loosestrife) were each less than 5%. By September this unplanted site reduced to 40% "No Cover," while LUDPAL increased to 35% cover, SALNIG to 11%, LYTSAL to 7%, P*anicum dichotomiflorum* (PANDIC, fall panicgrass) to 6% while TYPSPP, SAGLAT and *Juncus effusus* (JUNEFF, common rush) were less than 3%. Excluding *Nuphar*, the unplanted area contained 3 of 6 planted species: PONCOR, SAGLAT and JUNEFF although at this young time frame in lesser cover amounts than the planted area. That is of the planted species, these 3 species at least, were likely in the seed bank and volunteered in the unplanted area. The lower elevation unplanted area was not finished in July and basically had no cover in September.

Kenilworth Marsh MF 1, which has considerable wetland extent above mean high tide, in 2000 was in its 7th year since reconstruction. With Kingman Marsh just commencing its vegetation process in 2000 there is not much point at this time to try to compare Kenilworth directly to Kingman. Vegetation cover at MF1, which is a composite of 3 transects, was close to 100% in both July and September (Fig. 4). For July, *Typha* spp (including T. *latifolia*, *angustifolia* and *glauca*, which are all present, but difficult at best to consistently sort them out much of the time) yielded an extremely high cover value of over 30%. If this cover level holds it would mark a significant increase almost to the point of nuisance invasion. Note that *Typha* level had dropped by September but some of its presence still occurs in the detritus category since contribution by dead stalks of *Typha* were counted as detritus. *Leersia oryzoides* (LEEORY, rice cutgrass) remained an important species yielding over 20% cover. Unfortunately *Phragmites* cover also seems to be dramatically increasing with almost 15% cover in July and about twice that in September!! *Sagittaria* levels reflected its strategy of maturing during the summer (18% cover) and dying off before Fall (1% cover). As already observed, detritus contributed over 20% to cover in the Fall of 2000 at Kenilworth. This is a higher level than recorded for prior years and may be a function of the weather pattern. Data from the next few years will have to be evaluated as to whether this is an anomaly or for real. Important contributions to cover in the 5-10% range were made by *Phalaris arundinacea* (*PHAARU,* reed canarygrass*), Mikania scandens (*MIKSCA, climbing hempweed*), Impatiens capensis* (IMPCAP, jewelweed) and *P. virginica*.

Kenilworth Marsh MF2 lies mostly at mid-marsh elevation as determined by mean high tide. During its first five years following reconstruction (1993-1997) the species distribution tended to be even and diverse. The data from 2000 which is a composite of 5 transects suggests a shift toward *Typha* (5% July, 11% September) and *Phragmites* (just over 20% in July and September) cover with less of a shift from previous year cover by *Schoenoplectus fluviatilis* (SCHFLU, river bulrush) (Fig. 5). *Leersia* displayed seasonal increase from July to September while *Sagittaria* showed a seasonal decrease. Purple loosestrife (LYTSAL) appears to remain non-invasive in MF 2 with a cover of less than 3%. Partially from developing tidal guts and also perhaps from self-shading the no cover component of the Marsh exceeded 10% in both July and September.

The Dueling Creek site serves as a reference as a last remaining relict piece of tidal wetland in the Anacostia. It originally was part of the Anacostia tidal channel until it was cut off by landfilling and straightening of the Anacostia channel to Bladensburg. The Dueling Creek Marsh is clearly dominated by a matrix of *Leersia oryzoides* that provides about 50% cover (Fig. 6). After that there is a suite of species that tends to fall in the 5 to 10% cover range. These species include *Impatiens capensis, Polygonum sagittaria* and *P. arifolium ((POLSAG* and *POLARI*, arrowleaf and halberdleaf tearthumbs), *M. scandens, P. arundinacea, P. punctatum (POLPUN,* dotted smartweed*), L. salicaria, P. virginica, Sparganium eurocarpum* (SPAEUR, broadfruit bur-reed) and *Typha* species. This pattern of vegetation cover might well represent the best current target for Kingman and Kenilworth. However, it is lacking in *Zizania aquatica* (annual wild rice) and *Acorus calamus* (calamus), which historically were keystone species in the Anacostia.

The Patuxent Marsh, though in a separate watershed, does represent a well-established freshwater tidal marsh system. Importantly it should be noted there is no *L. oryzoides* or *L. salicaria* and little *Phragmites* (Fig. 7). In this system based upon a compilation of six transects, *P. arifolium* and *sagittatum* are important species coupled with *I. capensis* and *A. calamus* (in the spring and early summer). Parts of the marsh tend to low marsh as evidenced by the presence of *Nuphar lutea* (NUPLUT, yellow pond-lily) in small tidal guts. Also as at Dueling Creek, *Typha* seems to be in balance with a cover of less than 3%, which should emphasize the concern with increased *Typha* at Kenilworth and suggest the need of a watchful eye at Kingman Marsh for excessive *Typha* growth.

**Species Richness**

An extremely high species richness was observed at the just reconstructed Kingman Marsh (Appendix C and Table 1). Presumably this is due to the openness of the site and weakness of competition as the vegetation just gets established in this year of reconstruction. The whole marsh numbers from Table 1 show that 125 species were identified from the transects and walk-throughs in the reconstructed Kingman Marsh. Of these, 76 (62%) were facultative wet or wetter (National Wetland Indicator status). Forty-six species (38%) represented more terrestrial species. It can be anticipated that many of these are likely 'weedy' pioneers that will diminish, as the soil system remains saturated and competition from the better-adapted species increases. The data from the transects alone revealed 95 species or about 75% efficiency as compared to the whole marsh data, which are based on the transect information plus additional walk-throughs.

Comparing the Kingman transect data with the reference wetlands (Dueling 29 species, Kenilworth Marsh 35 species and Patuxent 40 species) one can sense the extraordinary species number during Year 1. Kingman Area 1, which was larger than Area 2 and possessed more elevation variation particularly higher elevations (several inches above mean high tide), contained 91 species while Area 2 had 52. This accentuated colonization was also noted at Kenilworth during its first year of vegetation in 1993. By 1995, two years following reconstruction as based on a detailed inventory (Stauss 1955), the species number at Kenilworth (whole marsh, not just transects) was about the same as Kingman in its first year. The higher- elevation unplanted area of Kingman Area 1 contained almost as many species (61) in just the 2 transects as did the planted area represented by 11 transects. There were no unplanted areas/transects in Kingman Area 2. As previously mentioned there were small amounts of 3 of the 6 planted species (excluding *Nuphar*) found to have volunteered in the unplanted area.

**<u>Other Species Characteristics</u>**

In terms of origin, 74% of the plants at Kingman were native and 26% were introduced (Appendix C and Table 1). This is a high number of introduced species which would be expected to decline over time as the pioneer volunteer species are out-competed by more wetland adapted species. For example, at Kenilworth Marsh the introduced species account for only 8-10% of the population (Table 1). Perennial plants at Kingman Marsh composed 56% of the population, annuals 26%, annuals/perennial 13%, biennials 1% and other combinations together made up the additional 5% when looking at the whole marsh data (Table 1). The numbers were quite similar for the transects while the rest of the marsh had more perennials. Again, the number of annuals will likely drop over time. By habit most of the plant forms were forbs/herbs (58%), with graminoids forming 29% of the species, trees 8%, shrubs 4% and vines 3%. Note the relatively high contribution of tree species at Kingman, particularly as compared to Patuxent, which exhibited none. As to be expected most of the species were facultative wet or wetter (62%) while 38% were more upland oriented. It would be anticipated that over time there would be a strong shift to even more wetland dependent vegetation. Documentation of these characteristics was derived from the USDA, NRCS 1999 PLANTS database. It is difficult at this point (need to combine more years of data) to compare Kingman with the other sites because the data from the transects are limited, e.g., hard to compare 11 transects at Kingman Area 1 with 3 transects at Dueling Creek. Whole site comparisons are not possible since there is no whole site data for Dueling or Patuxent.

### 1B. Biomass

Aboveground biomass was collected from 2 quarter-meter plots on the right side of each transect (i.e., the side opposite that used for cover) in August 2000. Plant material was separated into species and detritus, dried and weighed. While the data has not yet been put through statistical analysis it would appear that there is rather good correspondence between contribution through cover and biomass (Figs. 1-7 and Appendix D). Of course this stands to reason, but it may be noted that tall, vertical species such as *Typha* and *Phragmites* contributed relatively more to biomass than cover. It also must be recognized that quarter-meter plots represent but a small fraction of the wetland acreage and thus probably are not representative of all the species at the wetlands.

The Kingman peak standing biomass was less than the reference sites although Area 2 at Kingman was considerable in light of this being its first year (See Table 2 below)!
A range given by Whigham, McCormick, Good and Simpson (Whigham et al. 1978 ) for freshwater tidal marsh biomass is 566 – 2,300 g/m$^2$. The planted transects yielded more biomass than the unplanted ones at Kingman which suggests a benefit from planting with respect to getting the marsh established quickly. The higher biomasses at Kenilworth MF1 and MF2 may be attributed to the considerable contribution by stands of *Phragmites* and *Typha*, which are more robust species. Surely, Year 1 growth should not be viewed

as typical or the potential for Kingman. Note that detritus biomass was included in the biomass totals but was not biasing the Kingman Marsh totals since the new wetlands were devoid of biomass in Year 1. Data from the next years work should be more indicative, although there are indications waterfowl browse may become a serious problem. But biomass is a parameter to be followed closely as an indicator of the success of the reconstruction, particularly when goose browse may be an issue.

Also of interest was the higher number of species harvested in the newly reconstructed Kingman marshes (about two times as many), which is probably related to pioneer or adventitious species colonizing the open sediments. One would anticipate reduction in these numbers to ones closer to the reference wetlands in time as competition increases. As to be expected there was little or no detritus noted in the newly constructed Kingman sites whereas detritus was a major component of the established wetlands. It could also be generalized that the distribution of biomass contribution was more even in the newly reconstructed wetlands with the greatest contribution by a single species being less than 100 g/$m^2$ while the established wetlands all had species contributing about four times that growth production. If most other factors are similar such as relative amounts of species planted, average elevation, etc., the planted Area 2 produced more than the planted portion of Area 1 indicating that the earlier start in growth there (due to earlier planting) was responsible. A considerable portion of the higher biomass levels at Kenilworth Marsh is due to growth from *Phragmites* and *Typha*.

**Table 2**

**Biomass Corrected for Detritus**

**Kingman and Comparison Wetlands**

**2000**

| **Location** | **Biomass (g dry wt/$m^2$)** |
|---|---|
| Kingman Marsh Area 1- Planted | 255.7 |
| Kingman Marsh Area 1- Unplanted | 182.3 |
| Kingman Marsh Area 2 | 492.1 |
| Kenilworth Marsh Mass Fill 1 | 1022.8 |
| Kenilworth Marsh Mass Fill 2 | 1548.1 |
| Dueling Creek | 710.6 |
| Patuxent Marsh | 804.5 |

## 2. SEED BANK STUDIES

Special methodologies to determine the relative contributions for different potential seed sources had to be developed, tested and then utilized. These detailed methods were not part of the initial project description but are now included in the revised Study Plan (Appendix A). Much of this work was produced by Ms. Kelly Phyillaier and Dr. Andy Baldwin of the University of Maryland.

Results from this effort are still being analyzed. Even though seed collection was initiated in 2000 it takes considerable time to germinate and grow many of the specimens to the point that they may be identified. However, from observations, Kelly Phyillaier has noticed that water borne seed sources seem to be more important than the soil seed bank for establishing volunteer plants at the reconstructed wetlands.

## 3. SOILS

A number of parameters relating to soil elevations and soil structure will be measured over the course of the study including transect and general marsh elevations as well as tidal fluctuations to ascertain the frequency, duration and depth of surface inundations which control to a large degree the establishment of vegetation community associations. Soil quality will be characterized by assessing such variables as texture, pH, organic matter, nutrients, metals and redox potential. Soils methodologies are provided in Appendix A, the revised Study Plan. While equipment has been installed and some data collected, only limited data from the Year 1 redox measurements is available for this report. Comprehensive results will be provided following the second year of data collection.

### 3A. Redox

Redox measurements or redox potential remain a variable, but semi-quantitative method, for arriving at the status of wetland soils particularly the presence and intensity of reduction (See Table 3 below). The measurements obtained for Kingman and the 3 reference wetlands are all clearly representative of wetland soils since their mV values are negative, ranging from about –40 to about –225mV exposing their reduced state. It was surprising that the Dueling Creek means were by far the most oxidized of the sites, where one might have suspected the newly deposited Kingman soils to be more aerated. It is to be noted that the value for Patuxent as probably the most well established wetland was also the most reduced.

**Table 3**

**pH and Redox Potentials**

**Kingman and Comparison Wetlands**

**2000**

| | | pH | | Redox (mV) | |
|---|---|---|---|---|---|
| **Location** | **n** | **Mean** | **Std Dev** | **Mean** | **Std Dev** |
| Kingman Marsh | 105 | **6.96** | 0.65 | **-126.743** | 84.381 |
| Kenilworth Marsh | 42 | **6.41** | 0.11 | **-110.143** | 52.580 |
| Dueling Creek | 21 | **6.19** | 0.33 | **-42.619** | 55.443 |
| Patuxent Marsh | 21 | **6.14** | 0.16 | **-213.333** | 96.188 |

**3B. Piezometers**

Datalogging piezometers (hydrologgers) were installed in late March 2001 to monitor water levels in the wetlands for Year 2. One piezometer was installed into each of the seven different marsh sites (Kingman Marsh Area 1, Kingman Marsh Area 2, Kenilworth Marsh Mass Fill 1, Kenilworth Marsh Mass Fill 2, Patuxent River North of Route 4, Patuxent River South of Route 4, and Dueling Creek) - Maps 1-4. These were installed at a lower elevation than the transects so the full range of water level fluctuation at all sectors could be estimated. The piezometer is a 3" diameter PVC pipe with perforations throughout the pipe, a capacitance sensor inside, and a data logger on the top to record water levels at specific intervals Ecotone Model (Remote Data Systems, Inc., Whiteville, North Carolina). The pipe was pushed approximately 4' into the ground and extended 3' above the soil substrate. The water data will be downloaded from the loggers until November 2001. These were configured to record elevations every fifteen minutes. In late March 2001, we used a level to survey the elevation of all sectors in relation to the piezometers. Using this data, relative surface water levels will be measured for all transects. In addition, absolute elevations will be obtained in all areas where benchmarks or other markers of a known elevation are present.

**CONCLUSIONS:**

The following summary points may be made as a result of the Year 1 studies:

1. Marsh vegetation establishment was excellent especially considering the late start in planting and establishment of volunteer plants since Kingman Area 1 was not ready until

July; none of the plants grew from prior year rootstock; and goose browse delayed, stunted and depleted some of the new vegetation.

2. The strength of the first year marsh growth was revealed by the cover data, with Kingman Area 1 close to 80% and Area 2 almost 100% as compared to 95% at Kenilworth MF 1, 85% at Kenilworth MF 2, 98% at Dueling, and 93% at Patuxent. Even the aerial photographs of Kingman portrayed uniform and extensive cover. Contribution to cover by the predominant species differs from Kingman and the reference wetlands, but the reference wetlands also differ from each other.

3. The planted species provided roughly half of the cover with volunteer species contributing the other half.

4. Species richness at Kingman was greater than the reference wetlands no doubt due to it's being a new site and tolerating weedy species under conditions of reduced competition.

5. Seed arrival for volunteer species establishment was more prevalent from water born sources than from the soil seed bank.

6. Seed density in the Year 1 Kingman soil seed bank was lower than the (older) reference wetlands with the exception of Patuxent Marsh.

7. It must be recognized that first year data is based on a transitional system, one that is just getting established, and is best viewed in terms the rate of wetland vegetation establishment. Succeeding years' data will better represent the quality of the wetland and the degree to which marsh establishment mimics reference wetlands as well as those wetlands that historically occupied the area.

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**Acknowledgements**
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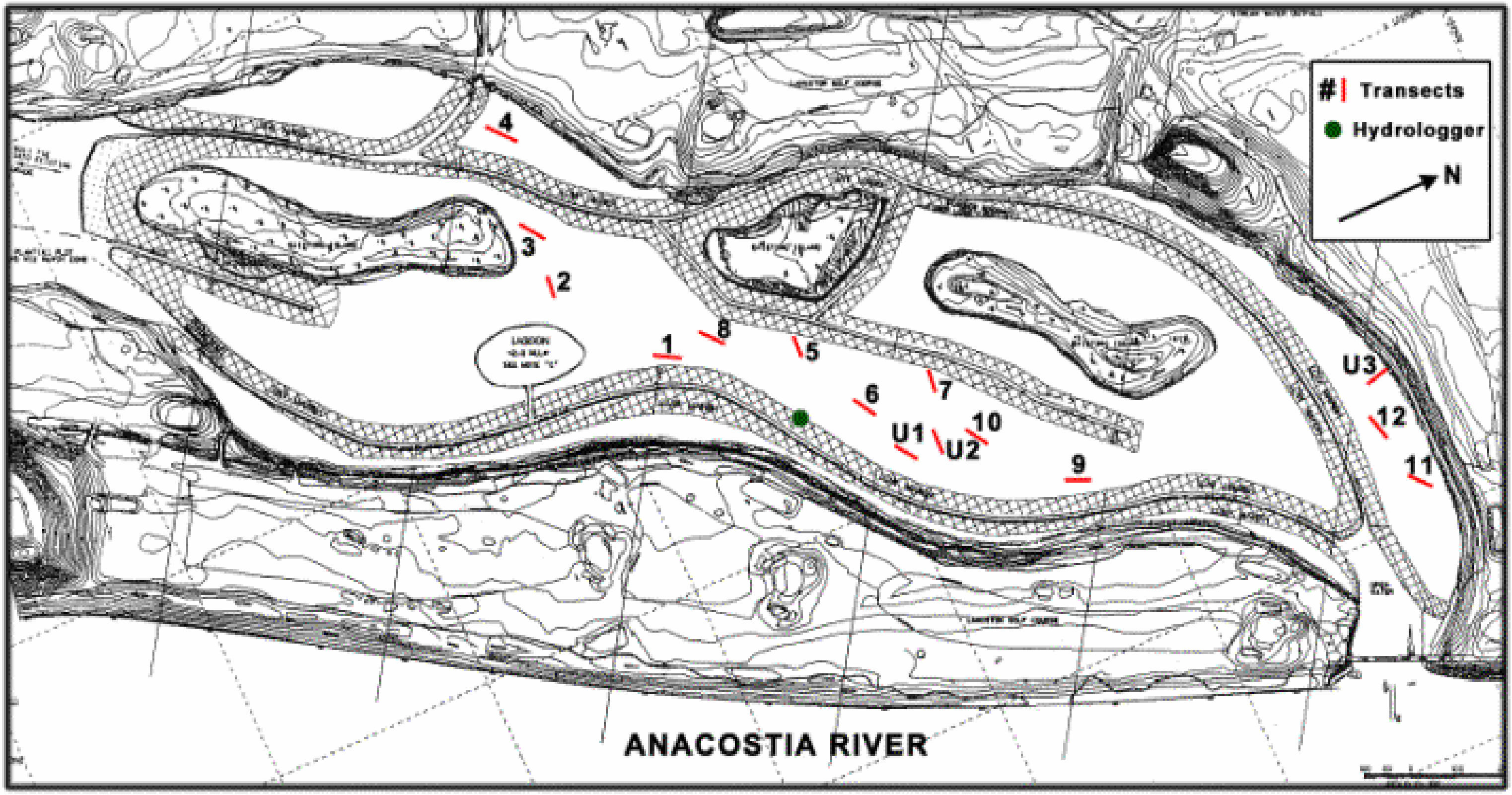
Maps

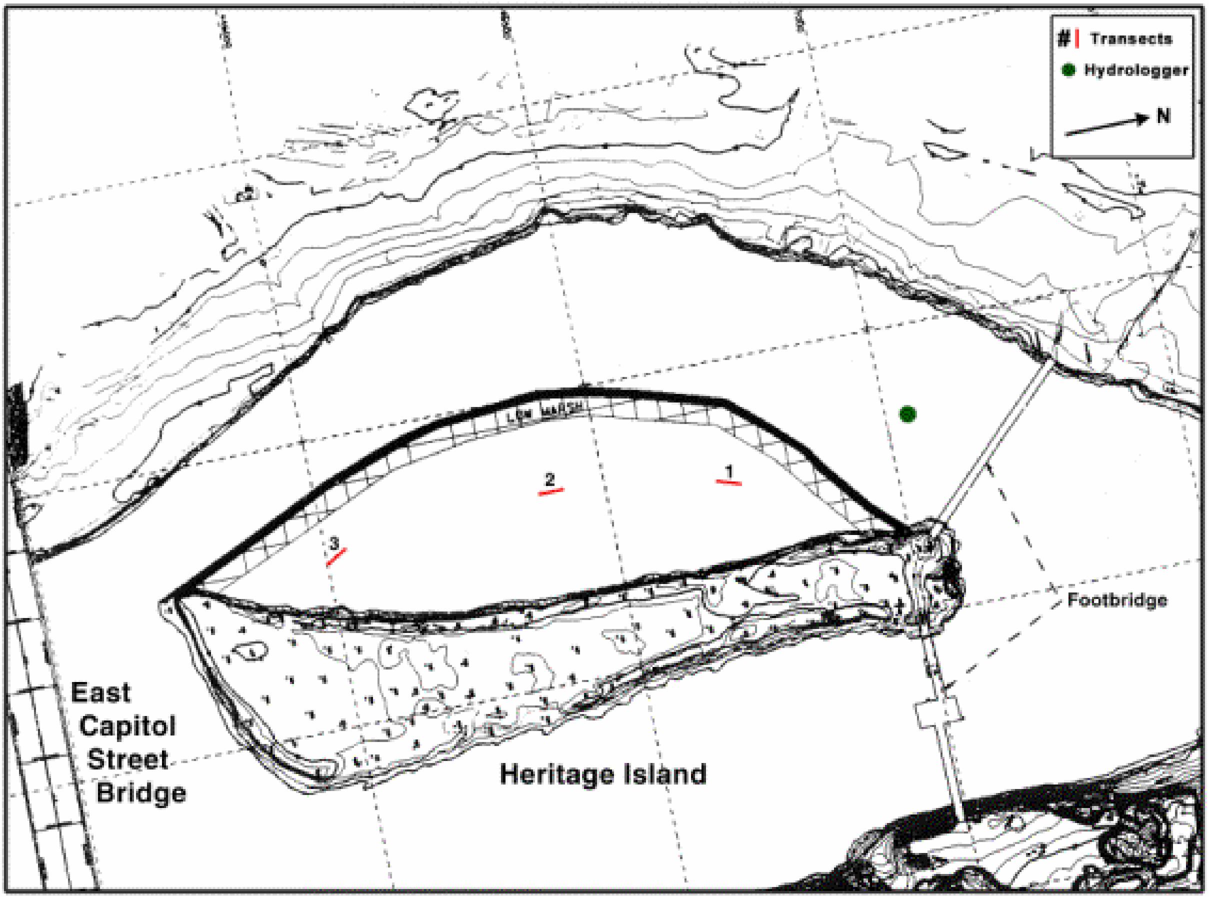
# Map 1
## Kingman Marsh Area 1



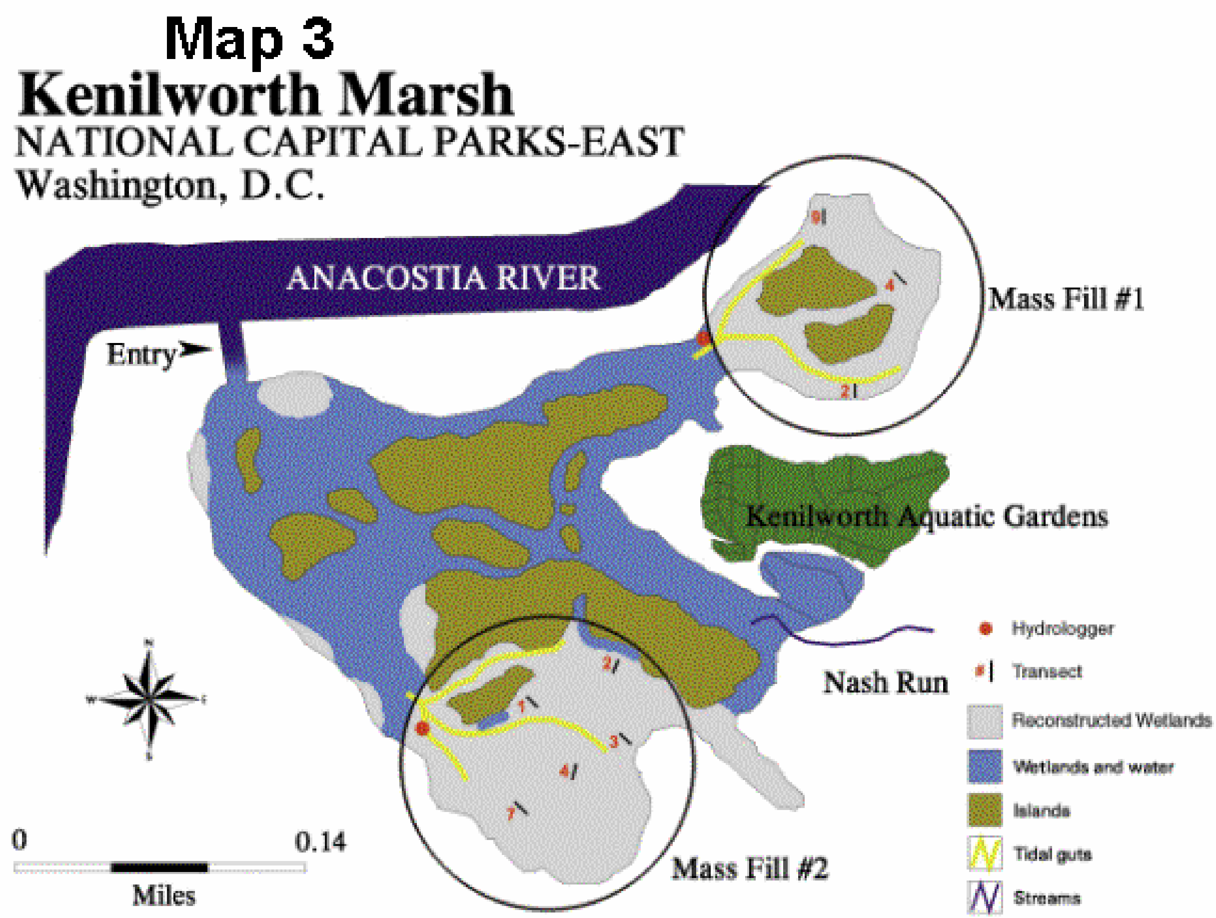

Note: Transect locations are approximate.

## Map 2

### Kingman Marsh Area 2

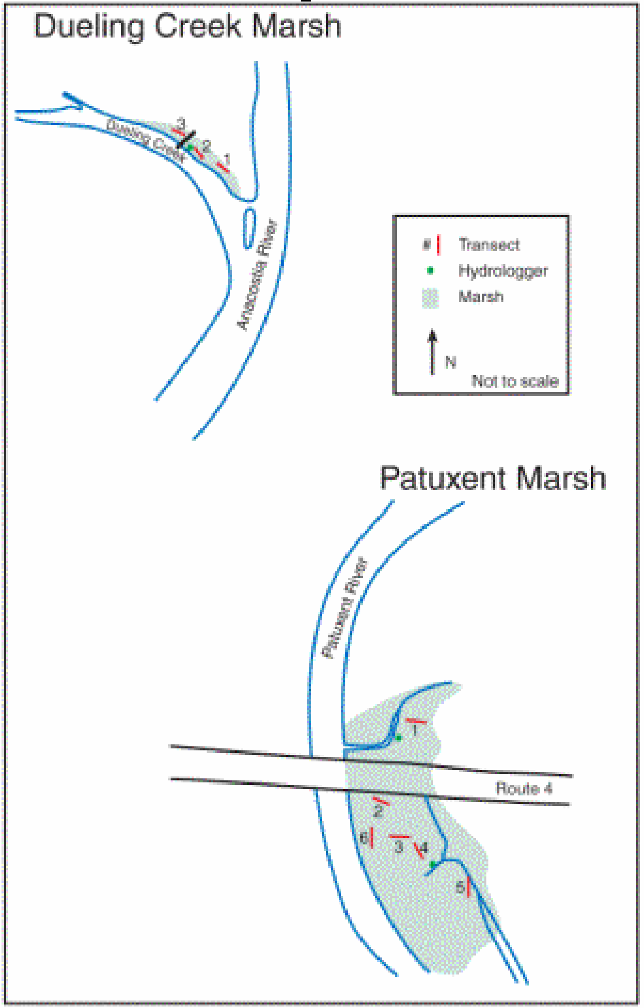



Note: Transect locations are approximate.




**Note: Transect locations are approximate.**

# Map 4


Dueling Creek Marsh
Dueling Creek
Anacostia River
Transect
Hydrologger
Marsh
N
Not to scale
Patuxent Marsh
Patuxent River
Route 4
1
2
3
4
5
6

Figures

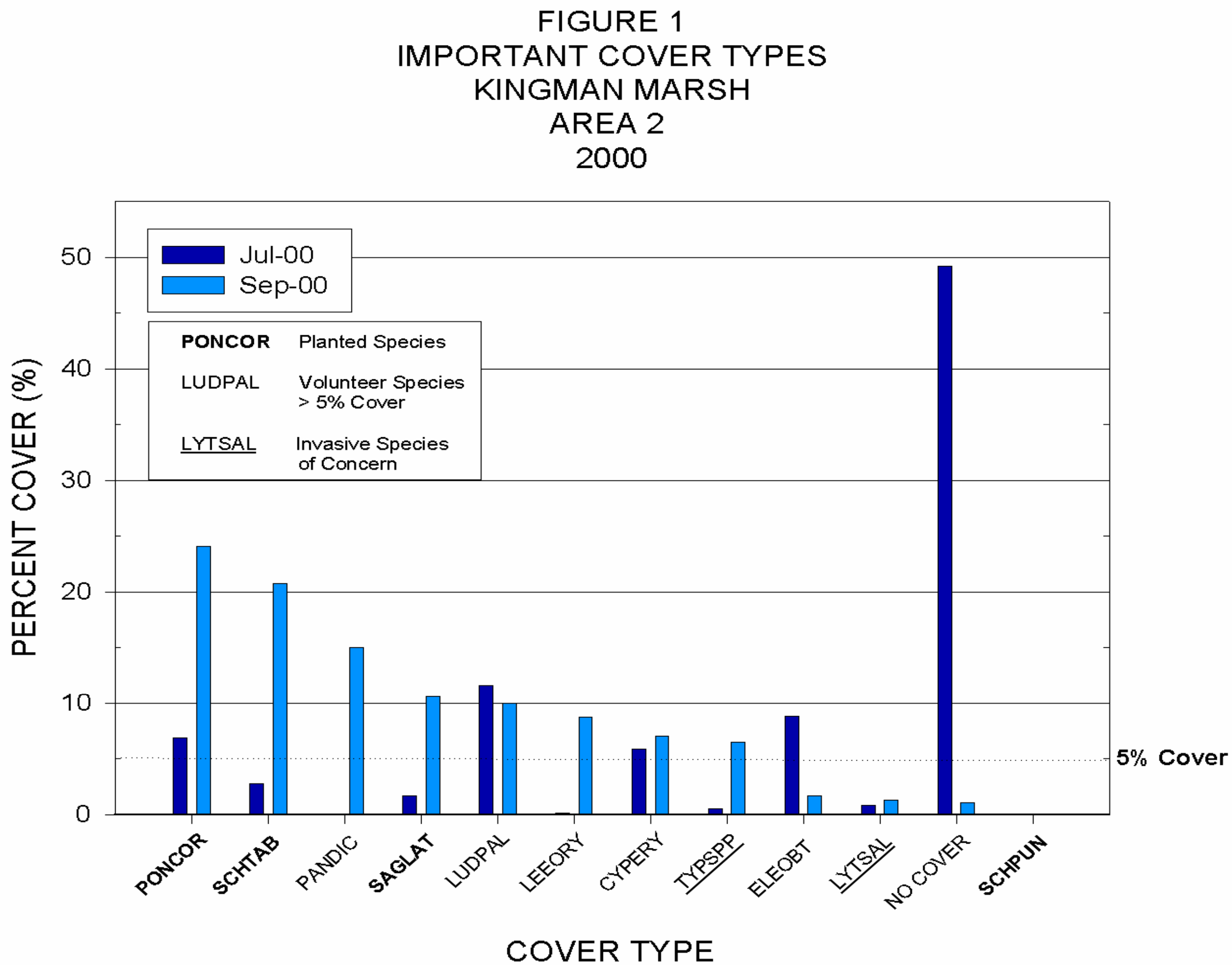


FIGURE 1
IMPORTANT COVER TYPES
KINGMAN MARSH
AREA 2
2000
Jul-00
Sep-00
PONCOR
Planted Species
LUDPAL
Volunteer Species > 5% Cover
LYTSAL
Invasive Species of Concern
PERCENT COVER (%)
0
10
20
30
40
50
5% Cover
PONCOR
SCHTAB
PANDIC
SAGLAT
LUDPAL
LEEORY
CYPERY
TYPSPP
ELEOBT
LYTSAL
NO COVER
SCHPUN
COVER TYPE

FIGURE 2
IMPORTANT COVER TYPES
KINGMAN MARSH
AREA 1- PLANTED
2000

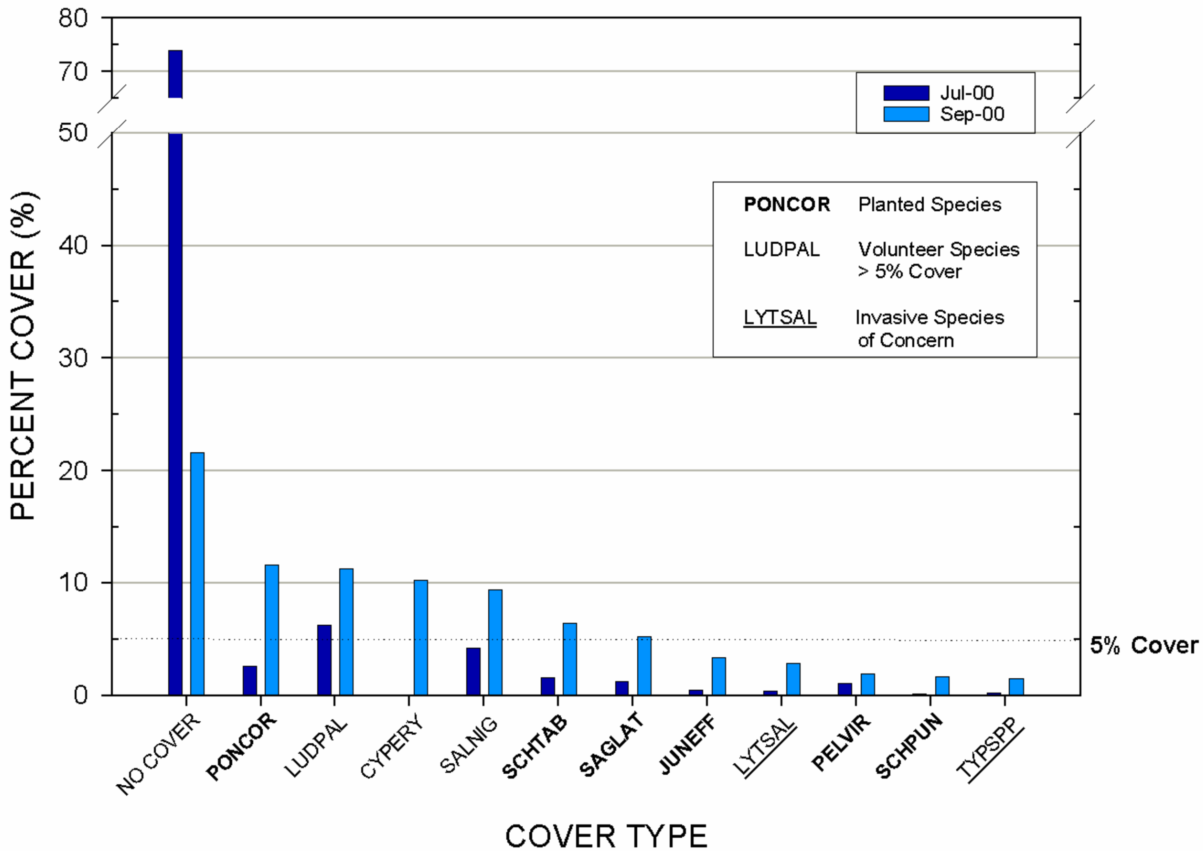


FIGURE 3
IMPORTANT COVER TYPES
KINGMAN MARSH
AREA 1 - UNPLANTED
2000

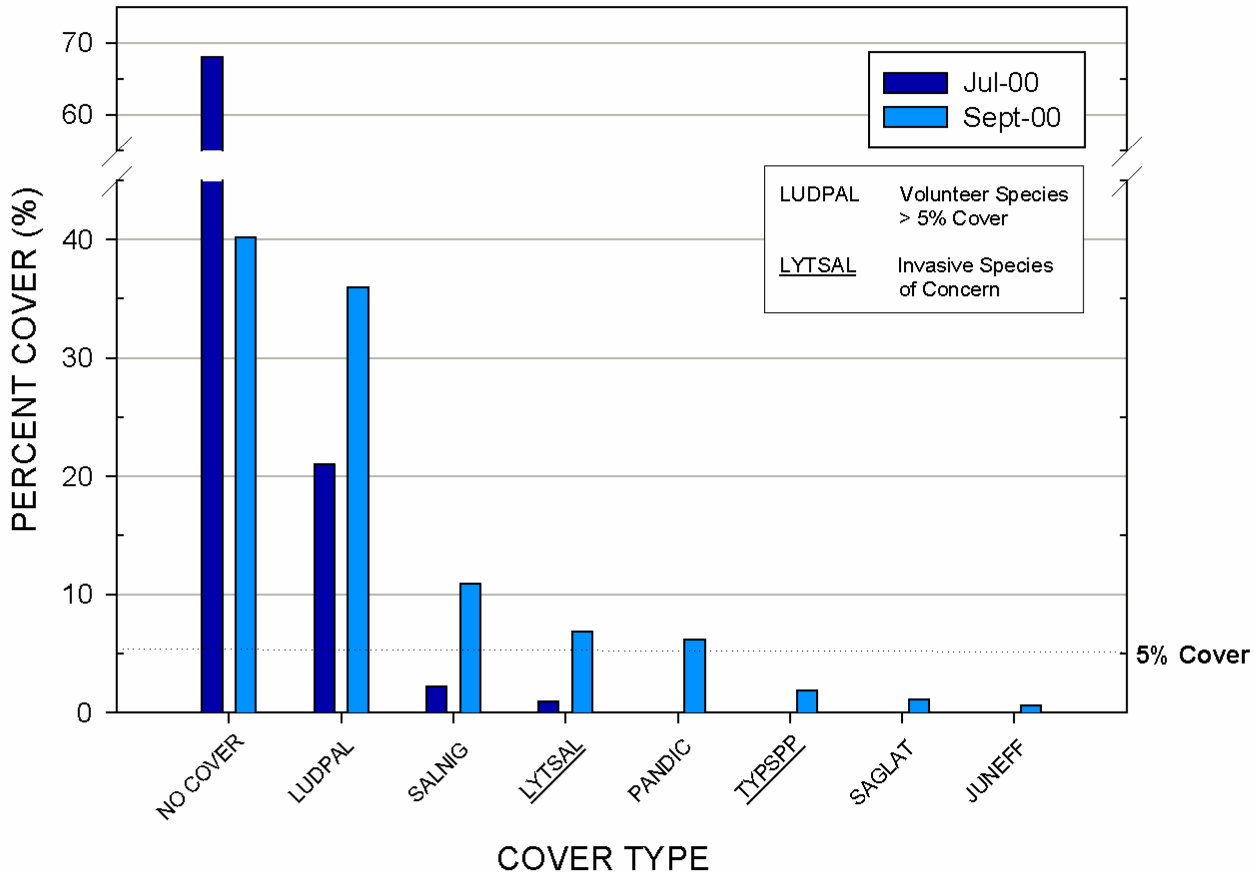


FIGURE 4
IMPORTANT COVER TYPES
KENILWORTH MARSH
MASS FILL 1
2000

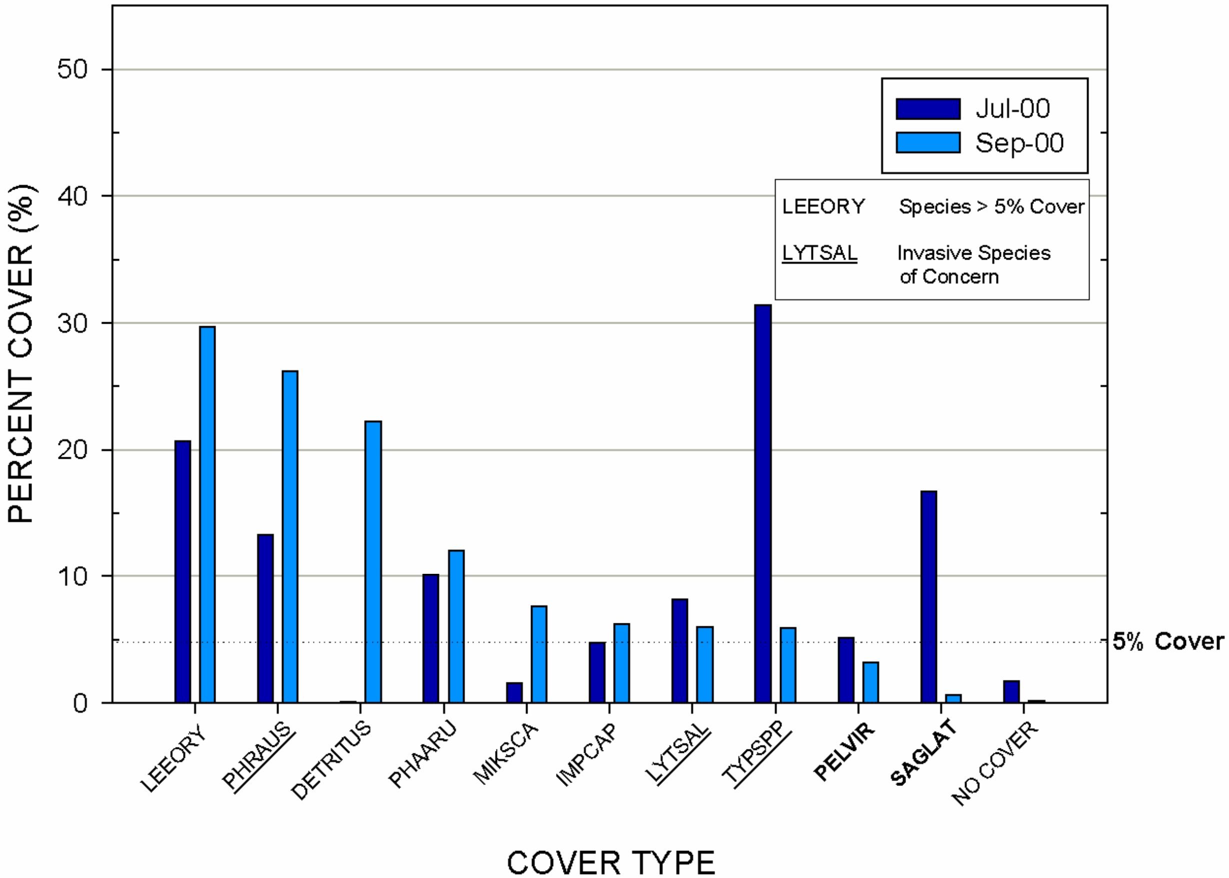
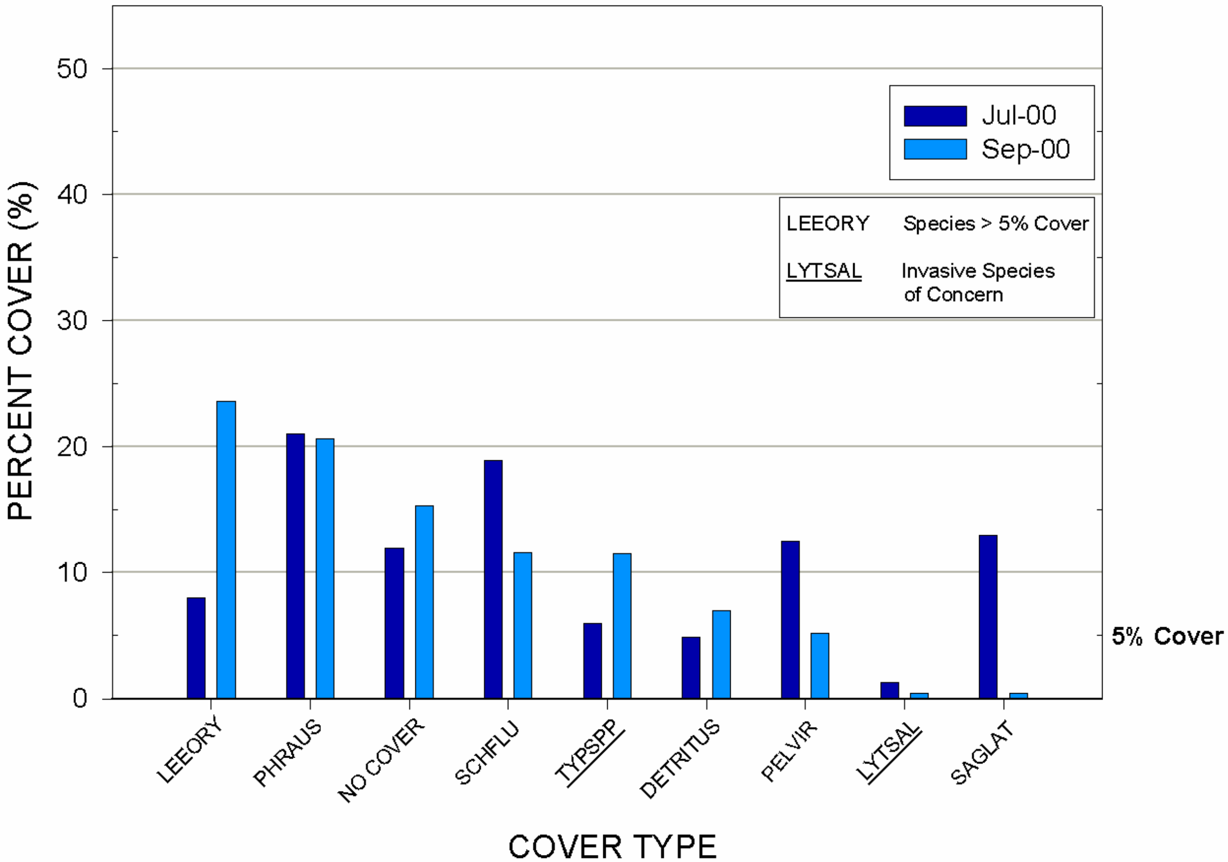


FIGURE 5
IMPORTANT COVER TYPES
KENILWORTH MARSH
MASS FILL 2
2000



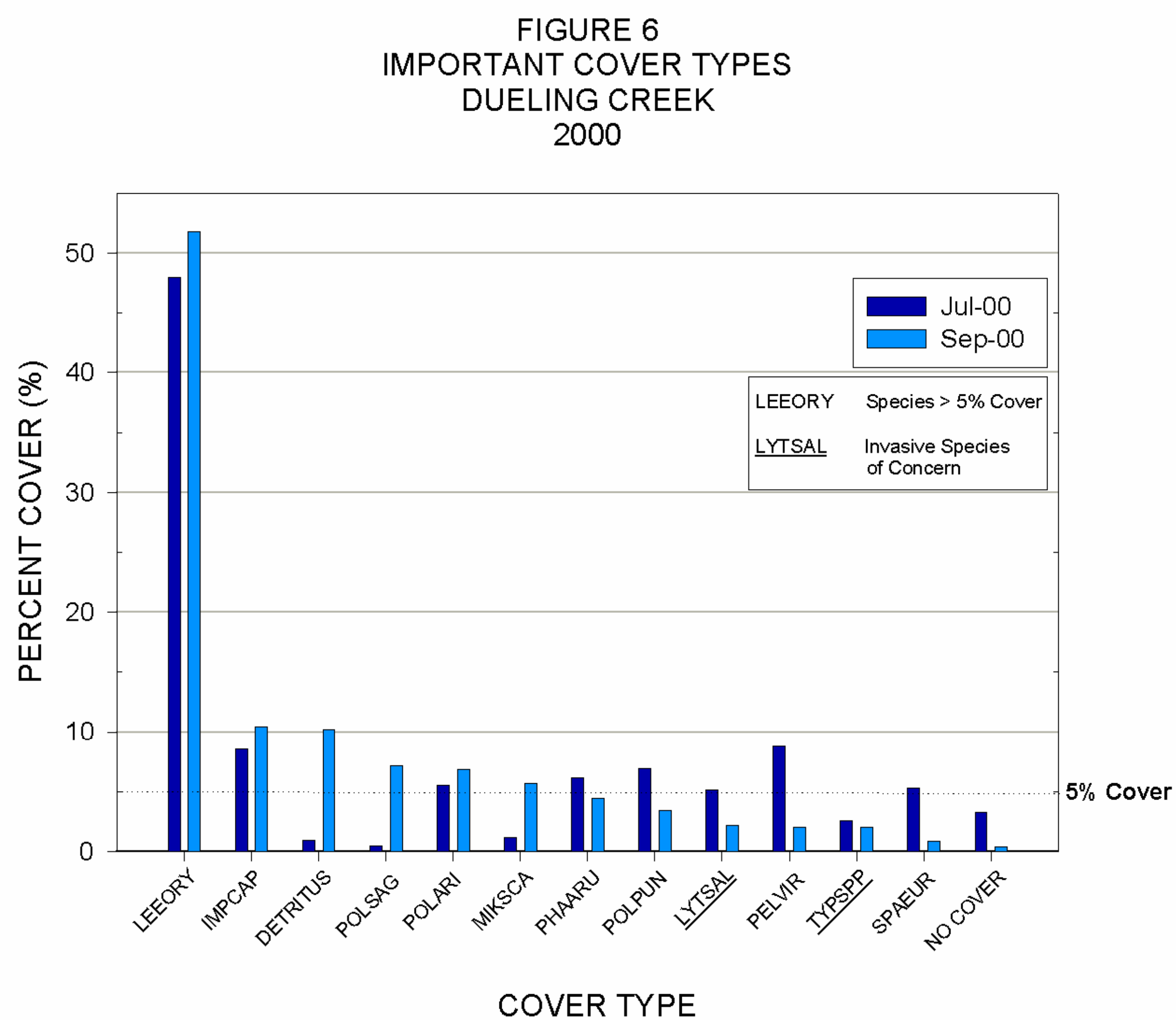
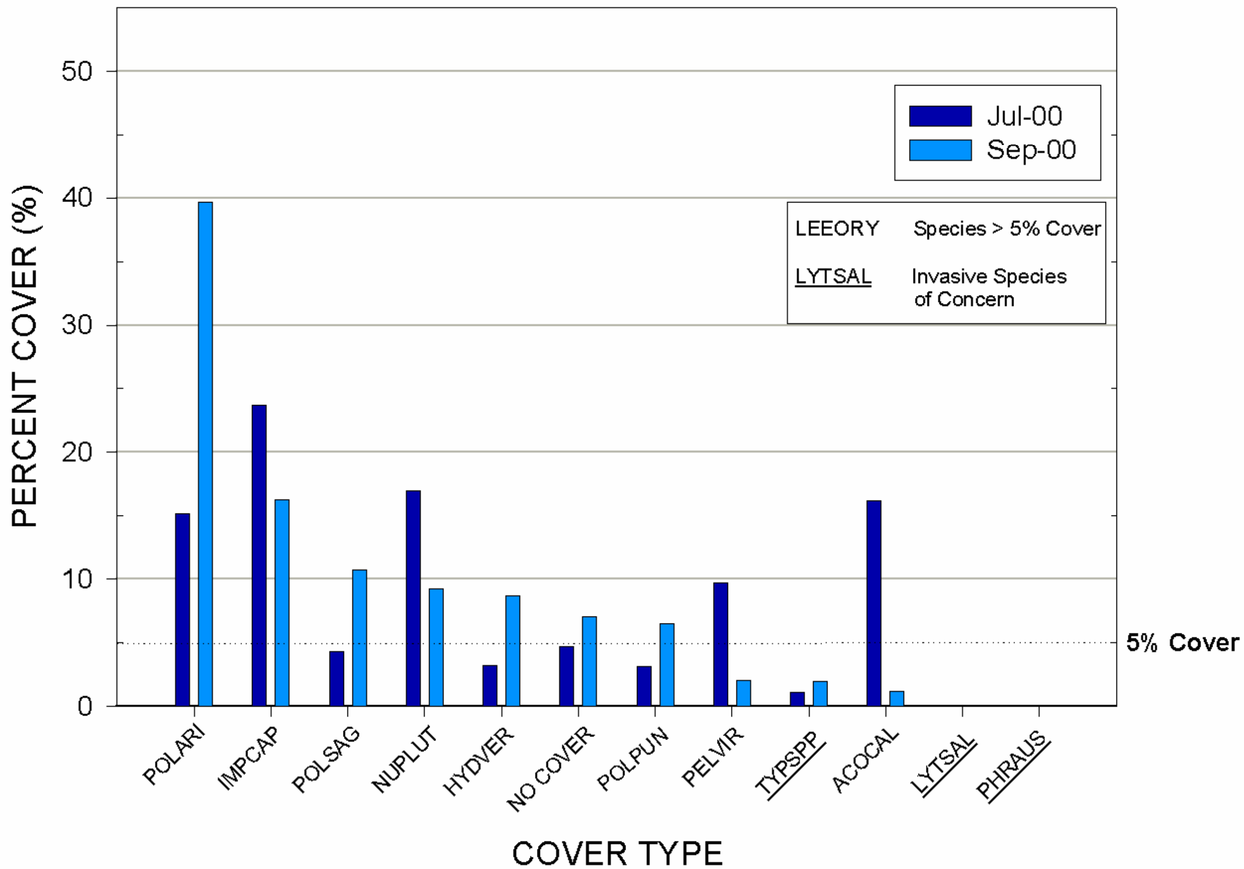


FIGURE 6
IMPORTANT COVER TYPES
DUELING CREEK
2000
PERCENT COVER (%)
0
10
20
30
40
50
Jul-00
Sep-00
LEEORY
Species > 5% Cover
LYTSAL
Invasive Species
of Concern
5% Cover
LEEORY
IMPCAP
DETRITUS
POLSAG
POLARI
MIKSCA
PHAARU
POLPUN
LYTSAL
PELVIR
TYPSPP
SPAEUR
NO COVER
COVER TYPE

FIGURE 7
IMPORTANT COVER TYPES
PATUXENT MARSH
2000



# Appendix A Study Plan

**Vegetation and Soil Characteristics of Restored Tidal Freshwater Wetlands at Kingman Lake, Washington, DC**

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**ABSTRACT**:

In 2000, portions of Kingman Lake along the Anacostia estuary in Washington, DC were restored to emergent freshwater tidal wetlands (Kingman Marsh). The process involved using a hydraulic dredge to pump a slurry of somewhat contaminated Anacostia channel sediments (variable amounts of anthropogenically derived chemicals such as chlordane, PCBs and PAHs) by a U.S. Army Corps of Engineers (COE) contractor into two separate containment cells at Kingman. Following dewatering and consolidation the resultant sediment flats covered about 35 acres and were planted with about 700,000 plants comprising 6 native species. Volunteer plants also began to grow from the soil seed bank as well as from propagules carried in by water and air. Much of the planted areas were surrounded by corrals of light plastic fencing to exclude geese and ducks, which browsed the new plantings. As a component of this reconstruction project the COE established funding for 5 years of post- reconstruction monitoring for two elements: food chain accumulation of contaminants (to be conducted by the Fish Wildlife Service) and vegetation establishment.

This project will monitor establishment and growth of vegetation and related factors through a close working partnership between the USGS Patuxent Wildlife Research Center (PWRC) and the University of Maryland Biological Resources Engineering Department (U. of Md.) as funded by COE and the USGS. The goals of the project are to measure and evaluate several site resources and processes to document both the status and the degree to which the marsh achieves a wetland condition similar to what might be expected compared to local and reference wetlands (i.e., emergent freshwater tidal wetland habitat). To determine the vegetation status and trends 17 one meter wide (belt) transects were randomly established at Kingman to be read each year in May, July and September for species and cover. Additional walk-through surveys to detect species not encountered along the transects will be taken. Results from Kingman will be

compared to local freshwater tidal emergent wetland reference sites at Kenilworth, Dueling Creek and the Patuxent. Comparisons will also be made internally at Kingman between Area 1 and Area 2 (two separated sites), as well as between planted and unplanted patches to help measure the contribution of volunteer plants to the marsh establishment. Vegetation biomass, as peak standing vegetation, will be determined by collecting above-ground vegetation in August from 0.25 meter plots along the transects. Plants will be sorted by species, dried and weighed. Soils will be studied by collecting soil cores from 3 shallow depths in the rooting zone along the transects and measured for soil structure, organic matter, pH and redox potential. Seed sources will be determined by collecting soil and germinating the soil seed bank, as well as by trapping floating and air born seed to be identified by germinating in trays under greenhouse conditions. A separate avian study will be conducted weekly using timed point counts to document birds in the wetland and walks between the points to identify birds along the wetland riparian zone. Additional studies are being considered through this project to amplify our understanding of the hydrologic and sediment deposition/sediment elevation processes controlling the wetland functions at this urban reconstructed freshwater tidal marsh. In addition other associated studies could include benthic/macroinvertebrate surveys, herptefauna surveys and effects of exclosures to assist wetland establishment.

## INTRODUCTION:

Historically, the Anacostia estuary was a fully-functional freshwater tidal marsh comprising several thousand acres that provided considerable food and habitat for wildlife and consequently served as an invaluable support resource for native Indians and subsequent colonists. Towards the end of the nineteenth century as sewage pollution, agriculturally derived sediments, surrounding development and disease threats increased in the Anacostia, intense pressure developed to remove the problematic wetlands. The U.S. Army Corps of Engineers (COE) was given the charge to dredge the Anacostia from its mouth at the Potomac in Washington, D.C. up to Bladensburg, Maryland. In addition to dredging, a stone seawall was built which yielded a hard line between the dredged river channel and the deposited fill behind the seawall. Essentially no emergent wetlands remained including areas within the dredged out tidal Kenilworth and Kingman Lakes. The National Park Service (NPS) eventually became the custodian of these newly built landscapes, which were to be used mostly for recreation.

In the 1980s park planners and resource managers began to envision the opportunity of restoring areas like Kenilworth Lake as a vestige of the once productive wetland habitat. Following a long series of planning and technical evaluations Kenilworth Marsh was reconstructed by the COE for the NPS as a freshwater tidal marsh (32 acres) in the highly urbanized Anacostia watershed in 1993. A similar reconstruction of tidal wetlands at the Kingman Lake site began during the spring of 2000 also using pumped dredge material from the Anacostia channel. Monitoring of various aspects of the restored wetlands at the Kingman site will be conducted over a 5-year period (2000-2004). We will focus upon the vegetation and soil characteristics of the site. These are important characteristics that affect the value of the site as habitat for fish and wildlife, the biogeochemical and hydrologic functioning, and the aesthetic value of the site. Vegetation monitoring will include two components: standing vegetation and seed bank including buried viable seeds as well as water and air born sources. Monitoring of soils will include measurements of soil particle size, organic matter, and redox potential (Eh). The vegetation, soil structure and seed bank will be the units of measure and will also be used for comparison to reference wetlands. Additional studies pertaining to site hydrologic function and avian populations are being pursued.

The project will measure the progress of the reconstructed marsh toward becoming a natural, viable freshwater tidal wetland. As such the project will serve as a learning curve and example for future restorations along the Anacostia and elsewhere. Consequently, the project will provide the COE as builders of the reconstructed wetland, the National park Service (NPS) as managers of the wetland, and the District of Columbia as the jurisdiction in which the wetland resides, an evaluation of the reconstructed marsh processes and the product wetland. By monitoring the vegetation, seed bank and soils, a verifiable documentation of the quality of the wetland as it matures over the five-year monitoring period can be made. The project will also help identify situations that may require actions to correct the defects during the formative stages of the wetland. It is anticipated that documentation of the avi-fauna use over time will also help describe the rate and degree of maturation processes at the urban reconstructed freshwater tidal wetlands. Additional studies will be pursued as part of this project to amplify our knowledge of the processes and products of the marsh reconstructions. Having the two similar nearby (one-half mile apart) urban reconstructed wetlands (Kingman 2000 and Kenilworth 1993) seven years apart in age provides an excellent opportunity to study the marsh restoration processes relative to each other over time.

## *OBJECTIVES:*

**1. Describe changes in plant communities at the site over a 5-year period**

a. standing vegetation
b. seed bank

*Rationale:* Standing vegetation determines the appearance of the site, plant biodiversity, physical structure, and the types of food and cover available to support birds, mammals, herpetofauna, fish, and invertebrates. Vegetation is the main criterion in the eyes of most people for determining if the restoration project was successful. Standing vegetation also affects soil characteristics and nutrient cycling through input of detritus. The seed bank is a component of plant communities that may or may not occur in the standing vegetation. Because recruitment of seedlings from the seed bank occurs following disturbance as well as in undisturbed vegetation in tidal freshwater marshes, the seed bank is of critical importance to maintaining the vegetation composition. The relative contribution of seed availability from sediment, water born and air born sources will help explain the prevalence of volunteer plant establishment. Also, the seed bank is a useful metric for comparing restored sites versus natural sites to evaluate the success of restoration. The seed bank from the reconstructed sites will be compared with that at the reference sites. Success can be measured as to the approximation of the structure and function of the reconstructed wetlands versus the wetlands that had been there previously and those well- established wetlands of similar kind (emergent freshwater tidal) nearby (reference wetlands).

**2. Describe changes in soil characteristics at the site over a 5-year period**

*Rationale:* Restoration of wetlands at the Kingman Lake site has been achieved by pumping river sediment into the Lake to increase elevation to levels that support marsh vegetation. River sediment is primarily comprised of mineral soil, with grain sizes ranging from silt and clay to sand and gravel. In contrast, soils of natural tidal freshwater wetlands are primarily organic, resulting from accumulation of undecomposed plant material. Organic soils have much lower bulk density than mineral soils (which affects plant growth and subsurface hydrology) and differ substantially from them in their nutrient content and capacity for sorption of chemicals. As such, soil characteristics are important in determining the marsh maturation rate and how the resultant structure and function of the site compares with natural wetlands.

**3. Compare the Avian Monitoring at the Reconstructed Kingman and Kenilworth Marshes**

*Rationale*: Avian surveys will be conducted for at least five years at the structurally similar urban freshwater tidal Kingman and Kenilworth Marshes (but not at the other reference sites) along the Anacostia River in Washington, D.C., starting in November 2000 to document changes in species diversity and abundance following reconstruction of the wetlands. The two wetlands are within a mile of one another along the Anacostia River. Kenilworth Marsh reconstruction took place in 1993 whereas Kingman Marsh reconstruction was just completed in 2000. Comparisons will be made *within* each site for status and any change over time as well as *between* the sites to determine whether the difference in time phase displays itself in the avian populations. This survey is being conducted in conjunction with other 5-year monitoring efforts at these urban wetlands as part of the effort to evaluate the relative success of the marsh reconstruction. It could also be continued as part of a long-term study.

**4. PROPOSAL: Examine the Hydrology of Reconstructed Urban Freshwater Tidal Wetlands in the Anacostia**

Hydrology drives the functions and processes of wetlands. The recently reconstructed freshwater tidal wetlands - Kenilworth (1993) and Kingman (2000) provide an excellent opportunity to study the role hydrology is playing in determining the sedimentation processes and the sediment/porewater characteristics such as redox zonation, as well as how these processes affect the vegetation structure and the resultant habitat**.** We will exploit the seven-year differential in time of reconstruction of the wetlands to evaluate the time needed to restore a wetland to natural hydrologic characteristics and function**.** The hydrology at Kenilworth is controlled by a single opening to the Anacostia through a previously constructed berm, while the hydrology at Kingman is regulated through two access points at opposite ends of the primary wetland. Both wetlands had tidal guts installed as part of the reconstruction process so as to provide the opportunity for hydrologic function similar to what was there originally. The Corps of Engineers (COE) developed a hydrologic model for Kingman prior to its reconstruction, as the basis for the tidal gut design. Both wetlands were provided with 'as built' placed sediment levels. The extent of this existing information will be verified and used in the study.

The hydrology study would be accomplished for the National Park Service as a cooperative effort between the Patuxent Wildlife Research Center (Dr. Dick Hammerschlag) and USGS Water Resource Division (Baltimore District) MD/DE/DC (Dr. Michelle Lorah). The COE is expected to be an interested cooperating agency and provide some sampling equipment such as a recording tide gage.

The hydrology study would:

- Measure the volumes and velocities of the tidal fluxes to, fro and within the wetlands. At Kingman where two tidal access routes exist, what is the relative contribution of each?
- Determine the frequency, duration, and depths of tidal coverage of the various portions of the wetlands and then relate how the hydrologic pattern affects the vegetation structure.
- Measure the sediment consolidation/compaction and deposition rates, and determine net sediment level changes using S.E.T. technology (long term **S**ediment **E**rosion **T**ables).
- Provide input to verifying and refining the hydrologically based computer model used by the COE to design Kingman Marsh.
- Measure quality and quantity of shallow ground-water contribution to the two wetlands.

## *METHODOLOGY:*

### Monitoring of standing vegetation by USGS and University of Maryland teams at the Kingman marsh and the reference sites

We have established a total of 18 35-m long belt transects for sampling standing vegetation at the Kingman Marsh site. Twelve transects were established in planted areas of Cell 1, a total of 3 transects in the two unplanted areas of Cell 1, and 3 transects in Cell 2. Transect locations were determined by using a random number generator to select locations in a grid overlying the site. Locations that resulted in transects being adjacent to each other were rejected to ensure that the site is adequately sampled. The beginning and ending point of each transect have been marked with labeled 10-foot long PVC poles and the beginning points have been located using GPS. In addition we are using 8 transects at Kenilworth Marsh, 3 at Dueling Creek and 6 at Patuxent.

Each belt transect consists of 7, 5 x 1m sections. Within each section, we will record percent aerial cover of each species with coverages greater than 15% being rounded to the nearest 5%. Aerial cover is the proportion of the section covered by leaves, stem, or fruit of each species or by bare ground as viewed from above and projected onto the ground. The data for each transect will be field checked to ensure that the total coverage of all species and no cover constitutes at least 100% but totals may well exceed 100% where the vertical vegetation structure exists in more than one stratum. Transects will be sampled three times during the growing season (May, July, September) for each study year for the duration of the project. Walk-throughs of the entire accessible marsh will be conducted to note additional species not detected along the transects.

In addition to cover measurements, aboveground plant biomass will be sampled in August of each year. Biomass will be determined by harvesting all above-ground plant parts in marked 0.5 m × 0.5 m plots located outside of but within 2 m of each transect. Plant material will be sorted by species, dried at 80ºC for 48 hours, and weighed to the nearest 0.1 g.

## *Seed bank study conducted by USGS and University of Maryland staff*

### ***Sediment samples***

Sediment seed bank samples will be collected at each of the 35 transects during years 1, 3, and 5 of the project to ascertain if there is a change as the reconstructed marshes mature and how they compare over time to the reference wetlands. Samples will be collected by taking one 4.8 cm diameter by 5 cm deep core from each transect section, and mixing them together to form a composite sample. The location of the cores for years 1, 3, and 5 will be within the center of the first, second, and third portions of the sections, respectively. Samples will be collected in April of each year, before the period of maximum seedling recruitment but after the period of natural cold-stratification of buried seeds. Samples will be stored at 4ºC until processing. Soil processing will consist of removing coarse organic material and living roots, and then mixing thoroughly. A 300 $cm^3$ subsample will then be spread (in a layer about 1 cm thick) on the surface of 3.5 cm of moist vermiculite in aluminum pans (15.6 cm by 21.8 cm surface area, 5.1 cm depth) with perforations in the bottom for drainage. The pans will be placed on a misting bench in a greenhouse at the University of Maryland, College Park to keep sediment moist. Seedlings emerging from the soil will be identified as distinct species and counted for three months, after which no additional seedlings are expected to emerge. Seedlings of unknown species will be transplanted into potting soil and grown until they can be identified. This approach, known as the emergence method, is effective in determining the species composition of viable seeds buried in wetland soils (Poiani and Johnson 1988; Gross 1990), and has been used widely in studies of wetland seed banks (van der Valk and Davis 1978; Keddy and Reznicek 1982; Leck and Simpson 1995; Baldwin et al. 1996; van der Valk and Rosburg 1997; Baldwin et al. 1998; Brown 1998).

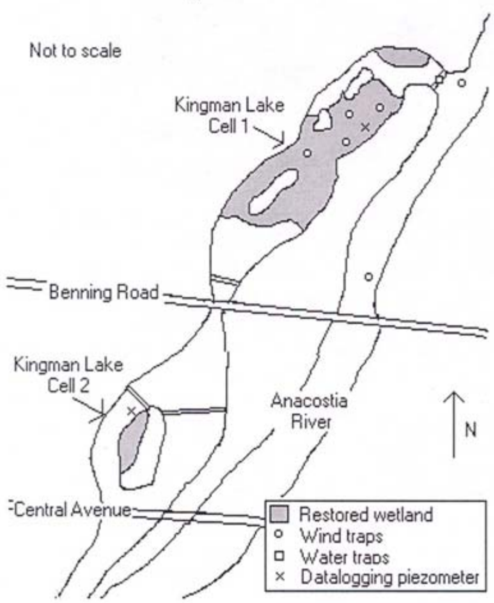
Debris samples

**It was felt that areas where debris collected or was concentrates by water wash would be good areas to find seeds. Such debris samples were taken during Year 1 in early May, by scraping off seeds and debris from the surface of the wetland to approximately equal the volume of the seed bank soil collection. These were stored and processed the same way as the seed bank samples. However, since the finer debris tended to get washed down into the vermiculite, it was spread over 3.5 cm of potting soil in 25.4 cm by 50.8 cm plastic pans with perforations on the bottom. These were also placed randomly on the greenhouse misting bench and treated the same as the seed bank study. This greenhouse germination study is completed.**

Water traps

**Another vehicle by which seeds could arrive at the marsh is through water transport. Seeds caught via water traps were collected at three different times at Kingman: May 2000, April 2001, and June 2001. In October 1999, six seed traps were attached to the North golf cart bridge supports at Kingman Lake Area (Cell) 1, the North entrance of Kingman Marsh to the Anacostia River (Fig. A).**

**Figure A**
Kingman Lake




**Three were facing the Anacostia River and three were facing Kingman Marsh to intercept seeds from both in-flowing and out-flowing tides. Each trap had four seed collectors, each positioned at a different height. The intent was for the lower three collectors to get water inputs from the tidal range of low to high tide, which is about a meter, and the top collector to get only wind inputs. The bottom collector was usually inundated with water while the middle collectors were inundated about twice a day during high tide. However, it appears that the top collector was also inundated occasionally with water. In addition, this top collector had tangle-foot (a tacky substance) applied to the surface to help snare seeds. The trap was a 2×4 piece of wood to which the four collectors were attached. The collectors were each a 25.4 cm by 50.8 cm piece of plywood, with the bottom three collectors attached at a 30-degree angle and the top collector attached parallel to a 2×4 piece of wood mounted perpendicular to the original piece of wood. This was bolted directly to the bridge supports. Each piece of plywood had two 10.16 cm by 15.24 cm holes cut out to allow for percolation of water. On top of the plywood was a 3.5 cm thick section of Bog Mat, a type of coconut fiber mat, attached by four plastic cable ties. These coconut mats were used to allow water to infiltrate through and trap seeds, therefore reducing seed losses by water runoff. These mats were collected in May 2000 (after seven months of exposure). They sustained considerable damage during**

**Year 1, possibly due to ice or debris booms placed during wetland restoration, and some seed collectors were broken and missing by May 2000. Therefore, the trap design was modified slightly for Year 2. The new traps were installed in November 2000. These new traps were similar to the original design with a few exceptions (Figure B). The plywood was replaced by sheet metal. This sheet metal had an extra 1 inch at either end, which was bent and screwed onto the wood. All the collectors were positioned at a 30-degree angle. The collectors were closer together vertically, allowing all the traps to be inundated with water at least once during each tidal cycle. The 2×4 pieces of wood were replaced by 2×8s. In addition, since the Bog Mat was no longer available, the new traps had two thinner coconut mats attached to each collector. The bottom mat was a 0.7 cm thick coconut fabric held together by plastic netting. The top mat was a 0.7 cm thick coconut fabric within a synthetic reinforcement structure. This plastic structure created a terraced effect to slow water runoff and increase seeds getting caught in the fabric. The coconut mats were collected and replaced in early April 2001 and early June. Since seeds collected in the summer or fall will require approximately two months cold stratification before the seven-month germination period begins, no further coconut mats will be collected for this study. The mats were stored at 4°C until they were processed. Large organic matter and debris were removed from the surface of the mats after they were rinsed with distilled water to remove any adhering seeds. These mats were placed on top of 3.5 cm of moist potting soil in 25.4 cm by 50.8 cm plastic pans, with perforations on the bottom for drainage. These were randomly arranged on a greenhouse misting bench. Year 1 samples were put in the greenhouse in May 2000 and Year 2 samples were put in the greenhouse in April 2001 and June 2001, depending on the collection date. The emergence method techniques were followed as described in the seed bank study.**

The greenhouse germination study for year 1 samples was completed.

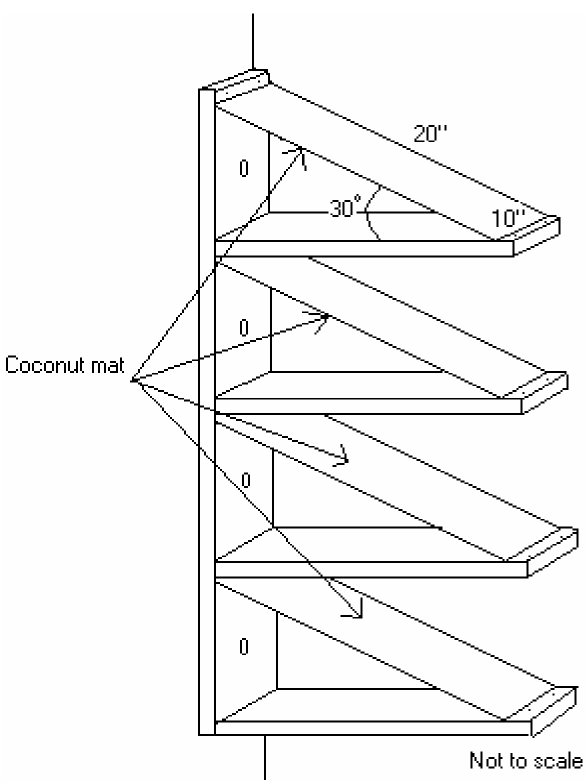



Figure B. Four-level water trap. Six sets of these traps were installed at Kingman Lake Cell 1 to collect seeds dispersed via water.

Wind traps

Aerially dispersed seeds were collected via wind traps at two different times at Kingman. Six wind seed traps were set up in November 2000. Two were located on the Anacostia River, one on the west side of the river at the Northern end of Kingman Marsh Area 1, and the other on the east side of the river at the southern end of Kingman Marsh Area 1 (Figure A). The four remaining traps were installed in the restored portion of

Kingman Marsh Area 1. The traps were made of two perforated metal poles driven five feet into the ground. These poles were attached to other metal poles, each with a 25.4 cm by 50.8 cm metal sheet welded on to serve as the seed collectors (see Figure C for details). These collectors each had two 10.16 cm by 15.24 cm holes for drainage. These collector traps were about 9 feet above the ground to reduce seed deposition from adjacent vegetation. As on the water traps, two coconut mats were attached to each of these metal sheets using four plastic cable ties. The intention was for rain to percolate through these mats, reducing seed losses from water runoff. Welded on the top of this trap was a 25.4 cm by 25.4 cm cross-shaped wind deflector, directing more airborne seeds onto the traps (Figure C). The traps were positioned to face the average wind directions in the area, as reported for past months by the National Weather Service, 320 degrees and 140 degrees. These coconut mats were installed in November 2000 and collected in early April 2001, and replaced and collected again in early June 2001. These coconut mats will be treated the same as those from the water traps. No further coconut mats will be collected from the wind traps for this study. The germination of the collected samples is being monitored in the greenhouse.

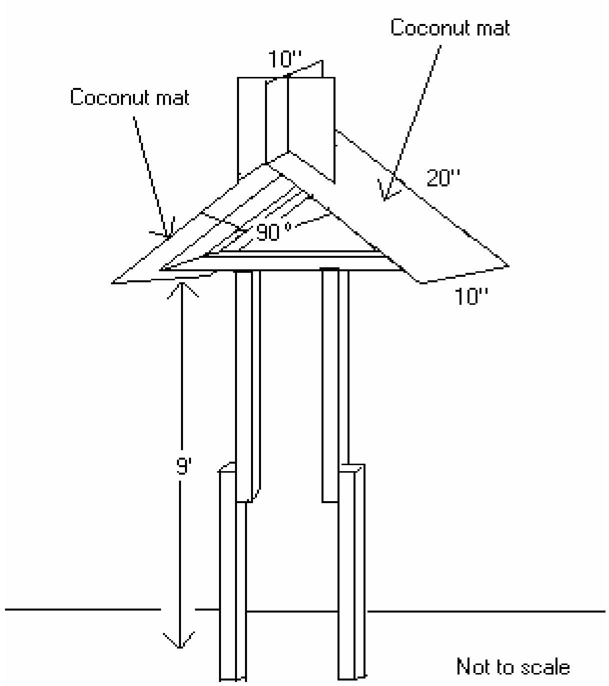



Figure C. Wind trap. Six traps were installed at Kingman Lake Cell 1 to collect seed dispersed via wind.

Seed trawling

An effort was made to trawl for seeds along the surface of the Anacostia River in November 2000, early April 2001, and early June 2001. A mesh net that funnels into a dolphin bucket was used, allowing river water to go through the net and deposit seeds and small debris into the bucket and the net (Figure D). Two floats were attached to the sides of the net and to the dolphin bucket to allow the top of the net to flow about 3 inches above the water surface. This net was attached to a rope, which was tied to a perforated metal pipe allowing the trap to float about two feet from the side of our boat. The trap was dragged along the front side of the boat, to reduce impact by the wake, at the slowest driving speed. When the dolphin bucket was full, debris and seeds from the net were placed into a plastic bag (coarse debris sample). The dolphin bucket was rinsed with distilled water into a plastic container (fine debris sample). Since the net was cleaned several times as needed for each measured distance, the coarse debris samples were combined and the fine debris samples were combined, resulting in two samples for each distance. Several samples were taken each trawl time: a sample from the boat ramp North of Dueling Creek, to the Dueling Creek entrance (approximately 0.8 km); a sample from within Dueling Creek; a sample from the Dueling Creek entrance to the Kenilworth entrance (approximately 0.8 km); a sample in Kenilworth; and a sample from the Kenilworth entrance to the Kingman entrance (approximately 0.8km). This resulted in ten samples, a coarse and a fine debris sample from each of the five locations. These were stored in 4$^{\circ}$C until processing. Processing consisted of rinsing any seeds off large debris and leaves with distilled water before removing the large debris. The coarse debris samples were spread onto 3.5 cm potting soil in 25.4 cm by 50.8 cm plastic trays with perforations on the bottom for drainage. Fine debris samples were spread onto 3.5 cm potting soil in aluminum pans (15.6 cm by 21.8 cm surface area, 5.1 cm depth) with perforations on the bottoms to allow drainage. These were all placed randomly on the greenhouse misting bench. Samples from November 2000 and April 2001 were placed in the greenhouse in April 2001. Samples from June 2001 were placed in the greenhouse in June 2001. No further trawling collections will be conducted for this study. The germination of the collected samples is being monitored in the greenhouse.

Figure D. Trawling net. Net floats along the side of the boat to collect seeds on the surface of the Anacostia River and funnel them into a dolphin bucket. The metal pipe extending from the boat allows the net to flow approximately two feet from the boat.

## *Soil characterization conducted by USGS and University of Maryland staff*

The methods used for this objective are similar to those described in the May 1999 Kingman Lake Wetland Restoration Monitoring Plan (developed by David Shepp and Timothy J. Murphy of the Metropolitan Washington Council of Governments for the U.S. Army Corps of Engineers), except that we are proposing additional sampling locations and analyses. Soil samples will be collected on the opposite side of each transect from that being read for cover (35 sample locations total). Samples will consist of 30 cm deep cores collected within the first, second, and third portions of each transect during years 1, 3, and 5, respectively. Samples will be separated into three depth strata: 0-7.5 cm, 7.5-15 cm, and 15-30 cm. Each stratum will be analyzed for particle size distribution (% sand, silt, clay), bulk density, moisture content, and organic matter content.

Samples in Year 2 will be taken in a similar manner, with soil from all three depths being collected and composited separately to create one sample for each depth in the transect. These will be taken at 7.5, 12.5, and 17.5 meters along the transects to avoid taking samples from the exact area of soil collection in Year 1. At Kingman Marsh Area 1, one single soil sample with these three depths will also be taken and left uncomposited for each transect, allowing us to estimate the variation along the transect. In addition, in Year 2 at Kingman Marsh Area 1 and Area 2, a peat auger will be used to collect five soil samples at each Area from a depth of 18” to three feet below the surface, being sure to collect only the sediment below the fill material. These will be analyzed to understand the characteristics of the subsurface layer.

Samples were stored at 4$^{\circ}$C until processing. Processing included putting the soil into aluminum trays and placing them in a walk-in growth chamber of 42$^{\circ}$C and 15% humidity. The soil samples were then ground up into homogeneous samples using a blender.

pH and organic matter will be measured at the University of Maryland. The loss on ignition method will be used to determine organic matter (Nelson and Sommers, 1996) for all samples from Year 1 and Year 2 except the subsurface samples. In order to pretreat beakers to eliminate any residual organic matter on the beakers, empty beakers will be heated in a muffle furnace at 400$^{\circ}$C for 2 hours, cooled, and weighed to 0.1mg. 1 to 3 grams of air-dried ground soil will be added to the beaker and heated at 105$^{\circ}$C for 24 hours. The filled beaker will then be cooled in a desiccator over $CaCl_2$ and weighed. The samples will then be ignited in a muffle furnace at 400$^{\circ}$C for 16 hours to burn off the organic matter and then cooled in a desiccator over $CaCl_2$ and weighed. The loss on ignition content is found using the following formula:

$$\text{LOI, \%} = (\text{Weight}_{105} - \text{Weight}_{400})/\text{Weight}_{105} \times 100$$

pH for these same samples will be measured using the method known as determination of pH in water. 10 grams of air-dried soil will be added to a 50-mL beaker. 10 mL of deionized water will be added and mixed well using a stirring rod. The sample will stand for 10 minutes. Then the beaker will be swirled and the electrode inserted into the suspension. The pH will be recorded. Care will be taken to reduce contamination by rinsing the stirring rod and electrode with distilled water between samples (Thomas, 1996).

A portion of each sample from Year 1 and Year 2 will be sent to the University of Delaware Soil Testing Program. In Year 1 and Year 2, total Nitrogen, total Carbon, and total Sulfur will be analyzed for all samples except the subsurface samples. These same samples will be analyzed for total Phosphorus using microwave digestion. In addition, the following metals will be measured onYear 1 and Year 2 samples at the depth of 0-7.5 cm using EPA3050 Digestion: Cadmium, Copper, Nickel, Chromium, Zinc, and Lead. Particle size analysis will measure texture on all samples from year 1, 0-7.5 cm depth samples from year 2 composited samples, all three depths from year 2 non-composited samples, and the subsurface samples.

Soil redox potential ($E_H$) was measured in each sector using five platinum electrodes and a pH/mV meter. Redox potential will also be measured in August 2001. A platinum electrode was inserted 5 cm into the soil and a mV measurement was taken for each sector. The pH of the water in the soil was measured for each transect by withdrawing water from the soil using a plastic tube attached to a syringe. The plastic tube was inserted into the soil and the syringe handle was pulled out, pulling water from the soil. This water was collected in a plastic container, a pH probe was inserted, and a pH reading was taken using a pH meter. This allowed me to adjust the $E_H$ readings for pH. Redox potential will be recorded for Year 2.

**Piezometers**

Datalogging piezometers (hydrologgers) were installed in late March 2001 to monitor water levels in the wetlands for Year 2. One piezometer was installed into each of the seven different marsh sites (Kingman marsh Area 1, Kingman Marsh Areal 2, Kenilworth Marsh Mass Fill 1, Kenilworth Marsh Mass Fill 2, Patuxent River North of Route 4, Patuxent River South of Route 4, and Dueling Creek) - Maps 1-4. These were installed at a lower elevation than the transects so the full range of water level fluctuation at all sectors could be estimated. The piezometer is a three inch diameter PVC pipe with perforations throughout the pipe, a capacitance sensor inside, and a data logger on the top to record water levels at specific intervals Ecotone Model (Remote Data Systems, Inc., Whiteville, North Carolina). The pipe was pushed approximately four feet into the ground and extended three feet above the soil substrate. The water data will be downloaded from the loggers until November 2001. These were configured to record elevations every fifteen minutes. In late March 2001, we used a level to survey the elevation of all sectors in relation to the piezometers. Using this data, relative surface water levels will be measured for all transects. In addition, absolute elevations will be obtained in all areas where benchmarks or other markers of a known elevation are present.

## *Data Analysis*

Plant community data will be processed to yield cover by species and relative cover, frequency, dominance, species richness and diversity, and importance. Comparisons will be made between Cell 1 and 2 within Kingman Marsh to determine how similar they are and to reference sites also being monitored including Kenilworth Marsh, Dueling Creek in the Anacostia and the Patuxent near Jug Bay. Literature comparisons will include Dyke Marsh and Piscataway wetlands in the Potomac. There will also be comparisons made between planted and unplanted transects to help evaluate the contribution of volunteer plants to the establishment of the wetland. Primary statistical analyses using the Kingman Marsh data will involve repeated measure ANOVAs. Any significant trends over time will be determined using parametric or non-parametric tests as needed.

Seed bank data will relate the species determined by germination from sediment collections as well as from water and air borne collections. Comparisons will be summarized to evaluate which medium probably contributed most to establishment of unplanted vegetation at Kingman. If the data proves strong enough the relative contribution by species for each medium will be measured.

For the soil sampling, data will be processed from each of the 3 sampling years for all the sites. Soil texture, % organic matter, soil moisture, pH and redox will be compared by year and by collection site. Particular interest will be paid to development of organic matter in the three collected levels, especially for the top 3 inches., over the 5-year period. Soil development at Kingman Marsh will be compared to Kenilworth and the other monitored reference wetlands.

For the avian study differences in months and trends over the years will be analyzed by month, tide and annual changes. Contrast will be used to test averages for seasonal differences and site changes.

## *Facilities and Equipment*

The University of Maryland portion of this research will be conducted out of the Wetland Ecology and Engineering Laboratory, which is supervised by Dr. Andrew Baldwin, located within the Department of Biological Resources Engineering at the University of Maryland, College Park. Equipment in this lab that will be used for this project includes drying ovens, a muffle furnace, coring devices, pH/mV meters, redox electrodes, analytical and top-loading balances, a grinding mill, computer measuring tapes, refrigerators, plant presses, laboratory glassware, waders, and mudders. Departmental vehicles will be used for field access. The seed bank studies will be conducted at the UM greenhouses.

The USGS portion of the research will be coordinated by Dr. Richard Hammerschlag out of the USGS Miriam Laboratory at the Patuxent Wildlife Research Center, Laurel, Maryland. Equipment from the Miriam lab that will be used on this project includes computers and field gear. Any work done in conjunction with WRD Baltimore would involve shared or acquired equipment.

## *WORKPLAN AND COSTS:*

*Fieldwork will commence in 2000 and be completed during 2004. Annual reports will be prepared for 2000-2003 and a Final Report will analyze results from the project duration: 2000-2004.*

*FUNDING: Current funding base includes $150,000 over 5 years from the U.S. Army Corps of Engineers (COE) and ~ $50,000 over 3 years from the USGS Human Resources Initiative (USGS HRI).*

| | ***Amount*** | ***Receiver*** | ***Source*** |
|---|---|---|---|
| Year 1 (2000) | 8,500 | U.of Md. | COE |
| | 11,500 | USGS PWRC | COE |
| | 19,000 | USGS/PWRC | USGS/HRI |
| Year 2 (2001) | 8,826 | U. of Md. | COE |
| | 16,174 | USGS/PWRC | COE |
| | 20,000 | USGS/PWRC | USGS/HRI |
| Year 3 (2002) | 12,000 | U. of Md. | COE |
| | 17,000 | USGS/PWRC | COE |
| | 10,000 | USGS/PWRC | USGS/HRI |
| Year 4 (2003) | 19,000 | U. of Md. | COE |
| | 19,000 | USGS/PWRC | COE |
| Year 5 (2004) | 19,000 | U. of Md. | COE |
| | 20,000 | U. of Md. | COE |

Salaries for Dr. A. Baldwin, Dr. R. Hammerschlag (0.6 MY/year) and Mrs. M. Paul (0.1 MY/year) will be paid by their respective Institutions as contributed base salary. The rounded contributed salaries will be:
University of Maryland – Dr. Andy Baldwin: $125,000
USGS/PWRC – Dr. Dick Hammerschlag: $250,000
USGS/PWRC – Mary Paul: $25,000

BUDGET:

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| Salaries | | | | | |
| U. Md.undergrad | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 |
| USGS biotech | $6,500 | $6,177 | $7,000 | $20,000 | $20,000 |
| USGS HRI student | $19,000 | $20,000 | $10,000 | | |
| Hammerschlag-USGS | 7 mo. | 7 mo. | 7 mo. | 8 mo. | 8 mo. |
| Baldwin-U. Md. | 3 mo. | 3 mo. | 3 mo. | 3 mo. | 3 mo. |
| Paul-USGS | 1 mo. | 1 mo. | 1 mo. | 1mo. | 1 mo. |
| | | | | | |
| Equipment | | | | | |
| GPS receiver | $500 | | | | |
| Data logging wells | $2,000 | | | | |
| | | | | | |
| Supplies | $1000 | $8,500 | $7,000 | $5,500 | $6,500 |
| | | | | | |
| Travel | $2,243 | $1,800 | $1,500 | $1,500 | $1,500 |
| | | | | | |
| Overhead (USGS 16%) | $2,757 | $3,447 | $3,500.00 | $6,000 | $6,000 |
| | | | | | |
| ***TOTAL COSTS*** | $39,000 | $45,000 | $39,000 | $38,000 | $39,000 |
| | | | | | |
| ***GRAND TOTAL*** | **$200,000** | | | | |
| | | | | | |
| Funds available | $150 K COE | | | | |
| | $50 K USGS | | | | |
| | | | | | |
| U.of Md. in kind | **$125,000** | | | | |
| USGS in kind | **$275,000** | | | | |
| | | | | | |
| **TOTAL PROJECT COST** | **$600,000** | | | | |

Preliminary estimated costs for the **Hydrology Study** would be $100K/year for project duration (3-5years).

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# Appendix B Plant Species Lists

Appendix B
Identified Plant Species
Kingman- Transects
2000

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Acer saccharinum* | silver maple | | ACESAC | Aceraceae |
| *Alisma subcordatum* | American water plantain | *Alisma plantago-aquatica* | ALISUB | Alismataceae |
| *Amaranthus blitum* | purple amaranth | *Amaranthus lividus* | AMABLI | Amaranthaceae |
| *Amaranthus cannabinus* | tidalmarsh amaranth | | AMACAN | Amaranthaceae |
| *Artemisia vulgaris* | common wormwood | | ARTVUL | Asteraceae |
| *Azolla caroliniana* | Carolina mosquitofern | | AZOCAR | Salviniaceae |
| *Bidens cernua* | nodding beggartick | | BIDCER | Asteraceae |
| *Bidens connata* | purplestem beggarticks | | BIDCON | Asteraceae |
| *Bidens frondosa* | devil's beggartick | | BIDFRO | Asteraceae |
| *Boehmeria cylindrica* | smallspike false nettle | | BOECYL | Urticaceae |
| *Callitriche heterophylla* | two-headed water-starwort | | CALHET | Callitrichaceae |
| *Cardamine pensylvanica* | Pennsylvania bittercress | | CARPEN | Brassicaceae |
| *Chamaesyce maculata* | spotted sandmat | *Euphorbia maculata* | CHAMAC | Euphorbiaceae |
| *Chenopodium ambrosioides* | Mexican tea | | CHEAMB | Chenopodiaceae |
| *Cleome hassleriana* | pink queen | *Cleome spinosa* | CLEHAS | Capparaceae |
| *Cynodon dactylon* | Bermudagrass | | CYNDAC | Poaceae |
| *Cyperus erythrorhizos* | redroot flatsedge | | CYPERY | Cyperaceae |
| *Cyperus flavescens* | yellow flatsedge | | CYPFLA | Cyperaceae |
| *Cyperus iria* | ricefield flatsedge | | CYPIRI | Cyperaceae |
| *Cyperus odoratus* | fragrant flatsedge | | CYPODO | Cyperaceae |
| *Cyperus squarrosus* | bearded flatsedge | | CYPSQU | Cyperaceae |
| *Dichanthelium clandestinum* | deertongue | *Panicum clandestinum* | DICCLA | Poaceae |
| *Digitaria sanguinalis* | hairy crabgrass | | DIGSAN | Poaceae |
| *Dulichium arundinaceum* | threeway sedge | | DULARU | Cyperaceae |
| *Echinochloa crus-galli* | barnyardgrass | | ECHCRU | Poaceae |
| *Echinochloa walteri* | coast cockspur grass | | ECHWAL | Poaceae |
| *Eclipta prostrata* | false daisy | | ECLPRO | Asteraceae |
| *Eleocharis obtusa* | blunt spikerush | | ELEOBT | Cyperaceae |
| *Eleusine indica* | Indian goosegrass | | ELEIND | Poaceae |
| *Equisetum arvense* | field horsetail | | EQUARV | Equisetaceae |

Appendix B
Identified Plant Species
Kingman- Transects
2000

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Eragrostis pectinacea* | tufted lovegrass | | ERAPEC | Poaceae |
| *Eragrostis pilosa* | Indian lovegrass | | ERAPIL | Poaceae |
| *Eupatorium capillifolium* | dogfennel | | EUPCAP | Asteraceae |
| *Eupatorium perfoliatum* | common boneset | | EUPPER | Asteraceae |
| *Eupatorium serotinum* | lateflowering boneset | | EUPSER | Asteraceae |
| *Fimbristylis autumnalis* | slender fimbry | | FIMAUT | Cyperaceae |
| *Heteranthera reniformis* | kidneyleaf mudplantain | | HETREN | Pontedariaceae |
| *Hibiscus moscheutos* | crimsoneyed rosemallow | | HIBMOS | Malvaceae |
| *Hypericum mutilum* | dwarf St. Johnswort | | HYPMUT | Clusiaceae |
| *Ipomoea lacunosa* | whitestar | | IPOLAC | Convolvulaceae |
| *Juncus acuminatus* | tapertip rush | | JUNACU | Juncaceae |
| *Juncus diffusissimus* | slimpod rush | | JUNDIF | Juncaceae |
| *Juncus effusus* | common rush | | JUNEFF | Juncaceae |
| *Juncus tenuis* | poverty rush | | JUNTEN | Juncaceae |
| *Kyllinga brevifolia* | shortleaf spikesedge | *Cyperus brevifolius* | KYLBRE | Cyperaceae |
| *Leersia oryzoides* | rice cutgrass | | LEEORY | Poaceae |
| *Lemna perpusilla* | minute duckweed | | LEMPER | Lemnaceae |
| *Lindernia dubia* | yellowseed false pimpernel | | LINDUB | Scrophulariaceae |
| *Ludwigia alternifolia* | seedbox | | LUDALT | Onagraceae |
| *Ludwigia decurrens* | wingleaf primrose-willow | *Jussiaea decurrens* | LUDDEC | Onagraceae |
| *Ludwigia leptocarpa* | anglestem primrose-willow | | LUDLEP | Onagraceae |
| *Ludwigia palustris* | marsh seedbox | | LUDPAL | Onagraceae |
| *Ludwigia peploides* ssp. *glabrescens* | floating primrose-willow | *Jussiaea repens* | LUDPEP | Onagraceae |
| *Lycopus americanus* | American water horehound | | LYCAME | Lamiaceae |
| *Lycopus virginicus* | Virginia water horehound | *Oxalis dillenii* | LYCVIR | Lamiaceae |
| *Lypersicon lycopersicum* var. *lycopersicum* | garden tomato | *Lycopersicon esculentum* | LYPLYC | Solanaceae |
| *Lythrum salicaria* | purple loosestrife | | LYTSAL | Lythraceae |
| *Mikania scandens* | climbing hempvine | | MIKSCA | Asteraceae |
| *Mimulus alatus* | sharpwing monkeyflower | | MIMALA | Scrophulariaceae |
| *Mimulus ringens* | Allegeny monkeyflower | | MIMRIN | Scrophulariaceae |

Appendix B
Identified Plant Species
Kingman- Transects
2000

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Mollugo verticillata* | green carpetweed | | MOLVER | Molluginaceae |
| *Panicum dichotomiflorum* | fall panicgrass | | PANDIC | Poaceae |
| *Peltandra virginica* | green arrow arum | | PELVIR | Araceae |
| *Penthorum sedoides* | ditch stonecrop | | PENSED | Saxifragaceae |
| *Pilea pumila* | Canadian clearweed | | PILPUM | Urticaceae |
| *Polygonum arifolium* | halberdleaf tearthumb | | POLARI | Polygonaceae |
| *Polygonum caespitosum* | oriental ladysthumb | | POLCAE | Polygonaceae |
| *Polygonum hydropiperoides* | swamp smartweed | *Polygonum hydropiperoides* var. *hydropiperoides* | POLHYD | Polygonaceae |
| *Polygonum lapathifolium* | curly knotweed | | POLLAP | Polygonaceae |
| *Polygonum pensylvanicum* | Pennsylvania smartweed | | POLPEN | Polygonaceae |
| *Polygonum persicaria* | spotted ladysthumb | | POLPER | Polygonaceae |
| *Polygonum punctatum* | dotted smartweed | | POLPUN | Polygonaceae |
| *Pontedaria cordata* | pickerelweed | | PONCOR | Pontedariaceae |
| *Populus deltoides* | eastern cottonwood | | POPDEL | Salicaceae |
| *Portulaca oleracea* | little hogweed | | POROLE | Portulaccaceae |
| *Ranunculus sceleratus* | cursed buttercup | | RANSCL | Ranunculaceae |
| *Rorippa palustris* ssp. *fernaldiana* | Fernald's yellowcress | *Rorippa islandica* | RORPAL | Brassicaceae |
| *Rumex crispus* | curly dock | | RUMCRI | Polygonaceae |
| *Rumex obtusifolius* | bitter dock | | RUMOBT | Polygonaceae |
| *Rumex verticillatus* | swamp dock | | RUMVER | Polygonaceae |
| *Sagittaria latifolia* | broadleaf arrowhead | | SAGLAT | Alismataceae |
| *Salix nigra* | black willow | | SALNIG | Salicaceae |
| *Schoenoplectus fluviatilis* | river bulrush | *Scirpus fluviatilis* | SCHFLU | Cyperaceae |
| *Schoenoplectus pungens* | common threesquare | *Scirpus americanus, Scirpus pungens* | SCHPUN | Cyperaceae |
| *Schoenoplectus tabernaemontani* | softstem bulrush | *Scirpus tabernaemontani, Scirpus validus* | SCHTAB | Cyperaceae |
| *Scirpus polyphyllus* | leafy bulrush | | SCIPOL | Cyperaceae |
| *Scutellaria lateriflora* | blue skullcap | | SCULAT | Lamiaceae |
| *Setaria parviflora* | marsh bristlegrass | *Setaria geniculata* | SETPAR | Poaceae |
| *Spirodela polyrrhiza* | common duckmeat | | SPIPOL | Lemnaceae |

Appendix B
Identified Plant Species
Kingman-  Transects
2000

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Taraxacum officinale* | common dandelion | | TAROFF | Asteraceae |
| *Trifolium repens* | white clover | | TRIREP | Fabaceae |
| *Typha angustifolia* | narrowleaf cattail | | TYPANG | Typhaceae |
| *Typha latifolia* | broadleaf cattail | | TYPLAT | Typhaceae |
| *Ulmus* sp. | elm | | ULMRUB | Ulmaceae |
| *Veronica peregrina* | neckweed | | VERPER | Scrophulariaceae |

* Nomenclature drawn from USDA, NRCS 1999.  The PLANTS database.  (http://plants.usda.gov/plants). National Plant Data Center, Baton Rouge, LA.

**Appendix B**

**Identified Plant Species** *

**Kingman- Non-Transect ****

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Ailanthus altissima* | tree of heaven | | AILALT | Simaroubiaceae |
| *Albizia julibrissin* | silktree | | ALBJUL | Mimosaceae |
| *Arctium minus* | lesser burrdock | | ARCMIN | Asteraceae |
| *Catalpa speciosa* | northern catalpa | | CATSPE | Bignoniaceae |
| *Cephalanthus occidentalis* | common buttonbush | | CEPOCC | Rubiaceae |
| *Convolvulus arvensis* | field bindweed | | CONARV | Convolvulaceae |
| *Conyza canadensis* var. *canadensis* | Canadian horseweed | *Erigeron canadensis* | CONCAN | Asteraceae |
| *Cuscuta gronovii* | scaldweed | | CUSGRO | Cuscutaceae |
| *Cyperus difformis* | variable flatsedge | | CYPDIF | Cyperaceae |
| *Cyperus strigosus* | strawcolored flatsedge | | CYPSTR | Cyperaceae |
| *Duchesnea indica* | Indian strawberry | | DUCIND | Rosaceae |
| *Fraxinus pennsylvanica* | green ash | | FRAPEN | Oleaceae |
| *Galinsoga quadriradiata* | shaggy soldier | | GALQUA | Asteraceae |
| *Hibiscus trionum* | flower of an hour | | HIBTRI | Malvaceae |
| *Juncus marginatus* | grassleaf rush | | JUNMAR | Juncaceae |
| *Juncus torreyi* | Torrey's rush | | JUNTOR | Juncaceae |
| *Leptochloa fusca* ssp. *fascicularis* | bearded sprangletop | *Leptochloa fascicularis* var. *acuminata* | LEPFUS | Poaceae |
| *Mazus pumilus* | Japanese mazus | *Mazus japonica* | MAZPUM | Scrophulariaceae |
| *Myosoton aquaticum* | giantchickweed | *Stellaria aquatica* | MYOAQU | Caryophyllaceae |
| *Najas minor* | brittle waternymph | | NAJMIN | Najadaceae |
| *Oxalis stricta* | woodsorrel | *Oxalis dillenii* | OXASTR | Oxalidaceae |
| *Paulownia tomentosa* | princesstree | | PAUTOM | Bignoniaceae |
| *Plantago rugelii* | blackseed plantain | | PLARUG | Platanginaceae |
| *Poa annua* | annual bluegrass | | POAANN | Poaceae |
| *Potamogeton diversifolius* | waterthread pondweed | | POTDIV | Potamogetonaceae |
| *Robinia pseudoacacia* | black locust | | ROBPSE | Fabaceae |
| *Salix matsudana* | corkscrew willow | | SALMAT | Salicaceae |
| *Sium suave* | hemlock waterparsnip | | SIUSUA | Apiaceae |
| *Solanum nigrum* | black nightshade | | SOLNIG | Solanaceae |
| *Sonchus asper* | spiny sowthistle | | SONASP | Asteraceae |
| *Verbena hastata* | swamp verbena | | VERHAS | Verbenaceae |

**Appendix B**

**Identified Plant Species** *

**Kingman- Non-Transect** **

**2000**

* Nomenclature drawn from USDA, NRCS 1999. The PLANTS database. (http://plants.usda.gov/plants).National Plant Data Center, Baton Rouge, LA.
** This list just represents species found in the marsh, but not in the transects. Species found in the transects are not repeated here.

**Appendix B**

**Identified Plant Species ***

**Kingman – Whole Marsh**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Acer saccharinum* | silver maple | | ACESAC | Aceraceae |
| *Ailanthus altissima* | tree of heaven | | AILALT | Simaroubiaceae |
| *Albizia julibrissin* | silktree | | ALBJUL | Mimosaceae |
| *Alisma subcordatum* | American water plantain | *Alisma plantago-aquatica* | ALISUB | Alismataceae |
| *Amaranthus blitum* | purple amaranth | *Amaranthus lividus* | AMABLI | Amaranthaceae |
| *Amaranthus cannabinus* | tidalmarsh amaranth | | AMACAN | Amaranthaceae |
| *Arctium minus* | lesser burrdock | | ARCMIN | Asteraceae |
| *Artemisia vulgaris* | common wormwood | | ARTVUL | Asteraceae |
| *Azolla caroliniana* | Carolina mosquitofern | | AZOCAR | Salviniaceae |
| *Bidens cernua* | nodding beggartick | | BIDCER | Asteraceae |
| *Bidens connata* | purplestem beggarticks | | BIDCON | Asteraceae |
| *Bidens frondosa* | devil's beggartick | | BIDFRO | Asteraceae |
| *Boehmeria cylindrica* | smallspike false nettle | | BOECYL | Urticaceae |
| *Callitriche heterophylla* | two-headed water-starwort | | CALHET | Callitrichaceae |
| *Cardamine pensylvanica* | Pennsylvania bittercress | | CARPEN | Brassicaceae |
| *Catalpa speciosa* | northern catalpa | | CATSPE | Bignoniaceae |
| *Cephalanthus occidentalis* | common buttonbush | | CEPOCC | Rubiaceae |
| *Chamaesyce maculata* | spotted sandmat | *Euphorbia maculata* | CHAMAC | Euphorbiaceae |
| *Chenopodium ambrosioides* | Mexican tea | | CHEAMB | Chenopodiaceae |
| *Cleome hassleriana* | pink queen | *Cleome spinosa* | CLEHAS | Capparaceae |
| *Convolvulus arvensis* | field bindweed | | CONARV | Convolvulaceae |
| *Conyza canadensis* | Canadian horseweed | | CONCAN | Asteraceae |
| *Cuscuta gronovii* | scaldweed | | CUSGRO | Cuscutaceae |
| *Cynodon dactylon* | Bermudagrass | | CYNDAC | Poaceae |
| *Cyperus difformis* | variable flatsedge | | CYPDIF | Cyperaceae |
| *Cyperus erythrorhizos* | redroot flatsedge | | CYPERY | Cyperaceae |
| *Cyperus flavescens* | yellow flatsedge | | CYPFLA | Cyperaceae |
| *Cyperus iria* | ricefield flatsedge | | CYPIRI | Cyperaceae |
| *Cyperus odoratus* | fragrant flatsedge | | CYPODO | Cyperaceae |
| *Cyperus squarrosus* | bearded flatsedge | | CYPSQU | Cyperaceae |
| *Cyperus strigosus* | strawcolored flatsedge | | CYPSTR | Cyperaceae |
| *Dichanthelium clandestinum* | deertongue | *Panicum clandestinum* | DICCLA | Poaceae |

**Appendix B**
**Identified Plant Species ***
**Kingman – Whole Marsh**
**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Digitaria sanguinalis* | hairy crabgrass | | DIGSAN | Poaceae |
| *Duchesnea indica* | Indian strawberry | | DUCIND | Rosaceae |
| *Dulichium arundinaceum* | threeway sedge | | DULARU | Cyperaceae |
| *Echinochloa crus-galli* | barnyardgrass | | ECHCRU | Poaceae |
| *Echinochloa walteri* | coast cockspur grass | | ECHWAL | Poaceae |
| *Eclipta prostrata* | false daisy | | ECLPRO | Asteraceae |
| *Eleocharis obtusa* | blunt spikerush | | ELEOBT | Cyperaceae |
| *Eleusine indica* | Indian goosegrass | | ELEIND | Poaceae |
| *Equisetum arvense* | field horsetail | | EQUARV | Equisetaceae |
| *Eragrostis pectinacea* | tufted lovegrass | | ERAPEC | Poaceae |
| *Eragrostis pilosa* | Indian lovegrass | | ERAPIL | Poaceae |
| *Eupatorium capillifolium* | dogfennel | | EUPCAP | Asteraceae |
| *Eupatorium perfoliatum* | common boneset | | EUPPER | Asteraceae |
| *Eupatorium serotinum* | lateflowering boneset | | EUPSER | Asteraceae |
| *Fimbristylis autumnalis* | slender fimbry | | FIMAUT | Cyperaceae |
| *Fraxinus pennsylvanica* | green ash | | FRAPEN | Oleaceae |
| *Galinsoga quadriradiata* | shaggy soldier | | GALQUA | Asteraceae |
| *Heteranthera reniformis* | kidneyleaf mudplantain | | HETREN | Pontedariaceae |
| *Hibiscus moscheutos* | crimsoneyed rosemallow | | HIBMOS | Malvaceae |
| *Hibiscus trionum* | flower of an hour | | HIBTRI | Malvaceae |
| *Hypericum mutilum* | dwarf St. Johnswort | | HYPMUT | Clusiaceae |
| *Ipomoea lacunosa* | whitestar | | IPOLAC | Convolvulaceae |
| *Juncus acuminatus* | tapertip rush | | JUNACU | Juncaceae |
| *Juncus diffusissimus* | slimpod rush | | JUNDIF | Juncaceae |
| *Juncus effusus* | common rush | | JUNEFF | Juncaceae |
| *Juncus marginatus* | grassleaf rush | | JUNMAR | Juncaceae |
| *Juncus tenuis* | poverty rush | | JUNTEN | Juncaceae |
| *Juncus torreyi* | Torrey's rush | | JUNTOR | Juncaceae |
| *Kyllinga brevifolia* | shortleaf spikesedge | *Cyperus brevifolius* | KYLBRE | Cyperaceae |
| *Leersia oryzoides* | rice cutgrass | | LEEORY | Poaceae |
| *Lemna perpusilla* | minute duckweed | | LEMPER | Lemnaceae |
| *Leptochloa fusca* ssp. *fascicularis* | bearded sprangletop | *Leptochloa fascicularis* | LEPFUS | Poaceae |

**Appendix B**
**Identified Plant Species ***
**Kingman – Whole Marsh**
**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Lindernia dubia* | yellowseed false pimpernel | | LINDUB | Scrophulariaceae |
| *Ludwigia alternifolia* | seedbox | | LUDALT | Onagraceae |
| *Ludwigia decurrens* | wingleaf primrose-willow | *Jussiaea decurrens* | LUDDEC | Onagraceae |
| *Ludwigia leptocarpa* | anglestem primrose-willow | | LUDLEP | Onagraceae |
| *Ludwigia palustris* | marsh seedbox | | LUDPAL | Onagraceae |
| *Ludwigia peploides* ssp. *glabrescens* | floating primrose-willow | *Jussiaea repens* | LUDPEP | Onagraceae |
| *Lycopus americanus* | American water horehound | | LYCAME | Lamiaceae |
| *Lycopus virginicus* | Virginia water horehound | *Oxalis dillenii* | LYCVIR | Lamiaceae |
| *Lypersicon lycopersicum* var. *lycopersicum* | garden tomato | *Lycopersicon esculentum* | LYPLYC | Solanaceae |
| *Lythrum salicaria* | purple loosestrife | | LYTSAL | Lythraceae |
| *Mazus pumilus* | Japanese mazus | *Mazus japonica* | MAZPUM | Scrophulariaceae |
| *Mikania scandens* | climbing hempvine | | MIKSCA | Asteraceae |
| *Mimulus alatus* | sharpwing monkeyflower | | MIMALA | Scrophulariaceae |
| *Mimulus ringens* | Allegeny monkeyflower | | MIMRIN | Scrophulariaceae |
| *Mollugo verticillata* | green carpetweed | | MOLVER | Molluginaceae |
| *Myosoton aquaticum* | giantchickweed | *Stellaria aquatica* | MYOAQU | Caryophyllaceae |
| *Najas minor* | brittle waternymph | | NAJMIN | Najadaceae |
| *Oxalis stricta* | woodssorrel | *Oxalis dillenii* | OXASTR | Oxalidaceae |
| *Panicum dichotomiflorum* | fall panicgrass | | PANDIC | Poaceae |
| *Paulownia tomentosa* | princesstree | | PAUTOM | Bignoniaceae |
| *Peltandra virginica* | green arrow arum | | PELVIR | Araceae |
| *Penthorum sedoides* | ditch stonecrop | | PENSED | Saxifragaceae |
| *Pilea pumila* | Canadian clearweed | | PILPUM | Urticaceae |
| *Plantago rugelii* | blackseed plantain | | PLARUG | Platanginaceae |
| *Poa annua* | annual bluegrass | | POAANN | Poaceae |
| *Polygonum arifolium* | halberdleaf tearthumb | | POLARI | Polygonaceae |
| *Polygonum caespitosum* | oriental ladysthumb | | POLCAE | Polygonaceae |
| *Polygonum hydropiperoides* | swamp smartweed | *Polygonum hydropiperoides* var. *hydropiperoides* | POLHYD | Polygonaceae |
| *Polygonum lapathifolium* | curly knotweed | | POLLAP | Polygonaceae |
| *Polygonum pensylvanicum* | Pennsylvania smartweed | | POLPEN | Polygonaceae |
| *Polygonum persicaria* | spotted ladysthumb | | POLPER | Polygonaceae |

**Appendix B**

**Identified Plant Species ***

**Kingman – Whole Marsh**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Polygonum punctatum* | dotted smartweed | | POLPUN | Polygonaceae |
| *Pontedaria cordata* | pickerelweed | | PONCOR | Pontedariaceae |
| *Populus deltoides* | eastern cottonwood | | POPDEL | Salicaceae |
| *Portulaca oleracea* | little hogweed | | POROLE | Portulaccaceae |
| *Potamogeton diversifolius* | waterthread pondweed | | POTDIV | Potamogetonaceae |
| *Ranunculus sceleratus* | cursed buttercup | | RANSCL | Ranunculaceae |
| *Robinia pseudoacacia* | black locust | | ROBPSE | Fabaceae |
| *Rorippa palustris* ssp. *fernaldiana* | Fernald's yellowcress | *Rorippa islandica* | RORPAL | Brassicaceae |
| *Rumex crispus* | curly dock | | RUMCRI | Polygonaceae |
| *Rumex obtusifolius* | bitter dock | | RUMOBT | Polygonaceae |
| *Rumex verticillatus* | swamp dock | | RUMVER | Polygonaceae |
| *Sagittaria latifolia* | broadleaf arrowhead | | SAGLAT | Alismataceae |
| *Salix matsudana* | corkscrew willow | | SALMAT | Salicaceae |
| *Salix nigra* | black willow | | SALNIG | Salicaceae |
| *Schoenoplectus fluviatilis* | river bulrush | *Scirpus fluviatilis* | SCHFLU | Cyperaceae |
| *Schoenoplectus pungens* | common threesquare | *Scirpus americanus, Scirpus pungens* | SCHPUN | Cyperaceae |
| *Schoenoplectus tabernaemontani* | softstem bulrush | *Scirpus tabernaemontani, Scirpus validus* | SCHTAB | Cyperaceae |
| *Scirpus polyphyllus* | leafy bulrush | | SCIPOL | Cyperaceae |
| *Scutellaria lateriflora* | blue skullcap | | SCULAT | Lamiaceae |
| *Setaria parviflora* | marsh bristlegrass | *Setaria geniculata* | SETPAR | Poaceae |
| *Sium suave* | hemlock waterparsnip | | SIUSUA | Apiaceae |
| *Solanum nigrum* | black nightshade | | SOLNIG | Solanaceae |
| *Sonchus asper* | spiny sowthistle | | SONASP | Asteraceae |
| *Spirodela polyrrhiza* | common duckmeat | | SPIPOL | Lemnaceae |
| *Taraxacum officinale* | common dandelion | | TAROFF | Asteraceae |
| *Trifolium repens* | white clover | | TRIREP | Fabaceae |
| *Typha angustifolia* | narrowleaf cattail | | TYPANG | Typhaceae |
| *Typha latifolia* | broadleaf cattail | | TYPLAT | Typhaceae |
| *Ulmus* sp. | elm | | ULMSP | Ulmaceae |
| *Verbena hastata* | swamp verbena | | VERHAS | Verbenaceae |
| *Veronica peregrina* | neckweed | | VERPER | Scrophulariaceae |

**Appendix B**

**Identified Plant Species ***

**Kingman Area 1- Planted Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Acer saccharinum* | silver maple | | ACESAC | Aceraceae |
| *Alisma subcordatum* | American water plantain | *Alisma plantago-aquatica* | ALISUB | Alismataceae |
| *Bidens cernua* | nodding beggartick | | BIDCER | Asteraceae |
| *Bidens connata* | purplestem beggarticks | | BIDCON | Asteraceae |
| *Bidens frondosa* | devil's beggartick | | BIDFRO | Asteraceae |
| *Cardamine pensylvanica* | Pennsylvania bittercress | | CARPEN | Brassicaceae |
| *Chenopodium ambrosioides* | Mexican tea | | CHEAMB | Chenopodiaceae |
| *Cleome hassleriana* | pink queen | *Cleome spinosa* | CLEHAS | Capparaceae |
| *Cyperus erythrorhizos* | redroot flatsedge | | CYPERY | Cyperaceae |
| *Cyperus flavescens* | yellow flatsedge | | CYPFLA | Cyperaceae |
| *Cyperus iria* | ricefield flatsedge | | CYPIRI | Cyperaceae |
| *Cyperus odoratus* | fragrant flatsedge | | CYPODO | Cyperaceae |
| *Dichanthelium clandestinum* | deertongue | *Panicum clandestinum* | DICCLA | Poaceae |
| *Digitaria sanguinalis* | hairy crabgrass | | DIGSAN | Poaceae |
| *Dulichium arundinaceum* | threeway sedge | | DULARU | Cyperaceae |
| *Echinochloa crus-galli* | barnyardgrass | | ECHCRU | Poaceae |
| *Echinochloa walteri* | coast cockspur grass | | ECHWAL | Poaceae |
| *Eclipta prostrata* | false daisy | | ECLPRO | Asteraceae |
| *Eleocharis obtusa* | blunt spikerush | | ELEOBT | Cyperaceae |
| *Eleusine indica* | Indian goosegrass | | ELEIND | Poaceae |
| *Equisetum arvense* | field horsetail | | EQUARV | Equisetaceae |
| *Eragrostis pectinacea* | tufted lovegrass | | ERAPEC | Poaceae |
| *Eupatorium capillifolium* | dogfennel | | EUPCAP | Asteraceae |
| *Eupatorium serotinum* | lateflowering boneset | | EUPSER | Asteraceae |
| *Fimbristylis autumnalis* | slender fimbry | | FIMAUT | Cyperaceae |
| *Hibiscus moscheutos* | crimsoneyed rosemallow | | HIBMOS | Malvaceae |
| *Hypericum mutilum* | dwarf St. Johnswort | | HYPMUT | Clusiaceae |
| *Ipomoea lacunosa* | whitestar | | IPOLAC | Convolvulaceae |
| *Juncus acuminatus* | tapertip rush | | JUNACU | Juncaceae |
| *Juncus diffusissimus* | slimpod rush | | JUNDIF | Juncaceae |
| *Juncus effusus* | common rush | | JUNEFF | Juncaceae |
| *Juncus tenuis* | poverty rush | | JUNTEN | Juncaceae |

**Appendix B**

**Identified Plant Species ***

**Kingman Area 1- Planted Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Leersia oryzoides* | rice cutgrass | | LEEORY | Poaceae |
| *Lemna perpusilla* | minute duckweed | | LEMPER | Lemnaceae |
| *Lindernia dubia* | yellowseed false pimpernel | | LINDUB | Scrophulariaceae |
| *Ludwigia decurrens* | wingleaf primrose-willow | *Jussiaea decurrens* | LUDDEC | Onagraceae |
| *Ludwigia leptocarpa* | anglestem primrose-willow | | LUDLEP | Onagraceae |
| *Ludwigia palustris* | marsh seedbox | | LUDPAL | Onagraceae |
| *Ludwigia peploides* ssp. *glabrescens* | floating primrose-willow | *Jussiaea repens* | LUDPEP | Onagraceae |
| *Lycopus americanus* | American water horehound | | LYCAME | Lamiaceae |
| *Lycopus virginicus* | Virginia water horehound | *Oxalis dillenii* | LYCVIR | Lamiaceae |
| *Lythrum salicaria* | purple loosestrife | | LYTSAL | Lythraceae |
| *Mikania scandens* | climbing hempvine | | MIKSCA | Asteraceae |
| *Mimulus alatus* | sharpwing monkeyflower | | MIMALA | Scrophulariaceae |
| *Mimulus ringens* | Allegeny monkeyflower | | MIMRIN | Scrophulariaceae |
| *Panicum dichotomiflorum* | fall panicgrass | | PANDIC | Poaceae |
| *Peltandra virginica* | green arrow arum | | PELVIR | Araceae |
| *Penthorum sedoides* | ditch stonecrop | | PENSED | Saxifragaceae |
| *Polygonum arifolium* | halberdleaf tearthumb | | POLARI | Polygonaceae |
| *Polygonum caespitosum* | oriental ladysthumb | | POLCAE | Polygonaceae |
| *Polygonum hydropiperoides* | swamp smartweed | *Polygonum hydropiperoides* | POLHYD | Polygonaceae |
| | | var. *hydropiperoides* | | |
| *Polygonum lapathifolium* | curly knotweed | | POLLAP | Polygonaceae |
| *Polygonum pensylvanicum* | Pennsylvania smartweed | | POLPEN | Polygonaceae |
| *Polygonum persicaria* | spotted ladysthumb | | POLPER | Polygonaceae |
| *Polygonum punctatum* | dotted smartweed | | POLPUN | Polygonaceae |
| *Pontedaria cordata* | pickerelweed | | PONCOR | Pontedariaceae |
| *Populus deltoides* | eastern cottonwood | | POPDEL | Salicaceae |
| *Portulaca oleracea* | little hogweed | | POROLE | Portulaccaceae |
| *Ranunculus sceleratus* | cursed buttercup | | RANSCL | Ranunculaceae |
| *Rumex crispus* | curly dock | | RUMCRI | Polygonaceae |
| *Sagittaria latifolia* | broadleaf arrowhead | | SAGLAT | Alismataceae |
| *Salix nigra* | black willow | | SALNIG | Salicaceae |
| *Schoenoplectus pungens* | common threesquare | *Scirpus americanus, Scirpus pungens* | SCHPUN | Cyperaceae |

**Appendix B**

**Identified Plant Species ***

**Kingman Area 1- Planted Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Schoenoplectus tabernaemontani* | softstem bulrush | *Scirpus tabernaemontani, Scirpus validus* | SCHTAB | Cyperaceae |
| *Scirpus polyphyllus* | leafy bulrush | | SCIPOL | Cyperaceae |
| *Scutellaria* sp. | blue skullcap | | SCULAT | Lamiaceae |
| *Setaria parviflora* | marsh bristlegrass | *Setaria geniculata* | SETPAR | Poaceae |
| *Spirodela polyrrhiza* | common duckmeat | | SPIPOL | Lemnaceae |
| *Trifolium repens* | white clover | | TRIREP | Fabaceae |
| *Typha angustifolia* | narrowleaf cattail | | TYPANG | Typhaceae |
| *Typha latifolia* | broadleaf cattail | | TYPLAT | Typhaceae |

**Appendix B**

**Identified Plant Species ***

**Kingman Area 1 - Unplanted Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Acer saccharinum* | silver maple | | ACESAC | Aceraceae |
| *Alisma subcordatum* | American water plantain | *Alisma plantago-aquatica* | ALISUB | Alismataceae |
| *Amaranthus cannabinus* | tidalmarsh amaranth | | AMACAN | Amaranthaceae |
| *Artemisia vulgaris* | common wormwood | | ARTVUL | Asteraceae |
| *Bidens connata* | purplestem beggarticks | | BIDCON | Asteraceae |
| *Boehmeria cylindrica* | smallspike false nettle | | BOECYL | Urticaceae |
| *Chamaesyce maculata* | spotted sandmat | *Euphorbia maculata* | CHAMAC | Euphorbiaceae |
| *Chenopodium ambrosioides* | Mexican tea | | CHEAMB | Chenopodiaceae |
| *Cynodon dactylon* | Bermudagrass | | CYNDAC | Poaceae |
| *Cyperus erythrorhizos* | redroot flatsedge | | CYPERY | Cyperaceae |
| *Cyperus flavescens* | yellow flatsedge | | CYPFLA | Cyperaceae |
| *Cyperus iria* | ricefield flatsedge | | CYPIRI | Cyperaceae |
| *Cyperus odoratus* | fragrant flatsedge | | CYPODO | Cyperaceae |
| *Cyperus squarrosus* | bearded flatsedge | | CYPSQU | Cyperaceae |
| *Cyperus strigosus* | strawcolored flatsedge | | CYPSTR | Cyperaceae |
| *Echinochloa crus-galli* | barnyardgrass | | ECHCRU | Poaceae |
| *Echinochloa walteri* | coast cockspur grass | | ECHWAL | Poaceae |
| *Eclipta prostrata* | false daisy | | ECLPRO | Asteraceae |
| *Eleocharis obtusa* | blunt spikerush | | ELEOBT | Cyperaceae |
| *Eleusine indica* | Indian goosegrass | | ELEIND | Poaceae |
| *Eragrostis pectinacea* | tufted lovegrass | | ERAPEC | Poaceae |
| *Eragrostis pilosa* | Indian lovegrass | | ERAPIL | Poaceae |
| *Eupatorium perfoliatum* | common boneset | | EUPPER | Asteraceae |
| *Eupatorium serotinum* | lateflowering boneset | | EUPSER | Asteraceae |
| *Heteranthera reniformis* | kidneyleaf mudplantain | | HETREN | Pontedariaceae |
| *Hypericum mutilum* | dwarf St. Johnswort | | HYPMUT | Clusiaceae |
| *Juncus acuminatus* | tapertip rush | | JUNACU | Juncaceae |
| *Juncus diffusissimus* | slimpod rush | | JUNDIF | Juncaceae |
| *Juncus effusus* | common rush | | JUNEFF | Juncaceae |
| *Juncus tenuis* | poverty rush | | JUNTEN | Juncaceae |
| *Kyllinga brevifolia* | shortleaf spikesedge | *Cyperus brevifolius* | KYLBRE | Cyperaceae |
| *Leersia oryzoides* | rice cutgrass | | LEEORY | Poaceae |

**Appendix B**

**Identified Plant Species ***

**Kingman Area 1 - Unplanted Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Lindernia dubia* | yellowseed false pimpernel | | LINDUB | Scrophulariaceae |
| *Ludwigia alternifolia* | seedbox | | LUDALT | Onagraceae |
| *Ludwigia palustris* | marsh seedbox | | LUDPAL | Onagraceae |
| *Ludwigia peploides* ssp. *glabrescens* | floating primrose-willow | *Jussiaea repens* | LUDPEP | Onagraceae |
| *Lycopus americanus* | American water horehound | | LYCAME | Lamiaceae |
| *Lythrum salicaria* | purple loosestrife | | LYTSAL | Lythraceae |
| *Mimulus alatus* | sharpwing monkeyflower | | MIMALA | Scrophulariaceae |
| *Mimulus ringens* | Allegeny monkeyflower | | MIMRIN | Scrophulariaceae |
| *Mollugo verticillata* | green carpetweed | | MOLVER | Molluginaceae |
| *Panicum dichotomiflorum* | fall panicgrass | | PANDIC | Poaceae |
| *Penthorum sedoides* | ditch stonecrop | | PENSED | Saxifragaceae |
| *Pilea pumila* | Canadian clearweed | | PILPUM | Urticaceae |
| *Polygonum caespitosum* | oriental ladysthumb | | POLCAE | Polygonaceae |
| *Polygonum hydropiperoides* | swamp smartweed | *Polygonum hydropiperoides* | POLHYD | Polygonaceae |
| | | var. *hydropiperoides* | | |
| *Polygonum lapathifolium* | curly knotweed | | POLLAP | Polygonaceae |
| *Polygonum pensylvanicum* | Pennsylvania smartweed | | POLPEN | Polygonaceae |
| *Polygonum persicaria* | spotted ladysthumb | | POLPER | Polygonaceae |
| *Polygonum punctatum* | dotted smartweed | | POLPUN | Polygonaceae |
| *Pontedaria cordata* | pickerelweed | | PONCOR | Pontedariaceae |
| *Populus deltoides* | eastern cottonwood | | POPDEL | Salicaceae |
| *Portulaca oleracea* | little hogweed | | POROLE | Portulaccaceae |
| *Rorippa palustris* ssp. *fernaldiana* | Fernald's yellowcress | *Rorippa islandica* | RORPAL | Brassicaceae |
| *Sagittaria latifolia* | broadleaf arrowhead | | SAGLAT | Alismataceae |
| *Salix nigra* | black willow | | SALNIG | Salicaceae |
| *Taraxacum officinale* | common dandelion | | TAROFF | Asteraceae |
| *Trifolium repens* | white clover | | TRIREP | Fabaceae |
| *Typha angustifolia* | narrowleaf cattail | | TYPANG | Typhaceae |
| *Typha latifolia* | broadleaf cattail | | TYPLAT | Typhaceae |
| *Veronica peregrina* | neckweed | | VERPER | Scrophulariaceae |

**Appendix B**

**Identified Plant Species** *

**Kingman Area 2 - Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Alisma subcordatum* | American water plantain | *Alisma plantago-aquatica* | ALISUB | Alismataceae |
| *Amaranthus blitum* | purple amaranth | *Amaranthus lividus* | AMABLI | Amaranthaceae |
| *Azolla caroliniana* | Carolina mosquitofern | | AZOCAR | Salviniaceae |
| *Bidens* sp. | beggartick | | BIDSP | Asteraceae |
| *Callitriche heterophylla* | two-headed water-starwort | | CALHET | Callitrichaceae |
| *Cardamine pensylvanica* | Pennsylvania bittercress | | CARPEN | Brassicaceae |
| *Cyperus erythrorhizos* | redroot flatsedge | | CYPERY | Cyperaceae |
| *Cyperus iria* | ricefield flatsedge | | CYPIRI | Cyperaceae |
| *Cyperus odoratus* | fragrant flatsedge | | CYPODO | Cyperaceae |
| *Cyperus squarrosus* | bearded flatsedge | | CYPSQU | Cyperaceae |
| *Cyperus strigosus* | strawcolored flatsedge | | CYPSTR | Cyperaceae |
| *Echinochloa crus-galli* | barnyardgrass | | ECHCRU | Poaceae |
| *Echinochloa walteri* | coast cockspur grass | | ECHWAL | Poaceae |
| *Eclipta prostrata* | false daisy | | ECLPRO | Asteraceae |
| *Eleocharis obtusa* | blunt spikerush | | ELEOBT | Cyperaceae |
| *Eragrostis* sp. | lovegrass | | ERASP | Poaceae |
| *Juncus acuminatus* | tapertip rush | | JUNACU | Juncaceae |
| *Juncus diffusissimus* | slimpod rush | | JUNDIF | Juncaceae |
| *Juncus effusus* | common rush | | JUNEFF | Juncaceae |
| *Leersia oryzoides* | rice cutgrass | | LEEORY | Poaceae |
| *Lemna perpusilla* | minute duckweed | | LEMPER | Lemnaceae |
| *Lindernia dubia* | yellowseed false pimpernel | | LINDUB | Scrophulariaceae |
| *Ludwigia alternifolia* | seedbox | | LUDALT | Onagraceae |
| *Ludwigia palustris* | marsh seedbox | | LUDPAL | Onagraceae |
| *Ludwigia peploides* ssp. *glabrescens* | floating primrose-willow | *Jussiaea repens* | LUDPEP | Onagraceae |
| *Lypersicon lycopersicum* var. *lycopersicum* | garden tomato | *Lycopersicon esculentum* | LYPLYC | Solanaceae |
| *Lythrum salicaria* | purple loosestrife | | LYTSAL | Lythraceae |
| *Mimulus alatus* | sharpwing monkeyflower | | MIMALA | Scrophulariaceae |
| *Mimulus ringens* | Allegeny monkeyflower | | MIMRIN | Scrophulariaceae |
| *Mollugo verticillata* | green carpetweed | | MOLVER | Molluginaceae |
| *Panicum dichotomiflorum* | fall panicgrass | | PANDIC | Poaceae |
| *Penthorum sedoides* | ditch stonecrop | | PENSED | Saxifragaceae |

**Appendix B**

**Identified Plant Species** *

**Kingman Area 2 - Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Polygonum caespitosum* | oriental ladysthumb | | POLCAE | Polygonaceae |
| *Polygonum lapathifolium* | curly knotweed | | POLLAP | Polygonaceae |
| *Polygonum persicaria* | spotted ladysthumb | | POLPER | Polygonaceae |
| *Polygonum punctatum* | dotted smartweed | | POLPUN | Polygonaceae |
| *Pontedaria cordata* | pickerelweed | | PONCOR | Pontedariaceae |
| *Populus deltoides* | eastern cottonwood | | POPDEL | Salicaceae |
| *Portulaca oleracea* | little hogweed | | POROLE | Portulaccaceae |
| *Ranunculus sceleratus* | cursed buttercup | | RANSCL | Ranunculaceae |
| *Rorippa palustris* ssp. *fernaldiana* | Fernald's yellowcress | *Rorippa islandica* | RORPAL | Brassicaceae |
| *Rumex obtusifolius* | bitter dock | | RUMOBT | Polygonaceae |
| *Rumex verticillatus* | swamp dock | | RUMVER | Polygonaceae |
| *Sagittaria latifolia* | broadleaf arrowhead | | SAGLAT | Alismataceae |
| *Salix nigra* | black willow | | SALNIG | Salicaceae |
| *Schoenoplectus fluviatilis* | river bulrush | *Scirpus fluviatilis* | SCHFLU | Cyperaceae |
| *Schoenoplectus pungens* | common threesquare | *Scirpus americanus, Scirpus pungens* | SCHPUN | Cyperaceae |
| *Schoenoplectus tabernaemontani* | softstem bulrush | *Scirpus tabernaemontani, Scirpus validus* | SCHTAB | Cyperaceae |
| *Scirpus polyphyllus* | leafy bulrush | | SCIPOL | Cyperaceae |
| *Trifolium repens* | white clover | | TRIREP | Fabaceae |
| *Typha angustifolia* | narrowleaf cattail | | TYPANG | Typhaceae |
| *Typha latifolia* | broadleaf cattail | | TYPLAT | Typhaceae |

**Appendix B**

**Identified Plant Species ***

**Kenilworth Marsh Mass Fill 1 - Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Apios americana* | groundnut | | APIAME | Fabaceae |
| *Bidens* sp. | beggartick | | BIDSP | Asteraceae |
| *Boehmeria cylindrica* | smallspike false nettle | | BOECYL | Urticaceae |
| *Carex lurida* | shallow sedge | | CARLUR | Cyperaceae |
| *Carex stricta* | upright sedge | | CARSTR | Cyperaceae |
| *Cephalanthus occidentalis* | common buttonbush | | CEPOCC | Rubiaceae |
| *Impatiens capensis* | jewelweed | | IMPCAP | Balsminaceae |
| *Juncus effusus* | common rush | | JUNEFF | Juncaceae |
| *Leersia oryzoides* | rice cutgrass | | LEEORY | Poaceae |
| *Lycopus americanus* | American water horehound | | LYCAME | Lamiaceae |
| *Lythrum salicaria* | purple loosestrife | | LYTSAL | Lythraceae |
| *Mikania scandens* | climbing hempvine | | MIKSCA | Asteraceae |
| *Peltandra virginica* | green arrow arum | | PELVIR | Araceae |
| *Phalaris arundinacea* | reed canarygrass | | PHAARU | Poaceae |
| *Phragmites australis* | common reed | *Phragmites communis* | PHRAUS | Poaceae |
| *Pilea pumila* | Canadian clearweed | | PILPUM | Urticaceae |
| *Polygonum arifolium* | halberdleaf tearthumb | | POLARI | Polygonaceae |
| *Polygonum punctatum* | dotted smartweed | | POLPUN | Polygonaceae |
| *Polygonum sagitattum* | arrowleaf tearthumb | | POLSAG | Polygonaceae |
| *Pontedaria cordata* | pickerelweed | | PONCOR | Pontedariaceae |
| *Sagittaria latifolia* | broadleaf arrowhead | | SAGLAT | Alismataceae |
| *Scirpus cyperinus* | woolgrass | | SCICYP | Cyperaceae |
| *Scirpus polyphyllus* | leafy bulrush | | SCIPOL | Cyperaceae |
| *Symphyotrichum dumosum var. dumosum* | rice button aster | *Aster dumosus* | SYMDUM | Asteraceae |
| *Typha angustifolia* | narrowleaf cattail | | TYPANG | Typhaceae |
| *Typha x glauca* | | | TYPGLA | Typhaceae |
| *Typha latifolia* | broadleaf cattail | | TYPLAT | Typhaceae |

**Appendix B**

**Identified Plant Species** *

**Kenilworth Marsh Mass Fill 2 - Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Amaranthus cannabinus* | tidalmarsh amaranth | | AMACAN | Amaranthaceae |
| *Bidens connata* | purplestem beggarticks | | BIDCON | Asteraceae |
| *Boehmeria cylindrica* | smallspike false nettle | | BOECYL | Urticaceae |
| *Cephalanthus occidentalis* | common buttonbush | | CEPOCC | Rubiaceae |
| *Echinochloa crus-galli* | barnyardgrass | | ECHCRU | Poaceae |
| *Echinochloa walteri* | coast cockspur grass | | ECHWAL | Poaceae |
| *Hibiscus moscheutos* | crimsoneyed rosemallow | | HIBMOS | Malvaceae |
| *Impatiens capensis* | jewelweed | | IMPCAP | Balsminaceae |
| *Leersia oryzoides* | rice cutgrass | | LEEORY | Poaceae |
| *Lycopus americanus* | American water horehound | | LYCAME | Lamiaceae |
| *Lythrum salicaria* | purple loosestrife | | LYTSAL | Lythraceae |
| *Mikania scandens* | climbing hempvine | | MIKSCA | Asteraceae |
| *Peltandra virginica* | green arrow arum | | PELVIR | Araceae |
| *Phalaris arundinacea* | reed canarygrass | | PHAARU | Poaceae |
| *Phragmites australis* | common reed | *Phragmites communis* | PHRAUS | Poaceae |
| *Polygonum punctatum* | dotted smartweed | | POLPUN | Polygonaceae |
| *Pontedaria cordata* | pickerelweed | | PONCOR | Pontedariaceae |
| *Rumex verticillatus* | swamp dock | | RUMVER | Polygonaceae |
| *Sagittaria latifolia* | broadleaf arrowhead | | SAGLAT | Alismataceae |
| *Salix nigra* | black willow | | SALNIG | Salicaceae |
| *Saururus cernuus* | lizard's tail | | SAUCER | Saururaceae |
| *Schoenoplectus fluviatilis* | river bulrush | *Scirpus fluviatilis* | SCHFLU | Cyperaceae |
| *Schoenoplectus tabernaemontani* | softstem bulrush | *Scirpus tabernaemontani, Scirpus validus* | SCHTAB | Cyperaceae |
| *Scirpus cyperinus* | woolgrass | | SCICYP | Cyperaceae |
| *Scutellaria lateriflora* | blue skullcap | | SCULAT | Lamiaceae |
| *Typha angustifolia* | narrowleaf cattail | | TYPANG | Typhaceae |
| *Typha x glauca* | | | TYPGLA | Typhaceae |
| *Typha latifolia* | broadleaf cattail | | TYPLAT | Typhaceae |
| *Zizania aquatica* | annual wildrice | | ZIZAQU | Poaceae |

**Appendix B**

**Identified Plant Species ***

**Dueling Creek - Transects**

**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Amaranthus cannabinus* | tidalmarsh amaranth | | AMACAN | Amaranthaceae |
| *Ampelopsis brevipedunculata* | Amur peppervine | | AMPBRE | Vitaceae |
| *Bidens* sp. | beggarticks | | BIDSP | Asteraceae |
| *Boehmeria cylindrica* | smallspike false nettle | | BOECYL | Urticaceae |
| *Carex lurida* | shallow sedge | | CARLUR | Cyperaceae |
| *Carex tribuloides* | blunt broom sedge | | CARTRI | Cyperaceae |
| *Cuscuta gronovii* | scaldweed | | CUSGRO | Cuscutaceae |
| *Fraxinus pennsylvanica* | green ash | | FRAPEN | Oleaceae |
| *Impatiens capensis* | jewelweed | | IMPCAP | Balsminaceae |
| *Iris pseudoacorus* | paleyellow iris | | IRIPSE | Iridaceae |
| *Juncus effusus* | common rush | | JUNEFF | Juncaceae |
| *Leersia oryzoides* | rice cutgrass | | LEEORY | Poaceae |
| *Lythrum salicaria* | purple loosestrife | | LYTSAL | Lythraceae |
| *Mikania scandens* | climbing hempvine | | MIKSCA | Asteraceae |
| *Peltandra virginica* | green arrow arum | | PELVIR | Araceae |
| *Phalaris arundinacea* | reed canarygrass | | PHAARU | Poaceae |
| *Pilea pumila* | Canadian clearweed | | PILPUM | Urticaceae |
| *Polygonum arifolium* | halberdleaf tearthumb | | POLARI | Polygonaceae |
| *Polygonum punctatum* | dotted smartweed | | POLPUN | Polygonaceae |
| *Polygonum sagitattum* | arrowleaf tearthumb | | POLSAG | Polygonaceae |
| *Pontedaria cordata* | pickerelweed | | PONCOR | Pontedariaceae |
| *Sagittaria latifolia* | broadleaf arrowhead | | SAGLAT | Alismataceae |
| *Schoenoplectus tabernaemontani* | softstem bulrush | *Scirpus tabernaemontani, Scirpus validus* | SCHTAB | Cyperaceae |
| *Scirpus cyperinus* | woolgrass | | SCICYP | Cyperaceae |
| *Scutellaria lateriflora* | blue skullcap | | SCULAT | Lamiaceae |
| *Sparganium eurycarpum* | broadfruit bur-reed | | SPAEUR | Sparganiaceae |
| *Typha angustifolia* | narrowleaf cattail | | TYPANG | Typhaceae |
| *Typha x glauca* | | | TYPGLA | Typhaceae |
| *Typha latifolia* | broadleaf cattail | | TYPLAT | Typhaceae |

**Appendix B**
**Identified Plant Species ***
**Patuxent Marsh - Transects**
**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Acorus calamus* | calamus | *Acorus americanus* | ACOCAL | Acoraceae |
| *Amaranthus cannabinus* | tidalmarsh amaranth | | AMACAN | Amaranthaceae |
| *Asclepias incarnata* | swamp milkweed | | ASCINC | Asclepiadaceae |
| *Bidens laevis* | smooth beggartick | | BIDLAE | Asteraceae |
| *Boehmeria cylindrica* | smallspike false nettle | | BOECYL | Urticaceae |
| *Cuscuta gronovii* | scaldweed | | CUSGRO | Cuscutaceae |
| *Cyperus* sp. | flatsedge | | CYPSP | Cyperaceae |
| *Eleocharis obtusa* | blunt spikerush | | ELEOBT | Cyperaceae |
| *Epilobium ciliatum* ssp. *glandulosum* | fringed willowherb | | EPICIL | Onagraceae |
| *Eupatorium perfoliatum* | common boneset | | EUPPER | Asteraceae |
| *Galium tinctorium* | stiff marsh bedstraw | | GALTIN | Rubiaceae |
| *Helenium autumnale* | common sneezeweed | | HELAUT | Asteraceae |
| *Hibiscus moscheutos* | crimsoneyed rosemallow | | HIBMOS | Malvaceae |
| *Hydrilla verticillata* | waterthyme | | HYDVER | Hydrocharitaceae |
| *Hypericum mutilum* | dwarf St. Johnswort | | HYPMUT | Clusiaceae |
| *Impatiens capensis* | jewelweed | | IMPCAP | Balsminaceae |
| *Leersia oryzoides* | rice cutgrass | | LEEORY | Poaceae |
| *Lobelia cardinalis* | cardinalflower | | LOBCAR | Campanulaceae |
| *Ludwigia palustris* | marsh seedbox | | LUDPAL | Onagraceae |
| *Mentha arvensis* | wild mint | | MENARV | Lamiaceae |
| *Mikania scandens* | climbing hempvine | | MIKSCA | Asteraceae |
| *Mimulus ringens* | Allegeny monkeyflower | | MIMRIN | Scrophulariaceae |
| *Nuphar lutea* | yellow pond-lily | | NUPLUT | Nymphaceae |
| *Orontium aquaticum* | goldenclub | | OROAQU | Araceae |
| *Peltandra virginica* | green arrow arum | | PELVIR | Araceae |
| *Penthorum sedoides* | ditch stonecrop | | PENSED | Saxifragaceae |
| *Pilea pumila* | Canadian clearweed | | PILPUM | Urticaceae |
| *Polygonum arifolium* | halberdleaf tearthumb | | POLARI | Polygonaceae |
| *Polygonum punctatum* | dotted smartweed | | POLPUN | Polygonaceae |
| *Polygonum sagitattum* | arrowleaf tearthumb | | POLSAG | Polygonaceae |
| *Ptilimnium capillaceum* | herbwilliam | | PTICAP | Apiaceae |
| *Sagittaria latifolia* | broadleaf arrowhead | | SAGLAT | Alismataceae |

**Appendix B**
**Identified Plant Species** *
**Patuxent Marsh - Transects**
**2000**

| SPECIES | COMMON NAME | SYNONYM | ACRONYM | FAMILY |
|---|---|---|---|---|
| *Sambucus racemosa* var. *racemosa* | red elderberry | *Sambucus pubens* | SAMRAC | Adoxaceae |
| *Schoenoplectus fluviatilis* | river bulrush | *Scirpus fluviatilis* | SCHFLU | Cyperaceae |
| *Schoenoplectus pungens* | common threesquare | *Scirpus americanus, Scirpus pungens* | SCHPUN | Cyperaceae |
| *Schoenoplectus tabernaemontani* | softstem bulrush | *Scirpus tabernaemontani, Scirpus validus* | SCHTAB | Cyperaceae |
| *Scirpus cyperinus* | woolgrass | | SCICYP | Cyperaceae |
| *Sparganium eurycarpum* | broadfruit bur-reed | | SPAEUR | Sparganiaceae |
| *Symphyotrichum puniceus* | purplestem aster | *Aster puniceus* | SYMPUN | Asteraceae |
| *Typha latifolia* | broadleaf cattail | | TYPLAT | Typhaceae |
| *Zizania aquatica* | annual wildrice | | ZIZAQU | Poaceae |

* Nomenclature drawn from USDA, NRCS 1999. The PLANTS database. (http://plants.usda.gov/plants).National Plant Data Center, Baton Rouge, LA.

# Appendix C Plant Species Characteristics

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman- Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Acer saccharinum* | T | P | N | FACW | |
| *Alisma subcordatum* | F/H | P | N | OBL | |
| *Amaranthus blitum* | F/H | A | I | NI | |
| *Amaranthus cannabinus* | F/H | P | N | OBL | |
| *Artemisia vulgaris* | F/H, SS | P | N & I | UPL | |
| *Azolla caroliniana* | F/H | A | N | OBL | G5, S1 |
| *Bidens cernua* | F/H | A | N | OBL | |
| *Bidens connata* | F/H | A | N | OBL | |
| *Bidens frondosa* | F/H | A | N | FACW | |
| *Boehmeria cylindrica* | F/H | P | N | FACW+ | |
| *Callitriche heterophylla* | F/H | A/P | N | OBL | |
| *Cardamine pensylvanica* | F/H | A/B/P | N | OBL | |
| *Chamaesyce maculata* | F/H | A | N | FACU- | |
| *Chenopodium ambrosioides* | F/H, SS | A/P | I | FACU | |
| *Cleome hassleriana* | F/H | A | I | FACU- | |
| *Cynodon dactylon* | G | P | I | FACU | |
| *Cyperus erythrorhizos* | G | A/P | N | FACW+ | G5, S3 |
| *Cyperus flavescens* | G | A | N | OBL | |
| *Cyperus iria* | G | A | I | FACW | |
| *Cyperus odoratus* | G | A/P | N | FACW | |
| *Cyperus squarrosus* | G | A | N | FACW+ | |
| *Dichanthelium clandestinum* | G | P | N | FAC+ | |
| *Digitaria sanguinalis* | G | A | N | FACU- | |
| *Dulichium arundinaceum* | G | P | N | OBL | |
| *Echinochloa crus-galli* | G | A | I | FACU | |
| *Echinochloa walteri* | G | A | N | FACW+ | |
| *Eclipta prostrata* | F/H | A/P | N | FAC | |
| *Eleocharis obtusa* | G | A/P | N | OBL | |
| *Eleusine indica* | G | A | I | FACU- | |
| *Equisetum arvense* | F/H | P | N | FAC | |
| *Eragrostis pectinacea* | G | A/P | N | FAC | |
| *Eragrostis pilosa* | G | A | N | FACU | |
| *Eupatorium capillifolium* | F/H | P | N | FACU- | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman- Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Eupatorium perfoliatum* | F/H | P | N | FACW+ | |
| *Eupatorium serotinum* | F/H | P | N | FAC- | |
| *Fimbristylis autumnalis* | G | A | N | FACW+ | |
| *Heteranthera reniformis* | F/H | P | N | OBL | |
| *Hibiscus moscheutos* | SS, S, F/H | A/P | N | OBL | |
| *Hypericum mutilum* | F/H | A/P | N | FACW | |
| *Ipomoea lacunosa* | V, F/H | A | N | FACW | |
| *Juncus acuminatus* | G | P | N | OBL | |
| *Juncus diffusissimus* | G | P | N | FACW | |
| *Juncus effusus* | G | P | N | FACW+ | |
| *Juncus tenuis* | G | P | N | FAC- | |
| *Kyllinga brevifolia* | G | P | N | FACW | |
| *Leersia oryzoides* | G | P | N | OBL | |
| *Lemna perpusilla* | F/H | P | N | OBL | G5, S3 |
| *Lindernia dubia* | F/H | A/B | N | OBL | |
| *Ludwigia alternifolia* | F/H | P | N | FACW+ | |
| *Ludwigia decurrens* | F/H | A/P | N | OBL | G5, S2 |
| *Ludwigia leptocarpa* | SS, S, F/H | A/P | N | OBL | |
| *Ludwigia palustris* | F/H | P | N | OBL | |
| *Ludwigia peploides* ssp. *glabrescens* | F/H | P | N | OBL | |
| *Lycopus americanus* | F/H | A/P | I | | |
| *Lycopus virginicus* | F/H | P | N | OBL | |
| *Lypersicon lycopersicum* var. *lycopersicum* | F/H | P | N | OBL | |
| *Lythrum salicaria* | SS, F/H | P | I | FACW+ | |
| *Mikania scandens* | V, F/H | P | N | FACW+ | |
| *Mimulus alatus* | F/H | P | N | OBL | |
| *Mimulus ringens* | F/H | P | N | OBL | |
| *Mollugo verticillata* | F/H | A | N | FAC | |
| *Panicum dichotomiflorum* | G | A | N | FACW- | |
| *Peltandra virginica* | F/H | P | N | OBL | |
| *Penthorum sedoides* | F/H | P | N | OBL | |
| *Pilea pumila* | F/H | A | N | FACW | |
| *Polygonum arifolium* | V, SS, F/H | A | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman- Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Polygonum caespitosum* | F/H | A | N & I | FACU- | |
| *Polygonum hydropiperoides* | F/H | P | N | OBL | |
| *Polygonum lapathifolium* | F/H | A | N | FACW+ | |
| *Polygonum pensylvanicum* | F/H | A | N | FACW | |
| *Polygonum persicaria* | F/H | A/P | I | FACW | |
| *Polygonum punctatum* | F/H | A/P | N | OBL | |
| *Pontedaria cordata* | F/H | P | N | OBL | |
| *Populus deltoides* | T | P | N | FAC | |
| *Portulaca oleracea* | F/H | A | N | FAC | |
| *Ranunculus sceleratus* | F/H | A/P | N | OBL | |
| *Rorippa palustris* ssp. *fernaldiana* | F/H | A/B/P | N | OBL | |
| *Rumex crispus* | F/H | P | I | FACU | |
| *Rumex obtusifolius* | F/H | P | I | FACU- | |
| *Rumex verticillatus* | F/H | P | N | OBL | |
| *Sagittaria latifolia* | F/H | P | N | OBL | |
| *Salix nigra* | T | P | N | FACW+ | |
| *Schoenoplectus fluviatilis* | G | P | N | OBL | G5, S3/S4 |
| *Schoenoplectus pungens* | G | P | N | FACW+ | |
| *Schoenoplectus tabernaemontani* | G | P | N | OBL | |
| *Scirpus polyphyllus* | G | P | N | OBL | |
| *Scutellaria lateriflora* | F/H | P | N | FACW+ | |
| *Setaria parviflora* | G | P | N | FAC | |
| *Spirodela polyrrhiza* | F/H | P | N | OBL | |
| *Taraxacum officinale* | F/H | P | N & I | FACU- | |
| *Trifolium repens* | F/H | P | I | FACU- | |
| *Typha angustifolia* | G | P | I | OBL | |
| *Typha latifolia* | G | P | N | OBL | |
| *Ulmus* sp. | T | P | | | |
| *Veronica peregrina* | F/H | A | N | FACU- | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman- Non- Transect**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Ailanthus altissima* | T | P | I | | |
| *Albizia julibrissin* | T, S | P | I | | |
| *Arctium minus* | F/H | B | I | FACU- | |
| *Catalpa speciosa* | T | P | N | FAC | |
| *Cephalanthus occidentalis* | S, T | P | N | OBL | |
| *Convolvulus arvensis* | V | P | I | | |
| *Conyza canadensis* var. *canadensis* | F/H | A/B | N | UPL | |
| *Cuscuta gronovii* | V, F/H | P | N | | |
| *Cyperus difformis* | G | A | I | OBL | |
| *Cyperus strigosus* | G | P | N | FACW | |
| *Duchesnea indica* | F/H | P | I | FACU- | |
| *Fraxinus pennsylvanica* | T | P | N | FACW | |
| *Galinsoga quadriradiata* | F/H | A | I | | |
| *Hibiscus trionum* | F/H | A | I | | |
| *Juncus marginatus* | G | P | N | FACW | |
| *Juncus torreyi* | G | P | N | FACW | G5, S1, E |
| *Leptochloa fusca* ssp. *fascicularis* | G | A | N | FACW | G5, S1, E |
| *Mazus pumilus* | F/H | A | I | FACU- | |
| *Myosoton aquaticum* | F/H | P | I | FACW | |
| *Najas minor* | F/H | A | I | OBL | |
| *Oxalis stricta* | F/H | P | N | UPL | |
| *Paulownia tomentosa* | T | P | I | UPL | |
| *Plantago rugelii* | F/H | P | N | FACU | |
| *Poa annua* | G | A/B | I | FACU | |
| *Potamogeton diversifolius* | F/H | P | N | OBL | |
| *Robinia pseudoacacia* | T | P | N | FACU- | |
| *Salix matsudana* | S | P | I | | |
| *Sium suave* | F/H | P | N | OBL | |
| *Solanum nigrum* | F/H, SS, S | A/P | I | | |
| *Sonchus asper* | F/H | A | I | FAC | |
| *Verbena hastata* | F/H | B/P | N | FACW+ | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman- Whole Marsh**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Acer saccharinum* | T | P | N | FACW | |
| *Ailanthus altissima* | T | P | I | | |
| *Albizia julibrissin* | T, S | P | I | | |
| *Alisma subcordatum* | F/H | P | N | OBL | |
| *Amaranthus blitum* | F/H | A | I | NI | |
| *Amaranthus cannabinus* | F/H | P | N | OBL | |
| *Arctium minus* | F/H | B | I | FACU- | |
| *Artemisia vulgaris* | F/H, SS | P | N & I | UPL | |
| *Azolla caroliniana* | F/H | A | N | OBL | G5, S1 |
| *Bidens cernua* | F/H | A | N | OBL | |
| *Bidens connata* | F/H | A | N | OBL | |
| *Bidens frondosa* | F/H | A | N | FACW | |
| *Boehmeria cylindrica* | F/H | P | N | FACW+ | |
| *Callitriche heterophylla* | F/H | A/P | N | OBL | |
| *Cardamine pensylvanica* | F/H | A/B/P | N | OBL | |
| *Catalpa speciosa* | T | P | N | FAC | |
| *Cephalanthus occidentalis* | S, T | P | N | OBL | |
| *Chamaesyce maculata* | F/H | A | N | FACU- | |
| *Chenopodium ambrosioides* | F/H, SS | A/P | I | FACU | |
| *Cleome hassleriana* | F/H | A | I | FACU- | |
| *Convolvulus arvensis* | V | P | I | | |
| *Conyza canadensis* | F/H | A/B | N | UPL | |
| *Cuscuta gronovii* | V, F/H | P | N | | |
| *Cynodon dactylon* | G | P | I | FACU | |
| *Cyperus difformis* | G | A | I | OBL | |
| *Cyperus erythrorhizos* | G | A/P | N | FACW+ | G5, S3 |
| *Cyperus flavescens* | G | A | N | OBL | |
| *Cyperus iria* | G | A | I | FACW | |
| *Cyperus odoratus* | G | A/P | N | FACW | |
| *Cyperus squarrosus* | G | A | N | FACW+ | |
| *Cyperus strigosus* | G | P | N | FACW | |
| *Dichanthelium clandestinum* | G | P | N | FAC+ | |
| *Digitaria sanguinalis* | G | A | N | FACU- | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman- Whole Marsh**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Duchesnea indica* | F/H | P | I | FACU- | |
| *Dulichium arundinaceum* | G | P | N | OBL | |
| *Echinochloa crus-galli* | G | A | I | FACU | |
| *Echinochloa walteri* | G | A | N | FACW+ | |
| *Eclipta prostrata* | F/H | A/P | N | FAC | |
| *Eleocharis obtusa* | G | A/P | N | OBL | |
| *Eleusine indica* | G | A | I | FACU- | |
| *Equisetum arvense* | F/H | P | N | FAC | |
| *Eragrostis pectinacea* | G | A/P | N | FAC | |
| *Eragrostis pilosa* | G | A | N | FACU | |
| *Eupatorium capillifolium* | F/H | P | N | FACU- | |
| *Eupatorium perfoliatum* | F/H | P | N | FACW+ | |
| *Eupatorium serotinum* | F/H | P | N | FAC- | |
| *Fimbristylis autumnalis* | G | A | N | FACW+ | |
| *Fraxinus pennsylvanica* | T | P | N | FACW | |
| *Galinsoga quadriradiata* | F/H | A | I | | |
| *Heteranthera reniformis* | F/H | P | N | OBL | |
| *Hibiscus moscheutos* | F/H, SS, S | A/P | N | OBL | |
| *Hibiscus trionum* | F/H | A | I | | |
| *Hypericum mutilum* | F/H | A/P | N | FACW | |
| *Ipomoea lacunosa* | V, F/H | A | N | FACW | |
| *Juncus acuminatus* | G | P | N | OBL | |
| *Juncus diffusissimus* | G | P | N | FACW | |
| *Juncus effusus* | G | P | N | FACW+ | |
| *Juncus marginatus* | G | P | N | FACW | |
| *Juncus tenuis* | G | P | N | FAC- | |
| *Juncus torreyi* | G | P | N | FACW | G5, S1, E |
| *Kyllinga brevifolia* | G | P | N | FACW | |
| *Leersia oryzoides* | G | P | N | OBL | |
| *Lemna perpusilla* | F/H | P | N | OBL | G5, S3 |
| *Leptochloa fusca* ssp. *fascicularis* | G | A | N | FACW | G5, S1, E |
| *Lindernia dubia* | F/H | A/B | N | OBL | |
| *Ludwigia alternifolia* | F/H | P | N | FACW+ | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman- Whole Marsh**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Ludwigia decurrens* | F/H | A/P | N | OBL | G5, S2 |
| *Ludwigia leptocarpa* | F/H, SS, S | A/P | N | OBL | |
| *Ludwigia palustris* | F/H | P | N | OBL | |
| *Ludwigia peploides* ssp. *glabrescens* | F/H | P | N | OBL | |
| *Lycopus americanus* | F/H | A/P | I | | |
| *Lycopus virginicus* | F/H | P | N | OBL | |
| *Lypersicon lycopersicum* var. *lycopersicum* | F/H | P | N | OBL | |
| *Lythrum salicaria* | F/H, SS | P | I | FACW+ | |
| *Mazus pumilus* | F/H | A | I | FACU- | |
| *Mikania scandens* | V, F/H | P | N | FACW+ | |
| *Mimulus alatus* | F/H | P | N | OBL | |
| *Mimulus ringens* | F/H | P | N | OBL | |
| *Mollugo verticillata* | F/H | A | N | FAC | |
| *Myosoton aquaticum* | F/H | P | I | FACW | |
| *Najas minor* | F/H | A | I | OBL | |
| *Oxalis stricta* | F/H | P | N | UPL | |
| *Panicum dichotomiflorum* | G | A | N | FACW- | |
| *Paulownia tomentosa* | T | P | I | UPL | |
| *Peltandra virginica* | F/H | P | N | OBL | |
| *Penthorum sedoides* | F/H | P | N | OBL | |
| *Pilea pumila* | F/H | A | N | FACW | |
| *Plantago rugelii* | F/H | P | N | FACU | |
| *Poa annua* | G | A/B | I | FACU | |
| *Polygonum arifolium* | V, SS, F/H | A | N | OBL | |
| *Polygonum caespitosum* | F/H | A | N & I | FACU- | |
| *Polygonum hydropiperoides* | F/H | P | N | OBL | |
| *Polygonum lapathifolium* | F/H | A | N | FACW+ | |
| *Polygonum pensylvanicum* | F/H | A | N | FACW | |
| *Polygonum persicaria* | F/H | A/P | I | FACW | |
| *Polygonum punctatum* | F/H | A/P | N | OBL | |
| *Pontedaria cordata* | F/H | P | N | OBL | |
| *Populus deltoides* | T | P | N | FAC | |
| *Portulaca oleracea* | F/H | A | N | FAC | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman- Whole Marsh**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Potamogeton diversifolius* | F/H | P | N | OBL | |
| *Ranunculus sceleratus* | F/H | A/P | N | OBL | |
| *Robinia pseudoacacia* | T | P | N | FACU- | |
| *Rorippa palustris* ssp. *fernaldiana* | F/H | A/B/P | N | OBL | |
| *Rumex crispus* | F/H | P | I | FACU | |
| *Rumex obtusifolius* | F/H | P | I | FACU- | |
| *Rumex verticillatus* | F/H | P | N | OBL | |
| *Sagittaria latifolia* | F/H | P | N | OBL | |
| *Salix matsudana* | S | P | I | | |
| *Salix nigra* | T | P | N | FACW+ | |
| *Schoenoplectus fluviatilis* | G | P | N | OBL | G5, S3/S4 |
| *Schoenoplectus pungens* | G | P | N | FACW+ | |
| *Schoenoplectus tabernaemontani* | G | P | N | OBL | |
| *Scirpus polyphyllus* | G | P | N | OBL | |
| *Scutellaria lateriflora* | F/H | P | N | FACW+ | |
| *Setaria parviflora* | G | P | N | FAC | |
| *Sium suave* | F/H | P | N | OBL | |
| *Solanum nigrum* | F/H, SS, S | A/P | I | | |
| *Sonchus asper* | F/H | A | I | FAC | |
| *Spirodela polyrrhiza* | F/H | P | N | OBL | |
| *Taraxacum officinale* | F/H | P | N & I | FACU- | |
| *Trifolium repens* | F/H | P | I | FACU- | |
| *Typha angustifolia* | G | P | I | OBL | |
| *Typha latifolia* | G | P | N | OBL | |
| *Ulmus* sp. | T | P | | | |
| *Verbena hastata* | F/H | B/P | N | FACW+ | |
| *Veronica peregrina* | F/H | A | N | FACU- | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman Area 1- Planted Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Acer saccharinum* | T | P | N | FACW | |
| *Alisma subcordatum* | F/H | P | N | OBL | |
| *Bidens cernua* | F/H | A | N | OBL | |
| *Bidens connata* | F/H | A | N | OBL | |
| *Bidens frondosa* | F/H | A | N | FACW | |
| *Cardamine pensylvanica* | F/H | A/B/P | N | OBL | |
| *Chenopodium ambrosioides* | F/H, SS | A/P | I | FACU | |
| *Cleome hassleriana* | F/H | A | I | FACU- | |
| *Cyperus erythrorhizos* | G | A/P | N | FACW+ | G5, S3 |
| *Cyperus flavescens* | G | A | N | OBL | |
| *Cyperus iria* | G | A | I | FACW | |
| *Cyperus odoratus* | G | A/P | N | FACW | |
| *Dichanthelium clandestinum* | G | P | N | FAC+ | |
| *Digitaria sanguinalis* | G | A | N | FACU- | |
| *Dulichium arundinaceum* | G | P | N | OBL | |
| *Echinochloa crus-galli* | G | A | I | FACU | |
| *Echinochloa walteri* | G | A | N | FACW+ | |
| *Eclipta prostrata* | F/H | A/P | N | FAC | |
| *Eleocharis obtusa* | G | A/P | N | OBL | |
| *Eleusine indica* | G | A | I | FACU- | |
| *Equisetum arvense* | F/H | P | N | FAC | |
| *Eragrostis pectinacea* | G | A/P | N | FAC | |
| *Eupatorium capillifolium* | F/H | P | N | FACU- | |
| *Eupatorium serotinum* | F/H | P | N | FAC- | |
| *Fimbristylis autumnalis* | G | A | N | FACW+ | |
| *Hibiscus moscheutos* | F/H, SS, S | A/P | N | OBL | |
| *Hypericum mutilum* | F/H | A/P | N | FACW | |
| *Ipomoea lacunosa* | V, F/H | A | N | FACW | |
| *Juncus acuminatus* | G | P | N | OBL | |
| *Juncus diffusissimus* | G | P | N | FACW | |
| *Juncus effusus* | G | P | N | FACW+ | |
| *Juncus tenuis* | G | P | N | FAC- | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman Area 1- Planted Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Leersia oryzoides* | G | P | N | OBL | |
| *Lemna perpusilla* | F/H | P | N | OBL | G5, S3 |
| *Lindernia dubia* | F/H | A/B | N | OBL | |
| *Ludwigia decurrens* | F/H | A/P | N | OBL | G5, S2 |
| *Ludwigia leptocarpa* | F/H, SS, S | A/P | N | OBL | |
| *Ludwigia palustris* | F/H | P | N | OBL | |
| *Ludwigia peploides* ssp. *glabrescens* | F/H | P | N | OBL | |
| *Lycopus americanus* | F/H | P | N | OBL | |
| *Lycopus virginicus* | F/H | P | N | OBL | |
| *Lythrum salicaria* | F/H, SS | P | I | FACW+ | |
| *Mikania scandens* | V, F/H | P | N | FACW+ | |
| *Mimulus alatus* | F/H | P | N | OBL | |
| *Mimulus ringens* | F/H | P | N | OBL | |
| *Panicum dichotomiflorum* | G | A | N | FACW- | |
| *Peltandra virginica* | F/H | P | N | OBL | |
| *Penthorum sedoides* | F/H | P | N | OBL | |
| *Polygonum arifolium* | V, SS, F/H | A | N | OBL | |
| *Polygonum caespitosum* | F/H | A | N & I | FACU- | |
| *Polygonum hydropiperoides* | F/H | P | N | OBL | |
| *Polygonum lapathifolium* | F/H | A | N | FACW+ | |
| *Polygonum pensylvanicum* | F/H | A | N | FACW | |
| *Polygonum persicaria* | F/H | A/P | I | FACW | |
| *Polygonum punctatum* | F/H | A/P | N | OBL | |
| *Pontedaria cordata* | F/H | P | N | OBL | |
| *Populus deltoides* | T | P | N | FAC | |
| *Portulaca oleracea* | F/H | A | N | FAC | |
| *Ranunculus sceleratus* | F/H | A/P | N | OBL | |
| *Rumex crispus* | F/H | P | I | FACU | |
| *Sagittaria latifolia* | F/H | P | N | OBL | |
| *Salix nigra* | T | P | N | FACW+ | |
| *Schoenoplectus pungens* | G | P | N | FACW+ | |
| *Schoenoplectus tabernaemontani* | G | P | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman Area 1- Planted Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Scirpus polyphyllus* | G | P | N | OBL | |
| *Scutellaria* sp. | F/H | P | | | |
| *Setaria parviflora* | G | P | N | FAC | |
| *Spirodela polyrrhiza* | F/H | P | N | OBL | |
| *Trifolium repens* | F/H | P | I | FACU- | |
| *Typha angustifolia* | G | P | I | OBL | |
| *Typha latifolia* | G | P | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman Area 1- Unplanted Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Acer saccharinum* | T | P | N | FACW | |
| *Alisma subcordatum* | F/H | P | N | OBL | |
| *Amaranthus cannabinus* | F/H | P | N | OBL | |
| *Artemisia vulgaris* | F/H, SS | P | N & I | UPL | |
| *Bidens connata* | F/H | A | N | OBL | |
| *Boehmeria cylindrica* | F/H | P | N | FACW+ | |
| *Chamaesyce maculata* | F/H | A | N | FACU- | |
| *Chenopodium ambrosioides* | F/H, SS | A/P | I | FACU | |
| *Cynodon dactylon* | G | P | I | FACU | |
| *Cyperus erythrorhizos* | G | A/P | N | FACW+ | G5, S3 |
| *Cyperus flavescens* | G | A | N | OBL | |
| *Cyperus iria* | G | A | I | FACW | |
| *Cyperus odoratus* | G | A/P | N | FACW | |
| *Cyperus squarrosus* | G | A | N | FACW+ | |
| *Cyperus strigosus* | G | P | N | FACW | |
| *Echinochloa crus-galli* | G | A | I | FACU | |
| *Echinochloa walteri* | G | A | N | FACW+ | |
| *Eclipta prostrata* | F/H | A/P | N | FAC | |
| *Eleocharis obtusa* | G | A/P | N | OBL | |
| *Eleusine indica* | G | A | I | FACU- | |
| *Eragrostis pectinacea* | G | A/P | N | FAC | |
| *Eragrostis pilosa* | G | A | N | FACU | |
| *Eupatorium perfoliatum* | F/H | P | N | FACW+ | |
| *Eupatorium serotinum* | F/H | P | N | FAC- | |
| *Heteranthera reniformis* | F/H | P | N | OBL | |
| *Hypericum mutilum* | F/H | A/P | N | FACW | |
| *Juncus acuminatus* | G | P | N | OBL | |
| *Juncus diffusissimus* | G | P | N | FACW | |
| *Juncus effusus* | G | P | N | FACW+ | |
| *Juncus tenuis* | G | P | N | FAC- | |
| *Kyllinga brevifolia* | G | P | N | FACW | |
| *Leersia oryzoides* | G | P | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman Area 1- Unplanted Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Lindernia dubia* | F/H | A/B | N | OBL | |
| *Ludwigia alternifolia* | F/H | P | N | FACW+ | |
| *Ludwigia palustris* | F/H | P | N | OBL | |
| *Ludwigia peploides* ssp. *glabrescens* | F/H | P | N | OBL | |
| *Lycopus americanus* | F/H | P | N | OBL | |
| *Lythrum salicaria* | F/H, SS | P | I | FACW+ | |
| *Mimulus alatus* | F/H | P | N | OBL | |
| *Mimulus ringens* | F/H | P | N | OBL | |
| *Mollugo verticillata* | F/H | A | N | FAC | |
| *Panicum dichotomiflorum* | G | A | N | FACW- | |
| *Penthorum sedoides* | F/H | P | N | OBL | |
| *Pilea pumila* | F/H | A | N | FACW | |
| *Polygonum caespitosum* | F/H | A | N & I | FACU- | |
| *Polygonum hydropiperoides* | F/H | P | N | OBL | |
| *Polygonum lapathifolium* | F/H | A | N | FACW+ | |
| *Polygonum pensylvanicum* | F/H | A | N | FACW | |
| *Polygonum persicaria* | F/H | A/P | I | FACW | |
| *Polygonum punctatum* | F/H | A/P | N | OBL | |
| *Pontedaria cordata* | F/H | P | N | OBL | |
| *Populus deltoides* | T | P | N | FAC | |
| *Portulaca oleracea* | F/H | A | N | FAC | |
| *Rorippa palustris* ssp. *fernaldiana* | F/H | A/B/P | N | OBL | |
| *Sagittaria latifolia* | F/H | P | N | OBL | |
| *Salix nigra* | T | P | N | FACW+ | |
| *Taraxacum officinale* | F/H | P | N & I | FACU- | |
| *Trifolium repens* | F/H | P | I | FACU- | |
| *Typha angustifolia* | G | P | I | OBL | |
| *Typha latifolia* | G | P | N | OBL | |
| *Veronica peregrina* | F/H | A | N | FACU- | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman Area 2 - Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Alisma subcordatum* | F/H | P | N | OBL | |
| *Amaranthus blitum* | F/H | A | I | NI | |
| *Azolla caroliniana* | F/H | A | N | OBL | G5, S1 |
| *Bidens* sp. | F/H | | | | |
| *Callitriche heterophylla* | F/H | A/P | N | OBL | |
| *Cardamine pensylvanica* | F/H | A/B/P | N | OBL | |
| *Cyperus erythrorhizos* | G | A/P | N | FACW+ | G5, S3 |
| *Cyperus iria* | G | A | I | FACW | |
| *Cyperus odoratus* | G | A/P | N | FACW | |
| *Cyperus squarrosus* | G | A | N | FACW+ | |
| *Cyperus strigosus* | G | P | N | FACW | |
| *Echinochloa crus-galli* | G | A | I | FACU | |
| *Echinochloa walteri* | G | A | N | FACW+ | |
| *Eclipta prostrata* | F/H | A/P | N | FAC | |
| *Eleocharis obtusa* | G | A/P | N | OBL | |
| *Eragrastis* sp. | G | | | | |
| *Juncus acuminatus* | G | P | N | OBL | |
| *Juncus diffusissimus* | G | P | N | FACW | |
| *Juncus effusus* | G | P | N | FACW+ | |
| *Leersia oryzoides* | G | P | N | OBL | |
| *Lemna perpusilla* | F/H | P | N | OBL | G5, S3 |
| *Lindernia dubia* | F/H | A/B | N | OBL | |
| *Ludwigia alternifolia* | F/H | P | N | FACW+ | |
| *Ludwigia palustris* | F/H | P | N | OBL | |
| *Ludwigia peploides* ssp. *glabrescens* | F/H | P | N | OBL | |
| *Lypersicon lycopersicum* var. *lycopersicum* | F/H | A/P | I | | |
| *Lythrum salicaria* | F/H, SS | P | I | FACW+ | |
| *Mimulus alatus* | F/H | P | N | OBL | |
| *Mimulus ringens* | F/H | P | N | OBL | |
| *Mollugo verticillata* | F/H | A | N | FAC | |
| *Panicum dichotomiflorum* | G | A | N | FACW- | |
| *Penthorum sedoides* | F/H | P | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kingman Area 2 - Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Polygonum caespitosum* | F/H | A | N & I | FACU- | |
| *Polygonum lapathifolium* | F/H | A | N | FACW+ | |
| *Polygonum persicaria* | F/H | A/P | I | FACW | |
| *Polygonum punctatum* | F/H | A/P | N | OBL | |
| *Pontedaria cordata* | F/H | P | N | OBL | |
| *Populus deltoides* | T | P | N | FAC | |
| *Portulaca oleracea* | F/H | A | N | FAC | |
| *Ranunculus sceleratus* | F/H | A/P | N | OBL | |
| *Rorippa palustris* ssp. *fernaldiana* | F/H | A/B/P | N | OBL | |
| *Rumex obtusifolius* | F/H | P | I | FACU- | |
| *Rumex verticillatus* | F/H | P | N | OBL | |
| *Sagittaria latifolia* | F/H | P | N | OBL | |
| *Salix nigra* | T | P | N | FACW+ | |
| *Schoenoplectus fluviatilis* | G | P | N | OBL | G5, S3/S4 |
| *Schoenoplectus pungens* | G | P | N | FACW+ | |
| *Schoenoplectus tabernaemontani* | G | P | N | OBL | |
| *Scirpus polyphyllus* | G | P | N | OBL | |
| *Trifolium repens* | F/H | P | I | FACU- | |
| *Typha angustifolia* | G | P | I | OBL | |
| *Typha latifolia* | G | P | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kenilworth Marsh Mass Fill 1 - Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Apios americana* | V, F/H | P | N | FACW | |
| *Bidens* sp. | F/H | | | | |
| *Boehmeria cylindrica* | F/H | P | N | FACW+ | |
| *Carex lurida* | G | P | N | OBL | |
| *Carex stricta* | G | P | N | OBL | |
| *Cephalanthus occidentalis* | S, T | P | N | OBL | |
| *Impatiens capensis* | F/H | A | N | FACW | |
| *Juncus effusus* | G | P | N | FACW+ | |
| *Leersia oryzoides* | G | P | N | OBL | |
| *Lycopus americanus* | F/H | P | N | OBL | |
| *Lythrum salicaria* | F/H, SS | P | I | FACW+ | |
| *Mikania scandens* | V, F/H | P | N | FACW+ | |
| *Peltandra virginica* | F/H | P | N | OBL | |
| *Phalaris arundinacea* | G | P | N | FACW | |
| *Phragmites australis* | F/H, SS, S | P | N | FACW | |
| *Pilea pumila* | F/H | A | N | FACW | |
| *Polygonum arifolium* | V, SS, F/H | A | N | OBL | |
| *Polygonum punctatum* | F/H | A/P | N | OBL | |
| *Polygonum sagitattum* | V, SS, F/H | A/P | N | OBL | |
| *Pontedaria cordata* | F/H | P | N | OBL | |
| *Sagittaria latifolia* | F/H | P | N | OBL | |
| *Scirpus cyperinus* | G | P | N | FACW+ | |
| *Scirpus polyphyllus* | G | P | N | OBL | |
| *Symphotrichum dumosum* var. *dumosum* | F/H | P | N | FAC | |
| *Typha angustifolia* | G | P | I | OBL | |
| *Typha x glauca* | G | P | N | OBL | |
| *Typha latifolia* | G | P | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Kenilworth Marsh Mass Fill 2 - Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Amaranthus cannabinus* | F/H | P | N | OBL | |
| *Bidens connata* | F/H | A | N | OBL | |
| *Boehmeria cylindrica* | F/H | P | N | FACW+ | |
| *Cephalanthus occidentalis* | S, T | P | N | OBL | |
| *Echinochloa crus-galli* | G | A | I | FACU | |
| *Echinochloa walteri* | G | A | N | FACW+ | |
| *Hibiscus moscheutos* | F/H, SS/S | A/P | N | OBL | |
| *Impatiens capensis* | F/H | A | N | FACW | |
| *Leersia oryzoides* | G | P | N | OBL | |
| *Lycopus americanus* | F/H | P | N | OBL | |
| *Lythrum salicaria* | F/H, SS | P | I | FACW+ | |
| *Mikania scandens* | V, F/H | P | N | FACW+ | |
| *Peltandra virginica* | F/H | P | N | OBL | |
| *Phalaris arundinacea* | G | P | N | FACW | |
| *Phragmites australis* | F/H, SS, S | P | N | FACW | |
| *Polygonum punctatum* | F/H | A/P | N | OBL | |
| *Pontedaria cordata* | F/H | P | N | OBL | |
| *Rumex verticillatus* | F/H | P | N | OBL | |
| *Sagittaria latifolia* | F/H | P | N | OBL | |
| *Salix nigra* | T | P | N | FACW+ | |
| *Saururus cernuus* | F/H | P | N | OBL | |
| *Schoenoplectus fluviatilis* | G | P | N | OBL | G5, S3/S4 |
| *Schoenoplectus tabernaemontani* | G | P | N | OBL | |
| *Scirpus cyperinus* | G | P | N | FACW+ | |
| *Scutellaria lateriflora* | F/H | P | N | FACW+ | |
| *Typha angustifolia* | G | P | I | OBL | |
| *Typha x glauca* | G | P | N | OBL | |
| *Typha latifolia* | G | P | N | OBL | |
| *Zizania aquatica* | G | A | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Dueling Creek - Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Amaranthus cannabinus* | F/H | P | N | OBL | |
| *Ampelopsis brevipedunculata* | V | P | I | | |
| *Bidens* sp. | F/H | | | | |
| *Boehmeria cylindrica* | F/H | P | N | FACW+ | |
| *Carex lurida* | G | P | N | OBL | |
| *Carex tribuloides* | G | P | N | FACW+ | |
| *Cuscuta gronovii* | V, F/H | P | N | | |
| *Fraxinus pennsylvanica* | T | P | N | FACW | |
| *Impatiens capensis* | F/H | A | N | FACW | |
| *Iris pseudoacorus* | F/H | P | I | OBL | |
| *Juncus effusus* | G | P | N | FACW+ | |
| *Leersia oryzoides* | G | P | N | OBL | |
| *Lythrum salicaria* | F/H, SS | P | I | FACW+ | |
| *Mikania scandens* | V, F/H | P | N | FACW+ | |
| *Peltandra virginica* | F/H | P | N | OBL | |
| *Phalaris arundinacea* | G | P | N | FACW | |
| *Pilea pumila* | F/H | A | N | FACW | |
| *Polygonum arifolium* | V, SS, F/H | A | N | OBL | |
| *Polygonum punctatum* | F/H | A/P | N | OBL | |
| *Polygonum sagitattum* | V, SS, F/H | A/P | N | OBL | |
| *Pontedaria cordata* | F/H | P | N | OBL | |
| *Sagittaria latifolia* | F/H | P | N | OBL | |
| *Schoenoplectus tabernaemontani* | G | P | N | OBL | |
| *Scirpus cyperinus* | G | P | N | FACW+ | |
| *Scutellaria lateriflora* | F/H | P | N | FACW+ | |
| *Sparganium eurycarpum* | F/H | P | N | OBL | |
| *Typha angustifolia* | G | P | I | OBL | |
| *Typha x glauca* | G | P | | OBL | |
| *Typha latifolia* | G | P | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Patuxent Marsh - Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Acorus calamus* | F/H | P | N | OBL | |
| *Amaranthus cannabinus* | F/H | P | N | OBL | |
| *Asclepias incarnata* | F/H | P | N | OBL | |
| *Bidens laevis* | F/H | A/P | N | OBL | |
| *Boehmeria cylindrica* | F/H | P | N | FACW+ | |
| *Cuscuta gronovii* | V, F/H | P | N | | |
| *Cyperus* sp. | G | | | | |
| *Eleocharis obtusa* | G | A/P | N | OBL | |
| *Epilobium ciliatum* ssp. *glandulosum* | F/H | P | N | FAC- | |
| *Eupatorium perfoliatum* | F/H | P | N | FACW+ | |
| *Galium tinctorium* | F/H | P | N | OBL | |
| *Helenium autumnale* | F/H | P | N | FACW+ | |
| *Hibiscus moscheutos* | F/H, SS, S | A/P | N | OBL | |
| *Hydrilla verticillata* | F/H | P | I | OBL | |
| *Hypericum mutilum* | F/H | A/P | N | FACW | |
| *Impatiens capensis* | F/H | A | N | FACW | |
| *Leersia oryzoides* | G | P | N | OBL | |
| *Lobelia cardinalis* | F/H | P | N | FACW+ | |
| *Ludwigia palustris* | F/H | P | N | OBL | |
| *Mentha arvensis* | F/H | P | N | FACW | |
| *Mikania scandens* | V, F/H | P | N | FACW+ | |
| *Mimulus ringens* | F/H | P | N | OBL | |
| *Nuphar lutea* | F/H | P | N | OBL | |
| *Orontium aquaticum* | F/H | P | N | OBL | |
| *Peltandra virginica* | F/H | P | N | OBL | |
| *Penthorum sedoides* | F/H | P | N | OBL | |
| *Pilea pumila* | F/H | A | N | FACW | |
| *Polygonum arifolium* | V, SS, F/H | A | N | OBL | |
| *Polygonum punctatum* | F/H | A/P | N | OBL | |
| *Polygonum sagitattum* | V, SS, F/H | A/P | N | OBL | |
| *Ptilimnium capillaceum* | F/H | A | N | OBL | |
| *Sagittaria latifolia* | F/H | P | N | OBL | |

**Appendix C**
**Characteristics of Identified Plant Species[1]**
**Patuxent Marsh - Transects**
**2000**

| SPECIES | HABIT[1a] | DURATION[1b] | ORIGIN[1c] | NWI INDICATOR STATUS[1d] | RTE RANK/STATUS[2] |
|---|---|---|---|---|---|
| *Sambucus racemosa* var. *racemosa* | S, SS, T | P | N | FACU | |
| *Schoenoplectus fluviatilis* | G | P | N | OBL | G5, S3/S4 |
| *Schoenoplectus pungens* | G | P | N | FACW+ | |
| *Schoenoplectus tabernaemontani* | G | P | N | OBL | |
| *Scirpus cyperinus* | G | P | N | FACW+ | |
| *Sparganium eurycarpum* | F/H | P | N | OBL | |
| *Symphyotrichum puniceus* | F/H, SS, S | P | N | OBL | |
| *Typha latifolia* | G | P | N | OBL | |
| *Zizania aquatica* | G | A | N | OBL | |

[1] Nomenclature and characteristics drawn from USDA, NRCS 1999. The PLANTS database. (http://plants.usda.gov/plants). National Plant Data Center, Baton Rouge, LA.

[1a] Habit: F/H = forb/herb; G = graminoid; S = shrub; SS= subshrub; T = tree.
In some cases PLANTS has listed multiple habits per species. In those cases we have provided all of the habits, listing first the habit that is, within our experience, the most common in the local area.

[1b] Duration: A = annual; B = biennial; P = perennial

[1c] Origin: I = introduced; N = native

[1d] NWI (National Wetland Inventory) Indicator Status: OBL = obligate wetland; FACW = facultative wetland; FAC = facultative; FACU = facultative upland; NI = no indicator status

[2]Rare, threatened, and endangered (RTE) plant information drawn from MD DNR, Wildlife and Heritage Division. April 30, 2001. Rare, threatened, and endangered plants of Maryland. (http://dnrweb.dnr.state.md.us/download/rteplants.pdf).

# Appendix D Biomass Data by Species

Appendix D
Biomass Data by Species
2000

**Kingman Area 1- Planted**

| Vegetation Type | Biomass (g dry wt/ $m^2$) |
|---|---|
| *Cyperus* spp. | 54 |
| *Ludwigia palustris* | 36 |
| *Salix* spp. | 32 |
| *Schoenoplectus tabernaemontani* | 30 |
| *Pontedaria cordata* | 21 |
| *Sagittaris latifolia* | 17 |
| *Echinochloa crus-galli* | 11 |
| *Lythrum salicaria* | 8 |
| *Juncus effusus* | 8 |
| *Polygonum lapathifolium* | 4 |
| *Schoenoplectus pungens* | 4 |
| *Cyperus odoratus* | 4 |
| *Echinochloa* sp. | 3 |
| *Polygonum* sp. | 3 |
| *Populus deltoides* | 3 |
| *Leersia oryzoides* | 3 |
| *Peltandra virginica* | 2 |
| *Cynodon dactylon* | 2 |
| *Alisma subcordatum* | 1 |
| *Juncus* sp. | 1 |
| *Eragrostis* sp. | 1 |
| *Eclipta prostrata* | 1 |
| *Juncus acuminatus* | 1 |
| *Lindernia dubia* | 1 |
| *Acer saccarhinum* | 1 |
| *Eleocharis obtusa* | 1 |
| *Typha latifolia* | 1 |
| *Penthorum sedoides* | < 1 |
| *Juncus tenuis* | < 1 |
| *Lycopus americanus* | < 1 |
| unknown dicot | < 1 |
| *Eleusine indica* | < 1 |
| unknown | < 1 |
| *Lemna perpusilla* | < 1 |
| unknown monocot | < 1 |
| *Spirodela polyrrhiza* | < 1 |
| *Azolla caroliniana* | < 1 |
| **Total** | **256** |

**Kingman Area 1- Unplanted**

| Vegetation Type | Biomass (g dry wt/ $m^2$) |
|---|---|
| *Salix* spp. | 74 |
| *Polygonum lapathifolium* | 67 |
| *Echinochloa crus-galli* | 17 |
| *Ludwigia palustris* | 14 |
| *Acer saccarhinum* | 2 |
| *Typha latifolia* | 1 |
| *Lythrum salicaria* | 1 |
| *Populus deltoides* | 1 |
| *Leersia oryzoides* | 1 |
| *Lindernia dubia* | 1 |
| *Cynodon dactylon* | 1 |
| *Eleocharis obtusa* | 1 |
| *Boehmeria cylindrica* | 1 |
| *Trifolium repens* | < 1 |
| *Eragrostis* sp. | < 1 |
| *Prunus* sp. | < 1 |
| *Polygonum* sp. | < 1 |
| *Poaceae* sp. | < 1 |
| *Mimulus ringens* | < 1 |
| unknown dicot | < 1 |
| *Eupatorium serotinum* | < 1 |
| **Total** | **182** |

Appendix D
Biomass Data by Species
2000

**Kingman Area 2**

| Vegetation Type | Biomass (g dry wt/ m$^2$) |
|---|---|
| *Echinochloa* sp. | 89 |
| *Pontedaria cordata* | 78 |
| *Sagittaris latifolia* | 76 |
| *Eleocharis obtusa* | 72 |
| *Cyperus* spp. | 68 |
| *Leersia oryzoides* | 23 |
| *Schoenoplectus tabernaemontani* | 23 |
| *Ludwigia palustris* | 21 |
| *Typha latifolia* | 13 |
| *Echinochloa crus-galli* | 11 |
| *Eclipta prostrata* | 10 |
| *Polygonum punctatum* | 4 |
| *Juncus effusus* | 2 |
| unknown woody | 1 |
| unknown dicot | < 1 |
| *Juncus acuminatus* | < 1 |
| *Polygonum* sp. | < 1 |
| *Salix nigra* | < 1 |
| *Acer saccarhinum* | < 1 |
| *Penthorum sedoides* | < 1 |
| *Cardamine pensylvanica* | < 1 |
| *Rumex obtusifolius* | < 1 |
| Poaceae sp. | < 1 |
| **Total** | **492** |

**Kenilworth Mass Fill 1**

| Vegetation Type | Biomass (g dry wt/ m$^2$) |
|---|---|
| *Phragmites australis* | 390 |
| *Typha latifolia* | 211 |
| Poaceae sp. | 156 |
| *Impatiens capensis* | 143 |
| *Typha angustifolia* | 56 |
| *Leersia oryzoides* | 29 |
| *Lythrum salicaria* | 26 |
| *Peltandra virginica* | 8 |
| *Sagittaris latifolia* | 4 |
| *Mikania scandens* | < 1 |
| **detritus** | **263** |
| **Total** | **1286** |

**Kenilworth Mass Fill 2**

| Vegetation Type | Biomass (g dry wt/ m$^2$) |
|---|---|
| *Phragmites australis* | 796 |
| *Typha latifolia* | 390 |
| *Schoenoplectus fluviatilis* | 218 |
| *Peltandra virginica* | 85 |
| *Leersia oryzoides* | 47 |
| *Mikania scandens* | 9 |
| *Salix nigra* | 2 |
| *Sagittaris latifolia* | 1 |
| *Pontedaria cordata* | 1 |
| *Polygonum punctatum* | < 1 |
| **detritus** | **527** |
| **Total** | **2075** |

Appendix D
Biomass Data by Species
2000

**Patuxent Marsh**

| Vegetation Type | Biomass (g dry wt/ $m^2$) |
|---|---|
| *Polygonum arifolium* | 405 |
| *Leersia oryzoides* | 175 |
| *Acorus calamus* | 72 |
| *Impatiens capensis* | 43 |
| *Polygonum punctatum* | 27 |
| *Nuphar lutea* | 21 |
| *Cuscuta gronovii* | 20 |
| *Peltandra virginica* | 15 |
| *Polygonum sagittatum* | 13 |
| *Sagittaris latifolia* | 6 |
| *Typha latifolia* | 4 |
| *Osmunda regalis* | 2 |
| *Schoenoplectus fluviatilis* | 1 |
| *Mikania scandens* | 1 |
| *Galium tinctorium* | 1 |
| **detritus** | **38** |
| **Total** | **842** |

**Dueling Creek**

| Vegetation Type | Biomass (g dry wt/ $m^2$) |
|---|---|
| *Leersia oryzoides* | 418 |
| *Typha latifolia* | 154 |
| *Polygonum punctatum* | 53 |
| *Polygonum arifolium* | 35 |
| *Impatiens capensis* | 13 |
| *Sparganium eurycarpum* | 11 |
| *Peltandra virginica* | 9 |
| *Mikania scandens* | 9 |
| *Polygonum sagittatum* | 7 |
| *Sagittaris latifolia* | 3 |
| **detritus** | **423** |
| **Total** | **1134** |