National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

# Invasive Exotic Plant Monitoring at Golden Spike National Historical Park

## *2021 Field Season*

Natural Resource Report NPS/NCPN/NRR—2022/2419



ON THE COVER

Rush skeletonweed (*Chondrilla juncea*). Steve Dewey, Utah State University, Bugwood.org.

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***Prepared by***
Dustin W. Perkins
Northern Colorado Plateau Network
National Park Service
P.O. Box 848
Moab, UT 84532

***Editing and Design***
Alice Wondrak Biel
Northern Colorado Plateau Network
National Park Service
P.O. Box 848
Moab, UT 84532

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# Executive Summary

Invasive exotic plant (IEP) species are one of the biggest threats to natural ecosystem integrity and biodiversity. Controlling them is a high priority for the National Park Service. The Northern Colorado Plateau Network (NCPN) selected the early detection of IEPs as one of 11 monitoring protocols to be implemented as part of its long-term monitoring program. This report represents work completed during the 2021 field season at Golden Spike National Historical Park (NHP). On June 24–25, 2021, we recorded a total of six priority IEP species during monitoring at the park. A total of 191 priority IEP patches were detected along 20 kilometers (12.4 miles) of 13 monitoring routes that covered all major roads, trails, and riparian areas. Three additional IEP species were recorded only in transects. The highest densities of IEP patches were recorded along the Hydro 1 and Last Cut drainages, followed by the Residence Service Road, East Tour Road, and Visitor Center Sidewalk Area. Rush skeletonweed (*Chondrilla juncea*) was the most prevalent priority species, representing 46% of all recorded patches. Field bindweed (*Convolvulus arvensis*) and Scotch thistle (*Onopordum acanthium*) constituted most other patches. The notable absence of Russian knapweed (*Centaurea repens*) represents past control efforts for this species. When compared to 2018, there was a dramatic increase in the number of IEP patches in 2021, driven by rush skeletonweed and field bindweed. More-widespread species monitored in transects were still common, with cheatgrass (*Bromus tectorum*), crested wheatgrass (*Agropyron cristatum*), and tumble mustard (*Sisymbrium altissimum*) present in 84%, 45%, and 36% of all transects, respectively. The network plans to return to Golden Spike NHP for an eighth year of monitoring in 2023.

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# 1 Introduction

Invasive exotic species fragment native ecosystems, displace native plants and animals, and alter ecosystem function. Invasive species are second only to habitat loss as threats to global biodiversity (Scott and Wilcove 1998) and represent one of the most serious threats to natural ecosystem integrity (NRC 2002). Biological invasions are occurring at accelerated rates in nearly every major ecosystem (Mooney and Hobbs 2000). Exotic plants negatively affect park resources and visitor enjoyment by altering landscapes and fire regimes, reducing native plant communities and animal habitat, and increasing trail-maintenance needs. Recognizing these challenges, Northern Colorado Plateau Network (NCPN) parks identified invasive exotic plants (IEPs) as a high-priority vital sign for long-term monitoring (O'Dell et al. 2005).

IEPs are a subset of exotic plants "whose introduction does or is likely to cause economic or environmental harm or harm to human health" (Executive Order 13112). With the aim of facilitating strategic control approaches, this monitoring program detects early invasions, identifies existing invasions, and, to the extent possible, tracks changes in the abundance and distribution of target IEPs in parks along key invasive pathways.

Invasive exotic plants can spread into national parks via a number of different pathway types. Predictable IEP pathways include roads, trails, and riparian corridors. Long-distance dispersal through cargo containers and air freight are examples of sudden pathways. Anthropogenic pathways include horticultural escapes and seeds transported on shoes and in restoration seed mixes. For the National Park Service (NPS), the consequences of these plant invasions present a significant challenge to the agency's ability to maintain natural resources "unimpaired for the enjoyment of future generations."

Because regular, comprehensive monitoring of the distribution and abundance of all exotic plant species within NCPN units is beyond the fiscal capabilities of the network and parks, the NCPN focuses on the most likely areas where a broad range of invasive exotic plants may occur: riparian corridors, roads, trails, areas of high visitor impact (e.g., campgrounds), and park boundaries. This approach is cost-effective for finding many new invasions in areas where they are most likely to occur, but it may miss exotic plants dispersed to the interior areas of large parks by wind and/or animals.

Specific objectives of NCPN invasive exotic plant monitoring are:

1. To detect incipient populations and new introductions of invasive plant species before they become established in areas of management significance and invasion pathways, and
2. To determine status and trends of selected invasive plant populations of management significance.

This report summarizes the 2021 field season and sixth complete monitoring visit at Golden Spike National Historical Park (NHP).

# 2 Methods

We followed the invasive plant monitoring protocol developed by the NCPN (Perkins et al. 2016), adapted from Andersen and Dewey (2007). The protocol emphasizes quick collection of IEP location and abundance data in order to maximize the amount of area searched, thus increasing our chances of finding a higher percentage of both new invasions and established IEPs. By focusing on roads, trails, and waterways, which are major vectors for invasive plants, we capture the greatest amount of information (i.e., benefit) with the least amount of time and effort (i.e., cost).

After park and NCPN staff reviewed the list of priority invasive plants (see Section 2.1), we established a series of co-located monitoring routes and quadrats along all roads, major drainages, and trails in the park. The quadrats, which are sampled in a quantitative manner, are used to make inference to the percent cover of IEPs located along the park's invasive pathways (i.e., the monitoring routes) and allow us to estimate trends in IEP percent cover over time. The monitoring routes, which are not quantitatively sampled, are used to increase the spatial coverage of mapping performed, with the goal of maximizing our opportunities for detecting IEPs in the park.

All roads, trails, and riparian areas surveyed in 2021 were previously surveyed with monitoring routes and quadrats in 2008, 2010, 2012, 2014, 2016, and 2018 (Perkins and Weissinger 2009; Perkins 2011, 2013, 2015, 2017; Washuta and Perkins 2019).

## 2.1 Developing a priority invasive exotic plant list

Prior to beginning monitoring in 2021, NCPN and park staff reviewed the list of high-priority IEPs (Table 2-1) that was initially developed in 2008 and then reviewed before each monitoring visit. No species were added in 2021. The original list was developed by reviewing past park literature and state and county weed lists, and consulting with park staff and county weed managers. The list of priority species is reviewed before each field season.

**Table 2-1. Priority invasive plant list, Golden Spike NHP, 2008–2021.**

| Scientific name | Common name |
|---|---|
| *Cardaria* sp. | whitetop |
| *Carduus nutans* | musk thistle |
| *Centaurea diffusa* | diffuse knapweed |
| *Centaurea maculosa* | spotted knapweed |
| *Centaurea repens* | Russian knapweed |
| *Centaurea solstitialis* | yellow starthistle |
| *Centaurea virgata* | squarrose knapweed |
| *Chondrilla juncea* | rush skeletonweed |
| *Cirsium arvense* | Canada thistle |
| *Convolvulus arvensis*[1] | field bindweed |
| *Crupina vulgaris* | common crupina |
| *Elymus repens* | quackgrass |
| *Euphorbia esula* | leafy spurge |
| *Hypericum perforatum* | common St. John's wort |
| *Isatis tinctoria* | dyer's woad |
| *Lepidium latifolium* | perennial pepperweed |
| *Linaria dalmatica* | dalmatian toadflax |
| *Marrubium vulgare* | horehound |
| *Onopordum acanthium* | Scotch thistle |
| *Salvia aethiopsis* | Mediterranean sage |
| *Senecio jacobaea* | tansy ragwort |
| *Taeniatherum caput-medusae* | Medusahead |
| *Tribulus terrestris* | puncture vine |
| *Verbascum blattaria* | moth mullein |

[1]Not on list in 2010–2012.

Our high-priority IEP list includes existing IEPs and potential IEPs of high management concern. Because these methods were designed to be rapid, field crews were trained to develop a focused search image on the target plants, instead of looking for every possible invasive plant species. Species on the priority list generally have the potential to be managed or even eradicated within the park. We also record crested wheatgrass (*Agropyron cristatum*), cheatgrass (*Bromus tectorum*), and tumble mustard (*Sisymbrium altissimum*) in all transects.

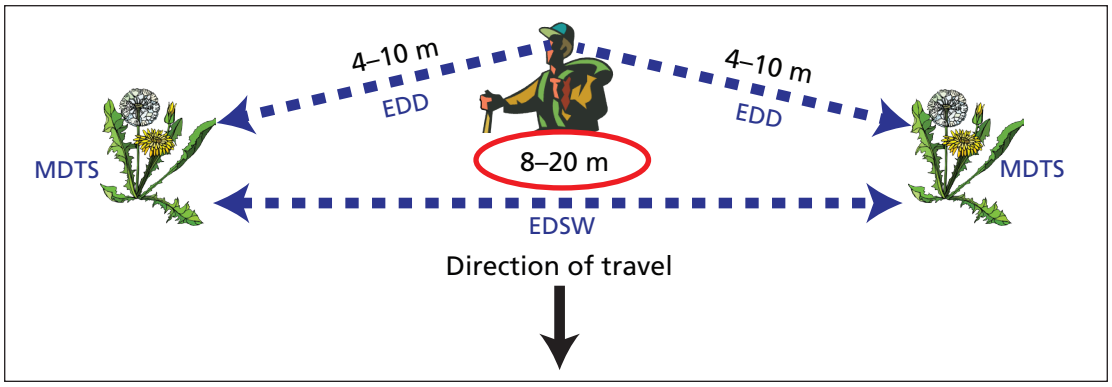



Figure 2-1. The maximum Effective Detection Distance (EDD) at Golden Spike National Historical Park ranged from 4 to 10 meters in 2021, making the Effective Detection Swath Width (EDSW) 8–20 meters.

## 2.2 Monitoring routes

### *2.2.1 Minimum detection target size*

The minimum detection target size (MDTS) represents the patch size large enough to be detected with a high level of confidence (typically at least 90% of the total number of patches of that size and larger in the monitoring area) under actual field conditions, but small enough that any missed patches smaller than the MDTS could still feasibly be eradicated if not found until the next scheduled monitoring visit. The NCPN has established an MDTS of 40 $m^2$ (~20 × 20 ft) for all IEPs. Use of the MDTS is necessary because field technicians are not expected to find every single plant of every targeted weed species during route surveys. Although searching for single mature plants of some species, such as Russian olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix* sp.), is possible due to their large size, single plants of other species, such as field bindweed (*Convolvulus arvensis*), are nearly impossible to detect in most field conditions.

### *2.2.2 Effective detection distance*

The effective detection distance (EDD) is the maximum distance from which a searcher could consistently detect (i.e., see and recognize) the MDTS of the least-visible targeted species with at least 90% detection efficiency (Figure 2-1). Crew members are trained by determining the maximum distance from which they can consistently see and recognize a patch of fake plants of a targeted size with complete confidence. The size of the EDD is estimated in the field by crew members. The distance is measured either by pacing or using a laser rangefinder. The EDD for Golden Spike NHP was between 4 and 10 meters in 2021, depending on vegetation.

### *2.2.3 Effective detection swath width*

Effective detection swath width (EDSW) is defined as the maximum width of a linear search swath (band transect) in which a walking observer is confident of visually detecting 90% of all target species of the MDTS (Figure 2-1). The effective detection swath width (EDSW) is equal to two times the EDD, because the surveyor is able to effectively detect weeds for one EDD on either side of the search route. The EDSW ranged from 8 to 20 meters at Golden Spike NHP in 2021.

### *2.2.4 Patch separation resolution*

We define patch separation resolution (PSR) as the minimum distance between plants that must be considered members of separate patches. Individuals or clusters of a target species separated by the PSR distance or more are recorded as separate patches. We consider plants separated by less than the PSR to be a single patch. The PSR is set at 50 meters, based on the assumption that most plants or groups of plants separated by less than 50 meters are typically considered to be one patch during planning and implementation of weed-control operations. If a patch is continuous for more than 50 meters, then cover estimates are made every 50 meters to aid in developing an effective management strategy for the entire patch.

### 2.2.5 Between feature position

Between feature positions allow electronic tracking of a user's route. GPS units are set to automatically generate these positions at a distance equal to the EDSW. Each time a surveyor walks the equivalent of one EDSW, the GPS unit creates a point.

### 2.2.6 Data collection methods

Crew members walked one EDD out from one side of a monitoring route and then returned to the starting point by walking back one EDD from the route on the other side. While walking, they searched for IEPs by visually scanning (side-to-side) all of the land within the borders of the swath. However, if the terrain was uneven or steep, and the observer had to glance frequently at the ground to ensure safe foot placement, then they stopped approximately every 10–20 meters (the length of one EDSW) and visually scanned the area in all directions. As monitoring routes were traversed, locations of all target species were documented using global positioning system (GPS) units with at least five-meter accuracy.

Only species designated as priority were consistently recorded on monitoring routes. When a priority IEP was discovered, observers recorded the following information: (1) monitoring route, (2) sequential number of the patch per monitoring route, (3) patch size class (see below), (4) whether the plant was pulled, and (5) cover class (see below). If several species were present with similar distributions at a single point, then we recorded a point for each individual species and assigned it its own sequential identification number. Patches more than 50 meters (55 yards) apart were considered separate and recorded with a separate point.

Patch size class was estimated as follows:

1. 1–3 plants (used for isolated single plants or very small patches (≤2 × 2 m),
2. Four plants–40 $m^2$ (48 $yd^2$),
3. 40–400 $m^2$ (48–478 $yd^2$),
4. 400–1,000 $m^2$ (0.1–0.25 acre), and
5. 1,000–2,000 $m^2$ (0.25–0.5 acre).

We recorded cover class by estimating the amount, or "percentage," of ground covered by the vertical projection of plant matter as visualized from a bird's-eye view of the vegetation (Elzinga et al. 1998). This estimate included both the living and dead standing material of the vegetation of a single plant species. Percent cover of a patch was recorded using the following classes:

1. Trace (<1%)
2. Low (1–5%)
3. Moderate (6–25%)
4. High (26–50%)
5. Majority (51–100%).

We recorded the following ancillary information with every patch: descriptive notes (e.g., hillside, distance to road, wetland, or stream), the growth stage of exotic trees (i.e., seedling, sapling, mature, old growth), evidence of prior treatment, and evidence of disturbances (e.g., recent fire, flood, small-mammal disturbance).

## 2.3 Monitoring transects

In 2008, 2016, 2018, and 2021, we established transects with three vegetation quadrats every 500 meters along monitoring routes. In 2010, 2012, and 2014, we altered our methods slightly. There were still transects every 500 meters. However, if no IEPs were detected for three consecutive transects (9 quadrats), then transects were established every 1,000 meters. If invasive plants were found in categories greater than 1 for cover class or patch size class, then we reverted to transects every 500 meters.

### 2.3.1 Quadrat establishment

Vegetation quadrats were centered at 0.5, 5, and 10 meters away from the edge of a route on the same side as the route that was being walked and on alternating sides for riparian areas, small roads, or trails. A 1-$m^2$ sampling frame was used to sample vegetation cover and soil surface features. Observers could make additional species observations, but non-priority species were not thoroughly mapped.

Quadrat sampling methods used in the 2008 pilot field season differed slightly from those in all subsequent years. In 2008, all IEPs were recorded in monitoring quadrats, and quadrats were embedded in a larger (177-$m^2$) macroplot centered five meters from the monitoring route.

### *2.3.2 Data collection methods*

In the monitoring quadrats, all priority IEP species observed were recorded. In all years except 2012, cheatgrass and crested wheatgrass were also recorded in transects. Starting in 2014, we also recorded tumble mustard in quadrats. For each quadrat, we recorded percent cover of each IEP using the following classes: <1, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100%. Prior to 2018, cover was recorded using the following classes: <1, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11–25, 26–50, or >50%. We also recorded percent cover to the nearest 10% of dominant soil surface features (i.e., dead wood, dung, fungus, lichen, litter/duff, live root/bole, mineral soil/sediment, moss, biological soil crust, road, rock, standing water/flooded, stream, or trash/junk).

## 2.4 Analyses

We calculated the mean number of patches per kilometer for monitoring routes. Percent-cover estimates were generated from the monitoring-quadrat data. We calculated the mean and standard error of percent cover by species for monitoring quadrats. For cover classes representing a range of values (this occurred in years prior to 2018), midpoints were used when calculating the mean and standard error. Due to differences in observers' knowledge, only priority species were used when comparing results across years.

# 3 Results

## 3.1 Monitoring routes

### *3.1.1 2021 results*

In 2021, we recorded a total of six priority IEP species in 191 patches along 20 kilometers (12.4 miles) of 13 monitoring routes during monitoring at Golden Spike NHP (Tables 3-1, 3-2; Figures 3-1, 3-2; Appendix A). Two additional priority patches were located outside of monitoring routes.

The highest densities of plant patches were recorded along the Last Cut Drainage (24.5/km), Hydro 1 (13.6/km) drainages and Residence Service Road (12.2/km), East Tour Road (11.4/km), and Visitor Center Sidewalk Area (10.9/km) (see Table 3-2).

Rush skeletonweed (*Chondrilla juncea*) was the most prevalent priority species, representing 46% of all recorded patches (Table 3-3). Scotch thistle (*Onopordum acanthium*) and field bindweed constituted most other patches.

Of the 191 patches, 88 (46%) were larger than 40 $m^2$ (see Table 3-3).

Four additional patches of non-priority IEPs were located on East Tour Road: three patches of ripgut brome (*Bromus diandra*) and one patch of prickly lettuce (*Lactuca serriola*). Three non-priority patches were observed on Last Cut drainage: two patches of jointed goatgrass (*Aegilops cylindrica*), and one patch of tamarisk. Single non-priority patches were found on Facility Road (jointed goatgrass), Big Fill Section County Road (Bermuda grass, *Cynodon dactylon*), County Road (black henbane, *Hyoscyamus niger*), and Poulsons Road (common hounds-tongue, *Cynoglossum officinale*).

## 3.2 Monitoring transects

We sampled a total of 44 transects in 2021 (Figure 3-3, Appendix B). Only two priority species were detected on transects: field bindweed (3 detections) and broad-leaf pepperwort (*Lepidum latifolium,* 1 detection). However, 100% of transects were found to contain at least one of the non-priority, transect-only species, crested wheatgrass, cheatgrass, and tumble mustard (Figures 3-4, 3-5).

Cheatgrass was the most prevalent species, found in 84% of transects, with an average cover of 1.07% across all transects. Crested wheatgrass was found in 45% of transects, with an average cover of 3.38% across all transects. Tumble mustard was found in 36% of transects, with an average cover of 0.05% across all transects.

## 3.3 IEPs over time

For IEP species consistently monitored from 2008 to 2021, there was a large increase in IEP patches in 2021, when 141 patches were found, compared to 61 patches in 2018 and a range of 6–77 patches over the entire monitoring period (Table 3-4). This increase was largely driven by rush skeletonweed, which increased from 8 patches in 2018 to 88 patches in 2021. Its previous highest number of patches was 32 in 2014. The lowest number of total patches (6) occurred in 2012, after several exotic-plant treatments within the park (NPS 2012).

Field bindweed has not been monitored as a priority species in all years, but also increased dramatically, from 12 patches in 2018 to 52 patches in 2021. Its previous highest number of patches was 41 in 2008. Since a sharp decline in 2012, Scotch thistle has stayed relatively stable since 2018. Dyer's woad (*Isatis tinctoria*) and moth mullein (*Verbascum blattaria*) stayed relatively stable and at low numbers in 2021. Russian knapweed (*Centaurea repens*) was not detected in the park, down from eight patches in 2018.

The average percent cover of crested wheatgrass had been declining across the park, from 6.4% in 2008 to 1.5% in 2018—but it increased to 3.38% in 2021 (see Figure 3-5). Cheatgrass has varied widely in average percent cover over the last three visits, ranging from 11.27% in 2018 to 1.07% in 2021. In contrast, the percent of transects in which crested wheatgrass, cheatgrass, and tumble mustard were detected has shown little change across all sampling years (see Figure 3-5).

**Table 3-1. Invasive exotic plants detected at Golden Spike NHP, June 24–25, 2021.**

| Scientific name | Common name | Method detected[1] | | Priority? |
|---|---|---|---|---|
| | | Routes | Transects[2] | |
| *Chondrilla juncea* | rush skeletonweed | X | – | Yes |
| *Convolvulus arvensis* | field bindweed | X | X | Yes |
| *Isatis tinctoria* | dyer's woad | X | – | Yes |
| *Lepidium latifolium* | broad-leaf pepperwort | X | X | Yes |
| *Onopordum acanthium* | Scotch thistle | X | – | Yes |
| *Verbascum blattaria* | moth mullein | X | – | Yes |
| *Agropyron cristatum* | crested wheatgrass | – | X | Transects |
| *Bromus tectorum* | cheatgrass | – | X | Transects |
| *Sisymbrium altissimum* | tumble mustard | – | X | Transects |
| *Aegilops cylindrica* | jointed goatgrass | X | – | No |
| *Bromus diandra* | ripgut brome | X | – | No |
| *Cynodon dactylon* | Bermuda grass | X | – | No |
| *Cynoglossum officinale* | common hounds-tongue | X | – | No |
| *Hyoscyamus major* | black henbane | X | – | No |
| *Lactuca serriola* | prickly lettuce | X | – | No |
| *Tamarix* sp. | tamarisk | X | – | No |

[1] "X" = Yes; "–" = No.
[2] Transect species are recorded only in transects and are not recorded along monitoring routes.

**Table 3.2. Number of priority IEP patches per kilometer by route surveyed, Golden Spike NHP, June 24–25, 2021.**

| Route | Route type | Length (km) | Priority patches | |
|---|---|---|---|---|
| | | | Total | Patches/km |
| Hydro 1 | Riparian | 0.295 | 4 | 13.6 |
| Last Cut Drainage | Riparian | 1.874 | 46 | 24.5 |
| Big Fill Section County Road | Road | 5.152 | 33 | 6.4 |
| County Road | Road | 1.975 | 12 | 6.1 |
| East Tour Road | Road | 5.258 | 59 | 11.2 |
| Facility Road | Road | 0.708 | 4 | 5.6 |
| Poulsons Road | Road | 2.067 | 15 | 7.3 |
| Residence Service Road | Road | 0.164 | 2 | 12.2 |
| Retired Service Road | Road | 0.260 | 1 | 3.9 |
| Water Tank Road | Road | 0.507 | 4 | 7.9 |
| Visitor Center Sidewalk Area | Road | 0.551 | 6 | 10.9 |
| Witkers Service Road | Road | 0.464 | 1 | 2.2 |
| Pacific Track Grade | Trail | 0.997 | 4 | 4.0 |
| All Riparian | Riparian | 2.169 | 50 | 23.1 |
| All Roads | Road | 17.106 | 137 | 8.0 |
| Overall totals | All | 20.272 | 191 | 9.4 |
| Not found on monitoring routes | | | 2 | NA |

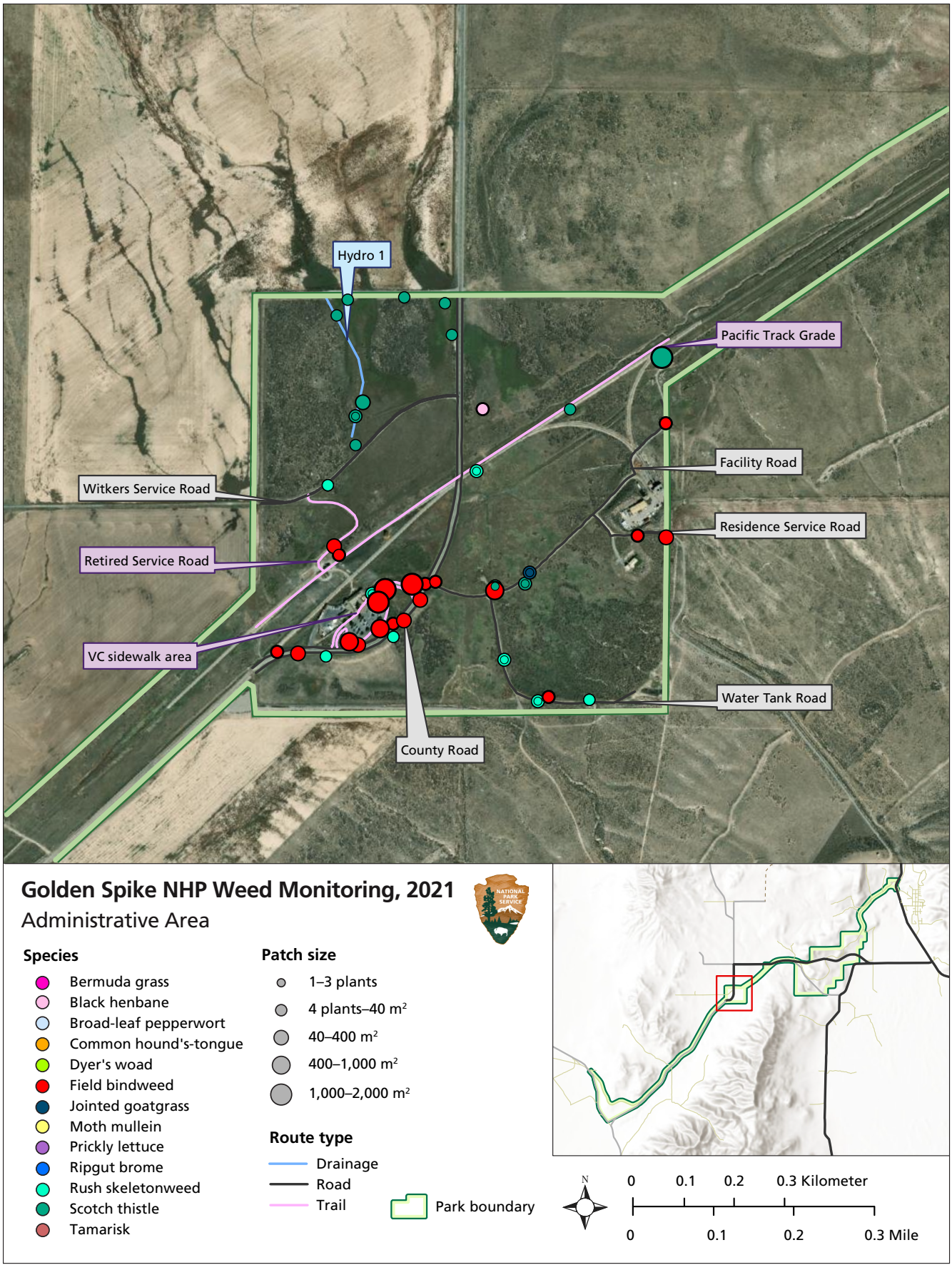



Figure 3-1. Invasive exotic plant patches detected along monitoring routes, Administrative Area, Golden Spike NHP, June 24–25, 2021.

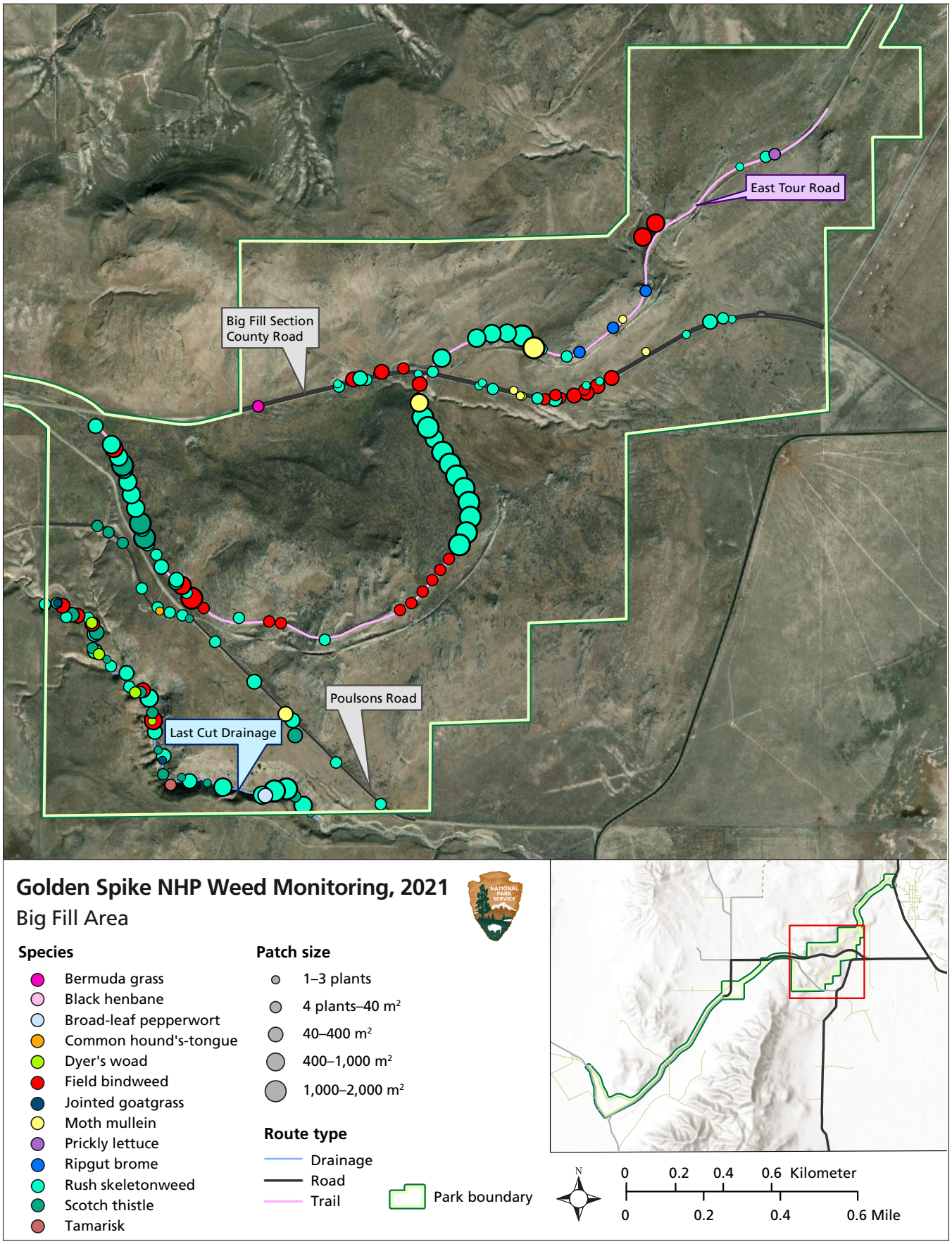



Figure 3-2. Invasive exotic plant monitoring routes and invasive patches detected along monitoring routes, Big Fill Area, Golden Spike NHP, June 24–25, 2021.

**Table 3.3. Number of priority IEP patches detected along monitoring routes by patch size class, Golden Spike NHP, June 24–25, 2021.**

| Scientific name | Common name | Total patches | Patch size class[1] | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| *Chondrilla juncea* | rush skeletonweed | 88 | 14 | 30 | 16 | 15 | 13 |
| *Convolvulus arvensis* | field bindweed | 52 | 0 | 22 | 18 | 8 | 4 |
| *Isatis tinctoria* | dyer's woad | 7 | 4 | 3 | 0 | 0 | 0 |
| *Lepidium latifolium* | broad-leaf pepperwort | 1 | 0 | 0 | 1 | 0 | 0 |
| *Onopordum acanthium* | Scotch thistle | 36 | 11 | 15 | 6 | 4 | 0 |
| *Verbascum blattaria* | moth mullein | 7 | 4 | 0 | 1 | 1 | 1 |
| Total | | 191 | 33 | 70 | 42 | 28 | 18 |

[1]Patch size classes: 1 = 1–3 plants (≤2 × 2 m), 2 = 4 plants–40 $m^2$ (48 $yd^2$), 3 = 40–400 $m^2$ (48–478 $yd^2$), 4 = 400–1,000 $m^2$ (0.1–0.25 acre), 5 = 1,000–2,000 $m^2$ (0.25–0.5 acre).

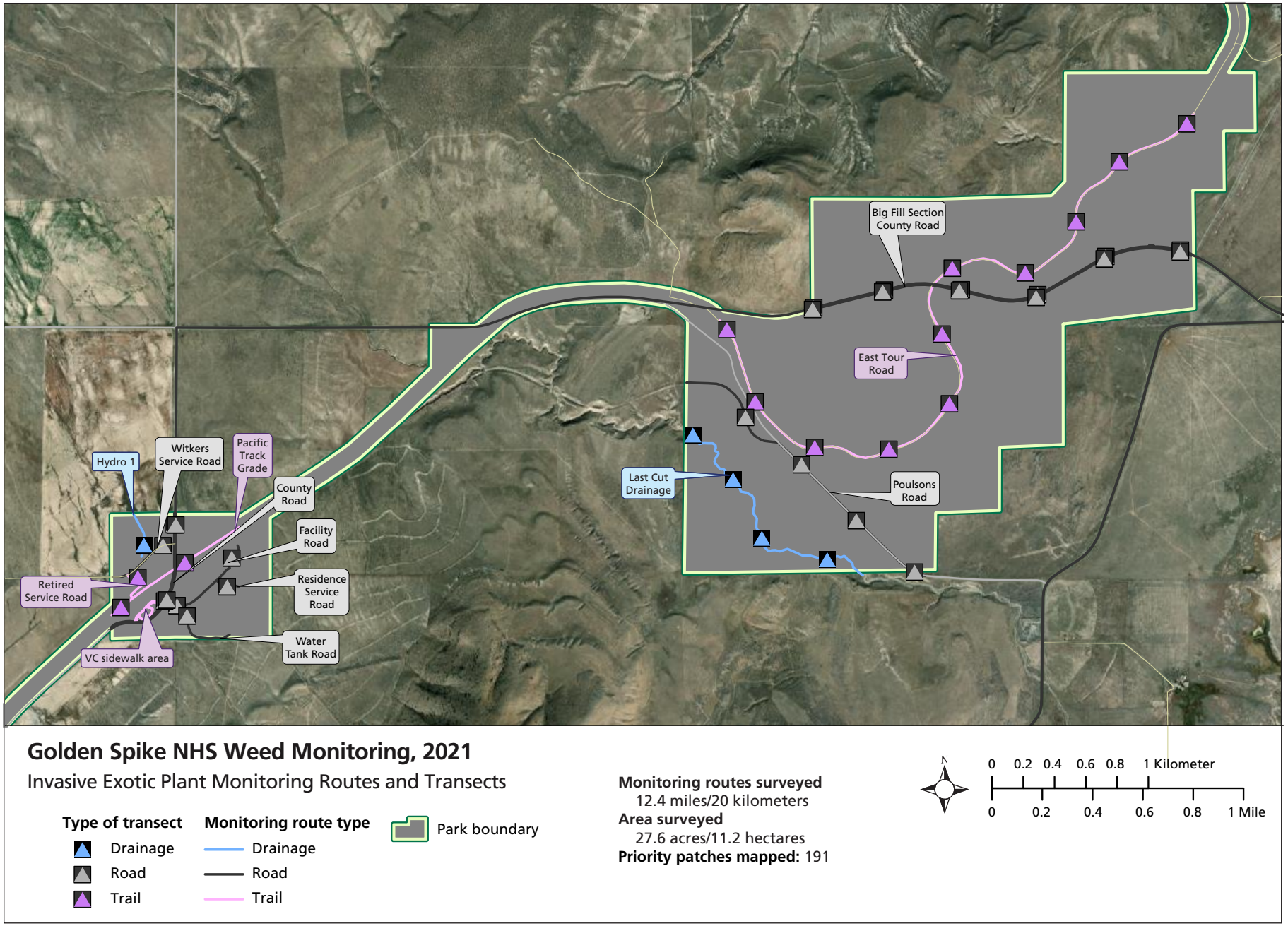



Figure 3-3. Invasive exotic plant monitoring routes and transects, Golden Spike NHP, June 24–25, 2021.

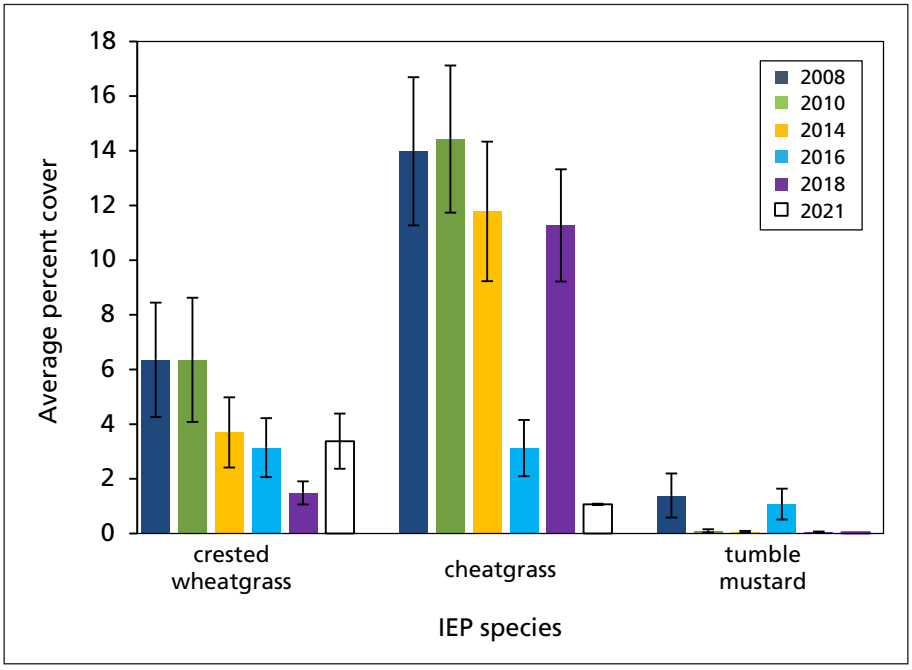



Figure 3-4. Percent cover with standard error of invasive species that were consistently recorded in transects at Golden Spike NHP in 2008, 2010, 2014, 2016, 2018, and 2021.

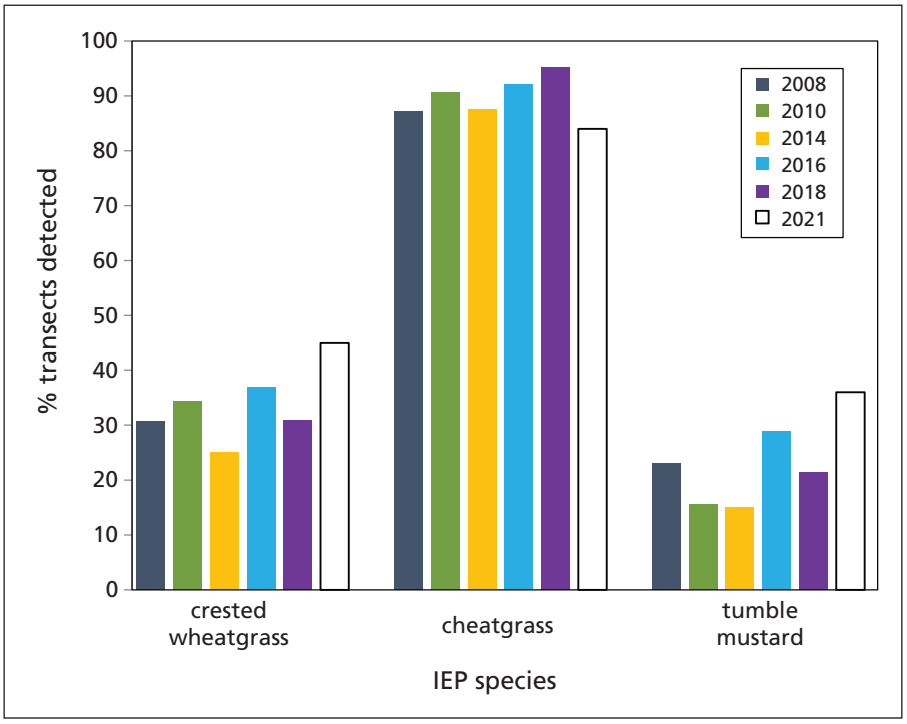



Figure 3-5. Percent of transects in which three common IEPs were recorded at Golden Spike NHP in 2008, 2010, 2014, 2016, 2018, and 2021.

**Table 3-4. Number of priority patches per kilometer and size class detected along the same monitoring routes at Golden Spike NHP, 2008–2021.**

| Scientific name | Common name | Year | Total patches | Patch size class[1] | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 |
| *Centaurea diffusa* | diffuse knapweed | 2008 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2010 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2012 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2014 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2016 | 1 | 1 | 0 | 0 | 0 | 0 |
| | | 2018 | 8 | 7 | 1 | 0 | 0 | 0 |
| | | 2021 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Chondrilla juncea* | rush skeletonweed | 2008 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2010 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2012 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2014 | 32 | 14 | 9 | 4 | 2 | 3 |
| | | 2016 | 13 | 10 | 3 | 0 | 0 | 0 |
| | | 2018 | 8 | 7 | 1 | 0 | 0 | 0 |
| | | 2021 | 88 | 14 | 30 | 16 | 15 | 13 |
| *Convolvulus arvensis* | field bindweed | 2008 | 41 | 5 | 15 | 14 | 5 | 2 |
| | | 2014 | 20 | 0 | 17 | 2 | 1 | 0 |
| | | 2016 | 15 | 1 | 13 | 1 | 0 | 0 |
| | | 2018 | 12 | 0 | 6 | 5 | 1 | 0 |
| | | 2021 | 52 | 0 | 22 | 18 | 8 | 4 |
| *Isatis tinctoria* | dyer's woad | 2008 | 28 | 20 | 4 | 3 | 1 | 0 |
| | | 2010 | 25 | 12 | 5 | 5 | 1 | 2 |
| | | 2012 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2014 | 4 | 2 | 0 | 1 | 1 | 0 |
| | | 2016 | 3 | 1 | 2 | 0 | 0 | 0 |
| | | 2018 | 4 | 3 | 1 | 0 | 0 | 0 |
| | | 2021 | 7 | 4 | 0 | 3 | 0 | 0 |
| *Onopordum acanthium* | Scotch thistle | 2008 | 26 | 8 | 8 | 10 | 0 | 0 |
| | | 2010 | 20 | 7 | 6 | 6 | 1 | 0 |
| | | 2012 | 2 | 1 | 1 | 0 | 0 | 0 |
| | | 2014 | 28 | 6 | 10 | 7 | 1 | 4 |
| | | 2016 | 29 | 11 | 16 | 2 | 0 | 0 |
| | | 2018 | 37 | 13 | 19 | 3 | 2 | 0 |
| | | 2021 | 38 | 11 | 17 | 6 | 4 | 0 |
| *Verbascum blattaria* | moth mullein | 2008 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2010 | 1 | 0 | 0 | 1 | 0 | 0 |
| | | 2012 | 4 | 0 | 2 | 2 | 0 | 0 |
| | | 2014 | 6 | 3 | 2 | 0 | 0 | 1 |
| | | 2016 | 6 | 0 | 0 | 1 | 2 | 3 |
| | | 2018 | 10 | 0 | 1 | 0 | 3 | 6 |
| | | 2021 | 7 | 4 | 0 | 1 | 1 | 1 |

***Table 3-4, cont. Number of priority patches per kilometer and size class detected along the same monitoring routes at Golden Spike NHP, 2008–2021.***

| Scientific name | Common name | Year | Total patches | Patch size class[1] | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 |
| Total priority species[2] | | 2008 | 59 | 30 | 13 | 15 | 1 | 0 |
| | | 2010 | 46 | 19 | 11 | 12 | 2 | 2 |
| | | 2012 | 6 | 1 | 3 | 2 | 0 | 0 |
| | | 2014 | 77 | 26 | 23 | 15 | 6 | 7 |
| | | 2016 | 52 | 23 | 21 | 3 | 2 | 3 |
| | | 2018 | 61 | 23 | 23 | 4 | 5 | 6 |
| | | 2021 | 141 | 33 | 50 | 24 | 20 | 14 |

[1]Patch size classes: 1 = 1–3 plants (≤2 × 2 m), 2 = 4 plants–40 $m^2$ (48 $yd^2$), 3 = 40–400 $m^2$ (48–478 $yd^2$), 4 = 400–1,000 $m^2$ (0.1–0.25 acre), 5 = 1,000–2,000 $m^2$ (0.25–0.5 acre).

[2]Includes species not listed in Tables 3-1 to 3-3 if they were a priority species for all sampling periods. Does not include *Convolvulus arvensis,* which was not on the priority list in 2010 or 2012.

# 4 Discussion

The number of priority IEP patches for species consistently monitored at Golden Spike NHP since 2008 increased to 141 in 2021, compared to 61 patches in 2018 (see Table 3-4). This increase was largely driven by rush skeletonweed. The 2018 NCPN crew frequently pulled this species, or at least removed and disposed of its flowers or fruits, when encountering it, so its dramatic increase since then is discouraging. This species may have increased due to excellent growing conditions in 2020, when the Northern Rocky Mountain Invasive Plant Management Team (IPMT) did not conduct control efforts due to covid-19 (S. Bekedam, pers. comm.).

A trial control effort for this species using aerial spraying of Milestone (aminopyralid) occurred in October 2021, after this monitoring took place. Biocontrol using the root moth (*Bradyrrhoa gilveolella*) is also being considered by IPMT and park staff. Field bindweed was not included in these numbers because it has not been a priority species in all samples, but it also increased dramatically—from 12 patches in 2018 to 52 in 2021. The increase in these two species has been widespread and rapid; for both species, more than 30% of patches are larger than 40 $m^2$.

The two riparian routes surveyed in the park, Hydro 1 and Last Cut drainages, continue to be hotspots for priority IEP patches. The highest density of patches not on drainages occurred on the Residence Service Road, East Tour Road, and Visitor Center area. Seven non-priority species in 11 patches were detected in 2021 (Appendix A). The network will review the priority list for 2023 based on these observations and park concerns.

Broad-leaf pepperwort, dyer's woad, and moth mullein were all detected in fewer than 10 patches in 2021. These species are good candidates for control due to the infrequent number of patches. Russian knapweed was not detected in 2021, demonstrating the success of past control efforts on this species. The Northern Rocky Mountain IPMT and Golden Spike NHP plan to hire a 12-week Scientist-in-Parks intern for 12 weeks during summer 2022 to focus on additional IEPs.

Percent frequency of cheatgrass, crested wheatgrass, and tumble mustard has not changed dramatically across sampling years (see Figure 3-5). But overall, these species remain widespread, with at least one present in every transect sampled in 2021. Percent cover of cheatgrass was much lower in 2021 than in 2018, but it was comparable to numbers in 2016. This species can vary widely in response to precipitation. Percent cover of crested wheatgrass increased from 2018, after declining from 2010 to 2018 (see Figure 3-4). Percent cover of tumble mustard has been consistently very low, due in part to its skeletal architecture, but this species is regularly found in transects across the park (see Figure 3-5).

Estimates of percent cover in this report are limited to the routes surveyed. Actual percent cover of IEPs across the entire park cannot be inferred with these methods. Because we have chosen to monitor along areas most likely to be invaded by a broad suite of IEPs, it is likely that the percent cover for most IEP species is lower in the interior of the park than along the monitoring routes.

The NCPN will continue to work with park staff and local weed experts to review and update the list of priority species each year. Presence and absence data for most priority species should be reliable for the areas searched. However, absence data for other species are suspect, as they are not consistently recorded from year to year. The network will continue to collect data on tumble mustard, cheatgrass, and crested wheatgrass in transects only.

IEPs at Golden Spike NHP will generally be monitored at the same time of year, every other year. Consistency in the timing of monitoring should ensure consistency in detection probabilities and cover estimates of most species. For many species, sampling at any time from May to September is not expected to drastically alter the chances of detecting IEP patches larger than the minimum detection target size. An eighth

sample of monitoring routes is planned for 2023. Long-term trend reporting will focus on trends in species distributions, trends in percent cover of individual species, and changes in IEP percent cover of priority species by monitoring route. Extra-area surveys will also be considered for inventories at the park's request.

# 5 Literature Cited


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# Appendix A. Invasive exotic plant patches detected on monitoring routes, Golden Spike NHP, June 24–25, 2021.

| Plot_ID | *Species* | Common_Name | Pulled | Growth_ Stage | N_Coord | E_Coord | Cover_ Class | Size_ Class | Priority |
|---|---|---|---|---|---|---|---|---|---|
| Facility Road | *Aegilops cylindrica* | Jointed goatgrass | No | – | 4608520 | 371139.1 | 5 | 1 | No |
| Last Cut Drainage | *Aegilops cylindrica* | Jointed goatgrass | Yes | – | 4609567 | 374317.3 | 2 | 1 | No |
| Last Cut Drainage | *Aegilops cylindrica* | Jointed goatgrass | Yes | – | 4608912 | 374753.4 | 5 | 1 | No |
| East Tour Road | *Bromus diandrus* | Ripgut brome | No | – | 4610867 | 376765.9 | 2 | 2 | No |
| East Tour Road | *Bromus diandrus* | Ripgut brome | No | – | 4610612 | 376490.1 | 2 | 2 | No |
| East Tour Road | *Bromus diandrus* | Ripgut brome | No | – | 4610714 | 376630 | 2 | 2 | No |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610522 | 375648.6 | 3 | 1 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610471 | 376071.4 | 5 | 1 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610685 | 376935 | 5 | 1 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610484 | 376085.2 | 4 | 1 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610521 | 375818.4 | 5 | 1 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610491 | 376573.9 | 5 | 1 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610749 | 377125.1 | 5 | 1 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610473 | 376518.2 | 5 | 1 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | Yes | – | 4610480 | 375482.6 | 5 | 1 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4611384 | 377157.6 | 5 | 1 | Yes |
| Pacific Track Grade | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608720 | 371034.5 | 5 | 1 | Yes |
| VC sidewalk area | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608479 | 370829.1 | 5 | 1 | Yes |
| Water Tank Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608267 | 371155.2 | 5 | 1 | Yes |
| Water Tank Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608349 | 371089.2 | 5 | 1 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610530 | 375878.9 | 1 | 2 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610420 | 376315.1 | 1 | 2 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610753 | 377087.8 | 1 | 2 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610497 | 375602.3 | 2 | 2 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610468 | 375488.4 | 1 | 2 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610459 | 376129.3 | 3 | 2 | Yes |
| County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608394 | 370871 | 1 | 2 | Yes |
| County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608356 | 370738.3 | 1 | 2 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610594 | 376436.9 | 2 | 2 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610625 | 376332.7 | 2 | 2 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4611426 | 377265.8 | 2 | 2 | Yes |

*Appendix A, cont. Invasive exotic plant patches detected on monitoring routes, Golden Spike NHP, June 24–25, 2021.*

| Plot_ID | *Species* | Common_Name | Pulled | Growth_ Stage | N_Coord | E_Coord | Cover_ Class | Size_ Class | Priority |
|---|---|---|---|---|---|---|---|---|---|
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609768 | 374727.8 | 2 | 2 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609505 | 375071.6 | 2 | 2 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609414 | 375429.2 | 2 | 2 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609610 | 374853.9 | 2 | 2 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610420 | 375818.8 | 2 | 2 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609509 | 374352.7 | 1 | 2 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609562 | 374263.7 | 1 | 2 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609304 | 374538.8 | 1 | 2 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609218 | 374614.8 | 1 | 2 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609505 | 374444.8 | 1 | 2 | Yes |
| Poulsons Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609528 | 374783.4 | 2 | 2 | Yes |
| Poulsons Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609515 | 374836.4 | 2 | 2 | Yes |
| Poulsons Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609549 | 374732.8 | 2 | 2 | Yes |
| Poulsons Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609405 | 374972.6 | 2 | 2 | Yes |
| Poulsons Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608902 | 375476.3 | 2 | 2 | Yes |
| Poulsons Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609628 | 374667.2 | 2 | 2 | Yes |
| Poulsons Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608729 | 375662 | 2 | 2 | Yes |
| Water Tank Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608270 | 371256.4 | 2 | 2 | Yes |
| Witkers Service Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608692 | 370742 | 1 | 2 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610503 | 375576.7 | 1 | 3 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610738 | 377034 | 1 | 3 | Yes |
| Big Fill Section County Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610417 | 376387.5 | 1 | 3 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609875 | 374668.4 | 2 | 3 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609815 | 374690.2 | 2 | 3 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609718 | 374748.4 | 2 | 3 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610304 | 374475 | 2 | 3 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609664 | 374811.7 | 2 | 3 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609275 | 374603.4 | 1 | 3 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609030 | 374721.7 | 1 | 3 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608825 | 374866.2 | 1 | 3 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608929 | 374758.2 | 1 | 3 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609366 | 374472.4 | 1 | 3 | Yes |

*Appendix A, cont. Invasive exotic plant patches detected on monitoring routes, Golden Spike NHP, June 24–25, 2021.*

| Plot_ID | *Species* | Common_Name | Pulled | Growth_ Stage | N_Coord | E_Coord | Cover_ Class | Size_ Class | Priority |
|---|---|---|---|---|---|---|---|---|---|
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609437 | 374470.3 | 1 | 3 | Yes |
| Poulsons Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609239 | 375135.6 | 2 | 3 | Yes |
| Poulsons Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609078 | 375295.1 | 2 | 3 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610670 | 376061.9 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610124 | 374592.3 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610689 | 376125.1 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610072 | 374608.8 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610587 | 375916.2 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610227 | 374540.9 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610018 | 374623.8 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610691 | 376189.1 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609962 | 374641.7 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610175 | 374570.7 | 2 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610250 | 375885.5 | 2 | 4 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609171 | 374698.1 | 1 | 4 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608800 | 375004.9 | 1 | 4 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608724 | 375339 | 1 | 4 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608766 | 375168.6 | 1 | 4 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609809 | 375989.9 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610096 | 375978.3 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609860 | 376019.1 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609986 | 376029.3 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610680 | 376251 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4609924 | 376035.1 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610340 | 375837.5 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610195 | 375919.8 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610044 | 376009.3 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610298 | 375859.4 | 2 | 5 | Yes |
| East Tour Road | *Chondrilla juncea* | Rush skeletonweed | No | – | 4610146 | 375950.2 | 2 | 5 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608784 | 375219.4 | 1 | 5 | Yes |
| Last Cut Drainage | *Chondrilla juncea* | Rush skeletonweed | No | – | 4608792 | 375270.1 | 1 | 5 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610544 | 375756.8 | 1 | 2 | Yes |

*Appendix A, cont. Invasive exotic plant patches detected on monitoring routes, Golden Spike NHP, June 24–25, 2021.*

| Plot_ID | *Species* | Common_Name | Pulled | Growth_ Stage | N_Coord | E_Coord | Cover_ Class | Size_ Class | Priority |
|---|---|---|---|---|---|---|---|---|---|
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610416 | 376344.6 | 1 | 2 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610433 | 376390.3 | 3 | 2 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610456 | 376510.9 | 1 | 2 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610420 | 376410.4 | 1 | 2 | Yes |
| County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608420 | 370870.3 | 1 | 2 | Yes |
| County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608502 | 370953.8 | 1 | 2 | Yes |
| County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608365 | 370642.3 | 3 | 2 | Yes |
| County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608498 | 370933.8 | 1 | 2 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609750 | 375946.1 | 3 | 2 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609538 | 375742.5 | 3 | 2 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609490 | 375197.8 | 2 | 2 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609566 | 375789.5 | 3 | 2 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609662 | 375876.9 | 2 | 2 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609614 | 375836.9 | 3 | 2 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609546 | 374925.1 | 2 | 2 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609705 | 375910.5 | 3 | 2 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609483 | 375246.7 | 2 | 2 | Yes |
| Facility Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608814 | 371406.8 | 1 | 2 | Yes |
| Pacific Track Grade | *Convolvulus arvensis* | Field bindweed | No | – | 4608555 | 370764 | 3 | 2 | Yes |
| Residence Service Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608593 | 371351.5 | 2 | 2 | Yes |
| Water Tank Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608276 | 371176.3 | 2 | 2 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610443 | 376520.1 | 2 | 3 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610530 | 375666.2 | 2 | 3 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610504 | 376623.8 | 3 | 3 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610431 | 376467.8 | 2 | 3 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610470 | 376565.2 | 2 | 3 | Yes |
| Big Fill Section County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610498 | 375547.3 | 1 | 3 | Yes |
| County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608361 | 370683.4 | 2 | 3 | Yes |
| County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608467 | 370923.8 | 1 | 3 | Yes |
| County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608426 | 370891.7 | 1 | 3 | Yes |
| County Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608378 | 370801.7 | 1 | 3 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610479 | 375824.7 | 3 | 3 | Yes |

*Appendix A, cont. Invasive exotic plant patches detected on monitoring routes, Golden Spike NHP, June 24–25, 2021.*

| Plot_ID | *Species* | Common_Name | Pulled | Growth_ Stage | N_Coord | E_Coord | Cover_ Class | Size_ Class | Priority |
|---|---|---|---|---|---|---|---|---|---|
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610658 | 376273.1 | 3 | 3 | Yes |
| Last Cut Drainage | *Convolvulus arvensis* | Field bindweed | No | – | 4609514 | 374399.4 | 2 | 3 | Yes |
| Last Cut Drainage | *Convolvulus arvensis* | Field bindweed | No | – | 4609204 | 374671.9 | 1 | 3 | Yes |
| Last Cut Drainage | *Convolvulus arvensis* | Field bindweed | No | – | 4609480 | 374461.1 | 2 | 3 | Yes |
| Last Cut Drainage | *Convolvulus arvensis* | Field bindweed | No | – | 4609555 | 374337.2 | 2 | 3 | Yes |
| Residence Service Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608590 | 371407.6 | 2 | 3 | Yes |
| Retired Service Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608572 | 370754.5 | 2 | 3 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4610211 | 374551 | 3 | 4 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4611149 | 376806.8 | 3 | 4 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609640 | 374834.3 | 2 | 4 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4611091 | 376753.6 | 3 | 4 | Yes |
| Facility Road | *Convolvulus arvensis* | Field bindweed | No | – | 4608485 | 371070.4 | 2 | 4 | Yes |
| Last Cut Drainage | *Convolvulus arvensis* | Field bindweed | No | – | 4609077 | 374715.5 | 2 | 4 | Yes |
| VC sidewalk area | *Convolvulus arvensis* | Field bindweed | No | – | 4608410 | 370844.8 | 2 | 4 | Yes |
| VC sidewalk area | *Convolvulus arvensis* | Field bindweed | No | – | 4608384 | 370784.2 | 2 | 4 | Yes |
| East Tour Road | *Convolvulus arvensis* | Field bindweed | No | – | 4609587 | 374875.3 | 2 | 5 | Yes |
| VC sidewalk area | *Convolvulus arvensis* | Field bindweed | No | – | 4608462 | 370841.3 | 2 | 5 | Yes |
| VC sidewalk area | *Convolvulus arvensis* | Field bindweed | No | – | 4608487 | 370854.8 | 2 | 5 | Yes |
| VC sidewalk area | *Convolvulus arvensis* | Field bindweed | No | – | 4608498 | 370907.9 | 2 | 5 | Yes |
| Big Fill Section County Road | *Cynodon dactylon* | Bermuda grass | No | – | 4610386 | 375152 | 5 | 2 | No |
| Poulsons Road | *Cynoglossum officinale* | Common hound's-tongue | No | – | 4609533 | 374741.6 | 5 | 1 | No |
| County Road | *Hyoscyamus niger* | Black henbane | No | – | 4608842 | 371046.6 | 2 | 2 | No |
| Big Fill Section County Road | *Isatis tinctoria* | Dyer's woad | No | – | 4610428 | 376252.1 | 5 | 1 | Yes |
| Last Cut Drainage | *Isatis tinctoria* | Dyer's woad | No | – | 4609437 | 374479.5 | 5 | 1 | Yes |
| Last Cut Drainage | *Isatis tinctoria* | Dyer's woad | No | – | 4609075 | 374710 | 5 | 1 | Yes |
| Last Cut Drainage | *Isatis tinctoria* | Dyer's woad | No | – | 4608798 | 375022.4 | 5 | 1 | Yes |
| Last Cut Drainage | *Isatis tinctoria* | Dyer's woad | No | – | 4609194 | 374639.8 | 1 | 2 | Yes |
| Last Cut Drainage | *Isatis tinctoria* | Dyer's woad | No | – | 4609354 | 374488.8 | 1 | 2 | Yes |
| Last Cut Drainage | *Isatis tinctoria* | Dyer's woad | No | – | 4609484 | 374458.8 | 1 | 2 | Yes |
| East Tour Road | *Lactuca serriola* | Prickly lettuce | No | – | 4611436 | 377303 | 2 | 2 | No |
| Last Cut Drainage | *Lepidium latifolium* | Broad-leaf pepperwort | No | – | 4608765 | 375181.5 | 1 | 3 | Yes |
| Facility Road | *Onopordum acanthium* | Scotch thistle | No | – | 4608493 | 371071.2 | 5 | 1 | Yes |

*Appendix A, cont. Invasive exotic plant patches detected on monitoring routes, Golden Spike NHP, June 24–25, 2021.*

| Plot_ID | *Species* | Common_Name | Pulled | Growth_ Stage | N_Coord | E_Coord | Cover_ Class | Size_ Class | Priority |
|---|---|---|---|---|---|---|---|---|---|
| Facility Road | *Onopordum acanthium* | Scotch thistle | No | – | 4608499 | 371130.1 | 5 | 1 | Yes |
| Hydro 1 | *Onopordum acanthium* | Scotch thistle | No | – | 4608828 | 370796.4 | 5 | 1 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609210 | 374624 | 5 | 1 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4608841 | 374832.7 | 3 | 1 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | Yes | – | 4608788 | 375225.4 | 5 | 1 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4608691 | 375369 | 5 | 1 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | Yes | – | 4608817 | 374939.9 | 5 | 1 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | Yes | – | 4608954 | 374735.4 | 4 | 1 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609332 | 374521.9 | 5 | 1 | Yes |
| Poulsons Road | *Onopordum acanthium* | Scotch thistle | No | – | 4609502 | 374865.2 | 5 | 1 | Yes |
| County Road | *Onopordum acanthium* | Scotch thistle | No | – | 4608988 | 370986 | 1 | 2 | Yes |
| County Road | *Onopordum acanthium* | Scotch thistle | No | – | 4609050 | 370972.4 | 1 | 2 | Yes |
| Hydro 1 | *Onopordum acanthium* | Scotch thistle | No | – | 4608771 | 370796.7 | 1 | 2 | Yes |
| Hydro 1 | *Onopordum acanthium* | Scotch thistle | No | – | 4609026 | 370759.5 | 1 | 2 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | Yes | – | 4608853 | 374755.7 | 2 | 2 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609557 | 374264.5 | 1 | 2 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609567 | 374312.5 | 1 | 2 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609379 | 374461.6 | 1 | 2 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | Yes | – | 4608761 | 375305.4 | 1 | 2 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609196 | 374662.7 | 2 | 2 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609110 | 374711.2 | 1 | 2 | Yes |
| Not on route | *Onopordum acanthium* | Scotch thistle | No | – | 4609062 | 370892.4 | 1 | 2 | Yes |
| Not on route | *Onopordum acanthium* | Scotch thistle | No | – | 4609057 | 370781.2 | 1 | 2 | Yes |
| Pacific Track Grade | *Onopordum acanthium* | Scotch thistle | No | – | 4608841 | 371218.5 | 2 | 2 | Yes |
| Poulsons Road | *Onopordum acanthium* | Scotch thistle | No | – | 4609817 | 374587.8 | 2 | 2 | Yes |
| Poulsons Road | *Onopordum acanthium* | Scotch thistle | No | – | 4609861 | 374528.6 | 2 | 2 | Yes |
| Poulsons Road | *Onopordum acanthium* | Scotch thistle | No | – | 4609888 | 374482.1 | 2 | 2 | Yes |
| East Tour Road | *Onopordum acanthium* | Scotch thistle | No | – | 4609653 | 374809.3 | 2 | 3 | Yes |
| Hydro 1 | *Onopordum acanthium* | Scotch thistle | No | – | 4608855 | 370810.9 | 1 | 3 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609444 | 374479.3 | 1 | 3 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609167 | 374703.8 | 1 | 3 | Yes |
| Last Cut Drainage | *Onopordum acanthium* | Scotch thistle | No | – | 4609518 | 374376.3 | 1 | 3 | Yes |

*Appendix A, cont. Invasive exotic plant patches detected on monitoring routes, Golden Spike NHP, June 24–25, 2021.*

| Plot_ID | *Species* | Common_Name | Pulled | Growth_ Stage | N_Coord | E_Coord | Cover_ Class | Size_ Class | Priority |
|---|---|---|---|---|---|---|---|---|---|
| Poulsons Road | *Onopordum acanthium* | Scotch thistle | No | – | 4609015 | 375305.7 | 2 | 3 | Yes |
| East Tour Road | *Onopordum acanthium* | Scotch thistle | No | – | 4609838 | 374678.9 | 2 | 4 | Yes |
| East Tour Road | *Onopordum acanthium* | Scotch thistle | No | – | 4609899 | 374660.6 | 2 | 4 | Yes |
| East Tour Road | *Onopordum acanthium* | Scotch thistle | No | – | 4610141 | 374586.8 | 2 | 4 | Yes |
| Pacific Track Grade | *Onopordum acanthium* | Scotch thistle | No | – | 4608944 | 371399.2 | 2 | 4 | Yes |
| Last Cut Drainage | *Tamarix* sp. | Tamarisk | No | Seedlings | 4608809 | 374787.3 | 2 | 2 | No |
| Big Fill Section County Road | *Verbascum blattaria* | Moth mullein | No | – | 4610430 | 376243.4 | 5 | 1 | Yes |
| Big Fill Section County Road | *Verbascum blattaria* | Moth mullein | Yes | – | 4610614 | 376766.8 | 5 | 1 | Yes |
| Big Fill Section County Road | *Verbascum blattaria* | Moth mullein | No | – | 4610453 | 376216 | 3 | 1 | Yes |
| East Tour Road | *Verbascum blattaria* | Moth mullein | No | – | 4610749 | 376670.2 | 5 | 1 | Yes |
| Poulsons Road | *Verbascum blattaria* | Moth mullein | No | – | 4609105 | 375265.9 | 2 | 3 | Yes |
| East Tour Road | *Verbascum blattaria* | Moth mullein | No | – | 4610401 | 375822.8 | 2 | 4 | Yes |
| East Tour Road | *Verbascum blattaria* | Moth mullein | No | – | 4610630 | 376300 | 2 | 5 | Yes |

# Appendix B. Invasive exotic plant transect data detected at Golden Spike NHP, June 24–25, 2021.

| Route | Transect | Area | E_Coord | N_Coord | Species | Common_Name | Alive? | AverageCover |
|---|---|---|---|---|---|---|---|---|
| Facility Road | 1 | Administrative Area | 371016.5 | 4608472 | *Agropyron cristatum* | crested wheatgrass | Y | 23.33333 |
| Facility Road | 2 | Administrative Area | 371366.9 | 4608776 | *Agropyron cristatum* | crested wheatgrass | Y | 4.666667 |
| County Road | 3 | Administrative Area | 370999.3 | 4608990 | *Agropyron cristatum* | crested wheatgrass | Y | 11 |
| County Road | 4 | Administrative Area | 370937.3 | 4608501 | *Agropyron cristatum* | crested wheatgrass | Y | 9.666667 |
| Witkers Service Road | 5 | Administrative Area | 370926.6 | 4608856 | *Agropyron cristatum* | crested wheatgrass | Y | 14 |
| Residence Service Road | 6 | Administrative Area | 371337.2 | 4608592 | *Agropyron cristatum* | crested wheatgrass | Y | 2.666667 |
| Water Tank Road | 7 | Administrative Area | 371080.5 | 4608405 | *Agropyron cristatum* | crested wheatgrass | Y | 4.166667 |
| Pacific Track Grade | 8 | Administrative Area | 370657.5 | 4608460 | *Agropyron cristatum* | crested wheatgrass | Y | 4 |
| Hydro 1 | 10 | Administrative Area | 370805.5 | 4608859 | *Agropyron cristatum* | crested wheatgrass | Y | 16 |
| Retired Service Road | 11 | Administrative Area | 370766.1 | 4608652 | *Agropyron cristatum* | crested wheatgrass | Y | 13.33333 |
| Big Fill Section County Road | 23 | Big Fill | 377433.1 | 4610746 | *Agropyron cristatum* | crested wheatgrass | Y | 3.333333 |
| Big Fill Section County Road | 27 | Big Fill | 375540.5 | 4610491 | *Agropyron cristatum* | crested wheatgrass | Y | 0.166667 |
| Big Fill Section County Road | 28 | Big Fill | 375088.1 | 4610378 | *Agropyron cristatum* | crested wheatgrass | Y | 0.166667 |
| Poulsons Road | 29 | Big Fill | 375733.7 | 4608686 | *Agropyron cristatum* | crested wheatgrass | Y | 1 |
| Last Cut Drainage | 33 | Big Fill | 374315.6 | 4609563 | *Agropyron cristatum* | crested wheatgrass | Y | 0.333333 |
| Last Cut Drainage | 34 | Big Fill | 374572.8 | 4609277 | *Agropyron cristatum* | crested wheatgrass | Y | 0.333333 |
| Last Cut Drainage | 35 | Big Fill | 374756.5 | 4608903 | *Agropyron cristatum* | crested wheatgrass | Y | 0.666667 |
| Last Cut Drainage | 36 | Big Fill | 375174.8 | 4608765 | *Agropyron cristatum* | crested wheatgrass | Y | 0.333333 |
| County Road | 37 | Administrative Area | 371008.9 | 4608988 | *Agropyron cristatum* | crested wheatgrass | Y | 12 |
| County Road | 38 | Administrative Area | 370951.3 | 4608508 | *Agropyron cristatum* | crested wheatgrass | Y | 27.66667 |
| County Road | 3 | Administrative Area | 370999.3 | 4608990 | *Bromus tectorum* | Cheatgrass | Y | 0.5 |
| County Road | 4 | Administrative Area | 370937.3 | 4608501 | *Bromus tectorum* | Cheatgrass | Y | 0.166667 |
| Water Tank Road | 7 | Administrative Area | 371080.5 | 4608405 | *Bromus tectorum* | Cheatgrass | Y | 0.166667 |
| Pacific Track Grade | 8 | Administrative Area | 370657.5 | 4608460 | *Bromus tectorum* | Cheatgrass | Y | 0.333333 |
| Pacific Track Grade | 9 | Administrative Area | 371067.2 | 4608745 | *Bromus tectorum* | Cheatgrass | Y | 0.333333 |
| East Tour Road | 12 | Big Fill | 374533.1 | 4610238 | *Bromus tectorum* | Cheatgrass | Y | 1 |
| East Tour Road | 13 | Big Fill | 374713.7 | 4609775 | *Bromus tectorum* | Cheatgrass | Y | 1.666667 |
| East Tour Road | 14 | Big Fill | 375094.6 | 4609484 | *Bromus tectorum* | Cheatgrass | Y | 1.166667 |
| East Tour Road | 15 | Big Fill | 375568.5 | 4609472 | *Bromus tectorum* | Cheatgrass | Y | 1 |
| East Tour Road | 16 | Big Fill | 375955.7 | 4609763 | *Bromus tectorum* | Cheatgrass | Y | 8.5 |
| East Tour Road | 17 | Big Fill | 375908.4 | 4610209 | *Bromus tectorum* | Cheatgrass | Y | 1.166667 |
| East Tour Road | 18 | Big Fill | 375974.1 | 4610630 | *Bromus tectorum* | Cheatgrass | Y | 1.166667 |

*Appendix B, cont. Invasive exotic plant transect data detected at Golden Spike NHP, June 24–25, 2021.*

| Route | Transect | Area | E_Coord | N_Coord | Species | Common_Name | Alive? | AverageCover |
|---|---|---|---|---|---|---|---|---|
| East Tour Road | 19 | Big Fill | 376441.4 | 4610600 | *Bromus tectorum* | Cheatgrass | Y | 1 |
| East Tour Road | 20 | Big Fill | 376765.9 | 4610927 | *Bromus tectorum* | Cheatgrass | Y | 0.5 |
| East Tour Road | 21 | Big Fill | 377042.7 | 4611311 | *Bromus tectorum* | Cheatgrass | Y | 7 |
| East Tour Road | 22 | Big Fill | 377473.9 | 4611553 | *Bromus tectorum* | Cheatgrass | Y | 1.333333 |
| Big Fill Section County Road | 23 | Big Fill | 377433.1 | 4610746 | *Bromus tectorum* | Cheatgrass | Y | 0.333333 |
| Big Fill Section County Road | 24 | Big Fill | 376956.2 | 4610706 | *Bromus tectorum* | Cheatgrass | Y | 1.333333 |
| Big Fill Section County Road | 25 | Big Fill | 376520.5 | 4610461 | *Bromus tectorum* | Cheatgrass | Y | 1.5 |
| Big Fill Section County Road | 26 | Big Fill | 376031.9 | 4610492 | *Bromus tectorum* | Cheatgrass | Y | 2.166667 |
| Big Fill Section County Road | 27 | Big Fill | 375540.5 | 4610491 | *Bromus tectorum* | Cheatgrass | Y | 2.666667 |
| Big Fill Section County Road | 28 | Big Fill | 375088.1 | 4610378 | *Bromus tectorum* | Cheatgrass | Y | 0.5 |
| Poulsons Road | 29 | Big Fill | 375733.7 | 4608686 | *Bromus tectorum* | Cheatgrass | Y | 0.5 |
| Poulsons Road | 30 | Big Fill | 375360.6 | 4609015 | *Bromus tectorum* | Cheatgrass | Y | 0.333333 |
| Poulsons Road | 31 | Big Fill | 375010.4 | 4609373 | *Bromus tectorum* | Cheatgrass | Y | 1.333333 |
| Poulsons Road | 32 | Big Fill | 374652.1 | 4609676 | *Bromus tectorum* | Cheatgrass | Y | 0.5 |
| Last Cut Drainage | 33 | Big Fill | 374315.6 | 4609563 | *Bromus tectorum* | Cheatgrass | Y | 0.5 |
| Last Cut Drainage | 34 | Big Fill | 374572.8 | 4609277 | *Bromus tectorum* | Cheatgrass | Y | 0.333333 |
| Last Cut Drainage | 35 | Big Fill | 374756.5 | 4608903 | *Bromus tectorum* | Cheatgrass | Y | 2.666667 |
| Last Cut Drainage | 36 | Big Fill | 375174.8 | 4608765 | *Bromus tectorum* | Cheatgrass | Y | 0.166667 |
| County Road | 37 | Administrative Area | 371008.9 | 4608988 | *Bromus tectorum* | Cheatgrass | Y | 0.166667 |
| Big Fill Section County Road | 39 | Big Fill | 377432.7 | 4610734 | *Bromus tectorum* | Cheatgrass | Y | 0.333333 |
| Big Fill Section County Road | 40 | Big Fill | 376945.7 | 4610689 | *Bromus tectorum* | Cheatgrass | Y | 2 |
| Big Fill Section County Road | 41 | Big Fill | 376510.5 | 4610443 | *Bromus tectorum* | Cheatgrass | Y | 1.166667 |
| Big Fill Section County Road | 42 | Big Fill | 376020.4 | 4610485 | *Bromus tectorum* | Cheatgrass | Y | 0.5 |
| Big Fill Section County Road | 43 | Big Fill | 375529.1 | 4610478 | *Bromus tectorum* | Cheatgrass | Y | 1 |
| Big Fill Section County Road | 44 | Big Fill | 375080.9 | 4610366 | *Bromus tectorum* | Cheatgrass | Y | 0.25 |
| Last Cut Drainage | 33 | Big Fill | 374315.6 | 4609563 | *Convolvulus arvensis* | Field bindweed | Y | 5.166667 |
| County Road | 38 | Administrative Area | 370951.3 | 4608508 | *Convolvulus arvensis* | Field bindweed | Y | 0.166667 |
| Big Fill Section County Road | 41 | Big Fill | 376510.5 | 4610443 | *Convolvulus arvensis* | Field bindweed | Y | 1.666667 |
| Last Cut Drainage | 36 | Big Fill | 375174.8 | 4608765 | *Lepidium latifolium* | Broad-leaf pepperwort | Y | 1 |
| East Tour Road | 15 | Big Fill | 375568.5 | 4609472 | *Sisymbrium altissimum* | Tumble mustard | Y | 0.166667 |
| East Tour Road | 16 | Big Fill | 375955.7 | 4609763 | *Sisymbrium altissimum* | Tumble mustard | Y | 0.5 |
| East Tour Road | 21 | Big Fill | 377042.7 | 4611311 | *Sisymbrium altissimum* | Tumble mustard | Y | 0.166667 |
| Big Fill Section County Road | 27 | Big Fill | 375540.5 | 4610491 | *Sisymbrium altissimum* | Tumble mustard | Y | 0.166667 |

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NPS 431/182737, June 2022

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