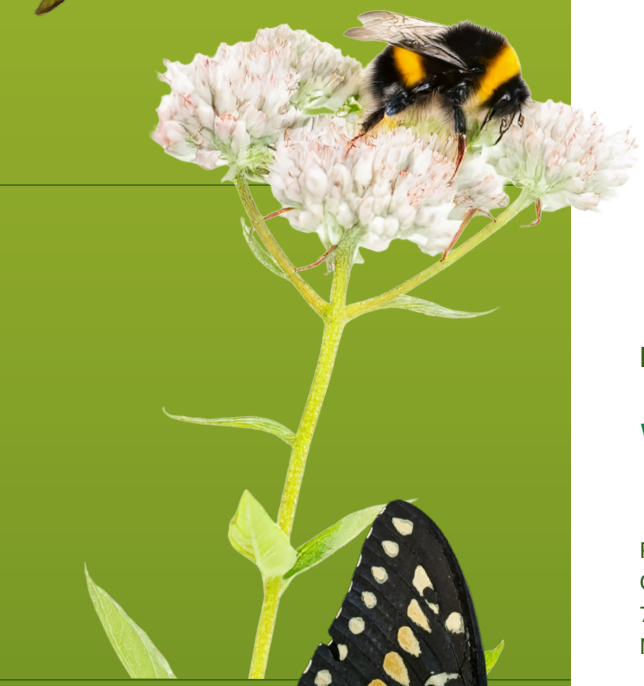
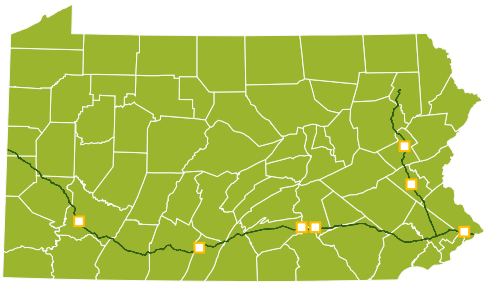
2025



Pennsylvania Turnpike Commission's Pollinator Initiative:

Pollinator Habitat Project

Year-End Report



- Central Administration Building
- Hickory Run Service Plaza
- Irwin Interchange
- Harrisburg West Interchange
- Bensalem Interchange
- Allentown Service Plaza
- T168.4 Salt Shed Westbound

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Executive Summary

The Pennsylvania Turnpike Commission (PA Turnpike) manages over 550 miles of right-of-way across the state. With a mission to operate this transportation corridor "*as a safe, reliable, customer-valued toll road system (Strategic Plan 2025-2029)*," the PA Turnpike embraces core values that emphasize improvement and innovation (Value: Advancing Excellence), while embodying sustainability in all their practices (Value: Responsibility Matters). These principles have led to the development of goals that prioritize stewardship, growth, and connection, among others. The Pollinator Habitat Project helps to meet the objectives of these goals by employing sustainable vegetation management strategies that reduce operating costs and create pollinator habitat while supporting employee learning and innovation. These efforts will also continue to strengthen the Commission's public reputation through media visibility.

The creation of pollinator habitats at the PA Turnpike administrative buildings, interchanges, travel plazas, and maintenance facilities has improved the management of vegetation within their right-of-way (ROW) and provides a natural laboratory to study the germination rates of seed mixes that develop a dominant cover of nectar-producing species and support pollinators in Pennsylvania. From the initiation of the Pollinator Habitat Project in 2022 (a.k.a. Pollinator Habitat Pilot Project), habitat sites were established at the Central Administration Building (CAB) and Hickory Run Service Plaza (HRSP) to test different seed mixes, their germination success rates, implementation techniques, and management practices prior to incorporating pollinator habitats into the PA Turnpike's statewide roadway network. Since then, five (5) additional sites were developed from 2023-2025. The sites were selected to represent a diversity of locations across the entire turnpike system, for their ease of access for implementation, and for their potential to sustain a pollinator-friendly herbaceous cover that supports the full life cycle of pollinator species. The pollinator habitat sites (and year of planting) are:

- Central Administration Building (CAB; 2022)
- Hickory Run Service Plaza (HRSP; 2022)
- Irwin Interchange (IRW; 2023)
- Harrisburg West Interchange (HBGW; 2023)
- Bensalem Interchange (BEN; 2023)
- Allentown Service Plaza (ASP; 2024)
- T-168.4 Salt Shed Westbound (SS; 2024)

This report represents the fourth year of monitoring for the Pollinator Habitat Project. The sites were monitored with the intent of documenting the effectiveness of habitat plots in establishing desired seed mixes that attracted pollinator species and resisted the development of invasive and undesirable species cover. In 2025, monitoring visits were conducted monthly from May to October, which was a greater frequency than in previous years, in order to improve the PA Turnpike response time in addressing any maintenance concerns. The monthly visits consisted of both a Full monitoring event consistent with

previous protocols, and a Health Check monitoring event that served to document the need and effectiveness of herbicide treatments while documenting the presence of flowering species and pollinators.

The results from the 2025 monitoring year revealed the following developments from each site:

Year 1 Sites

SS, a new site to the pollinator program in 2025, was seeded in 2024 with a short native grass mixture containing only a few showy flowers. SS was not initially intended to be a pollinator site, and data from this seed mix and general observations on pollinator activity were valuable for comparison against other showier and diverse seed mixes. In the first year of establishment, SS was comparable to the other pollinator plots, with germination rates and average monthly areal cover near 50 percent. Pollinator counts were generally low, and attributed to the mixes' overall lack of nectar-producing flowers. One herbicide treatment was applied in the early season of 2025 to control the spread of undesirables. This was a lower frequency than in other pollinator sites, which often require two applications to address intrusions in Year 1.

Year 2 Sites

ASP was the only site in 2025 in Year 2 of establishment, a year marked by the development of a robust herbaceous cover reaching heights of 5 feet or greater for most of the plots. Similar to other sites in their Year 2, the germination rates at ASP doubled in 2025, and the density of cover increased with the emergence of perennials that had not germinated in Year 1. Pollinator individual counts remained steady or slightly increased since Year 1, but saw a doubling in pollinator species richness across the plots. Site maintenance included a pre-emergent application to all plots in the spring for weed control of various grasses and problematic broadleaf species. A single herbicide application for undesirable weed control was applied in June.

Year 3 and Year 4 Sites

HBGW, BEN, and IRW are in their Year 3 of development. Seed mix trends are beginning to develop at this stage, and they provide better data to assist in seed mix selection for future applications in the *Pollinator Initiative*. Biennial/short-lived species, such as blackeyed Susan (*Rudbeckia hirta*) and bachelor's buttons/cornflower (*Centaurea cyanus*); or annuals like partridge pea (*Cassia fasciculata*) have faded from dominance and are being replaced with hardy/long-lived perennials like purple coneflower (*Echinacea purpurea*), lanceleaf coreopsis (*Coreopsis lanceolata*), and goldenrod (*Solidago* spp.), or graminoid species like switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), and Virginia wildrye (*Elymus virginicus*). This trend was also evident for sites in their Year 4 of development, such as CAB and HRSP. These mature sites are trending toward becoming self-sustaining habitats with increased germination rates. Pollinator abundance and richness vary from year to year and across monitoring events, but generally increase with the timing of the peak bloom periods. Problematic incursions of invasive and undesirable species that were addressed in the first two years of these sites have

predominantly been addressed and now require a reduced level of intervention to maintain the desired seed mix cover.

Seed Mixes

Seed mixes in Year 3 or Year 4 of growth have developed trends that are valuable for evaluating their future uses and site applicability to the overall *Pollinator Initiative.* For seed mixes in which data collection has shown an emerging trend, recommendations were developed to determine how and where to use these mixes in future sites. The top performing seed mixes thus far include **Butterfly & Hummingbird Garden Mix**, PTC Wet Habitat Mix, Deer Resistant Meadow Mixes, PTC Pollinator ROW Mix, PTC Pollinator Interchange Mix, and the **PTC Monarch Specialty Mix**.

Finally, to aid in tracking goals of the pollinator habitat project each year, a tracking table was developed to review how the project is meeting PA Turnpike's goals for employing sustainable vegetation management strategies and reducing operating costs, and for creating pollinator habitat while also supporting employee learning and innovation.

Native vs. Non-Native

In July 2024, Pennsylvania Law (House Bill 797) "Native Vegetation Along Pennsylvania's Highways" was signed and required PennDOT to plant vegetation identified as being native to this Commonwealth and that will thrive in the plant hardiness zone under the environmental conditions of the highway ROW. The department may use non-native vegetation where the use of native vegetation is not feasible, provided that the non-native vegetation is not a federally listed invasive plant or noxious weed. Most of the seed mixes used in this pollinator pilot project are or can be slightly altered to be compliant with this new law, with the exception of the Butterfly & Hummingbird Garden Mix and the PTC Monarch Specialty Mix. The **PTC Monarch Specialty Mix** could become compliant with the removal of showy milkweed (*Asclepias speciosa*), which is not native to the Commonwealth of Pennsylvania. However, the **Butterfly & Hummingbird Garden Mix** contains nine non-native species of the 34 species in the seed mix, which means that 26.5% of this mix would need to be removed to meet the law. Although Act 37 applies to PennDOT specifically, the PA Turnpike may choose to include native species in their seed mixes and plantings, when practical.

PA Turnpike Pollinator Pilot Program - Goal Tracking Sheet						
Goal Area	**2023 Goals**	**2024 Goals**	**2025 Goals**	**2025 Outcomes**	**Assessment**	**2026 Goals**
Pilot Expansion	Launch 3 new sites (Irwin Interchange [IRW], Harrisburg West Interchange [HBGW], Bensalem Interchange [BEN]) in addition to Central Administration Building (CAB) and Hickory Run Service Plaza (HRSP).	Maintain and monitor all 5 pilot sites. Design 1 new site (Allentown Service Plaza [ASP])	Maintain and monitor all 6 pollinator habitat sites.	All 6 sites were monitored monthly; CAB and ASP matured into model habitats. T-168.4 Salt Shed Westbound (SS) was added to monitoring.	☑ Achieved	Create a site development plan template for developing a successful habitat within PA TURNPIKE ROW.
Monitoring Protocols	Develop baseline protocols for vegetation and pollinator tracking.	Standardize monitoring with use of ArcGIS Survey123 and expand frequency of site visits.	Expand monitoring to bi-monthly from May to October. Implemented new protocols to focus on control of undesirable species and standardize pollinator counts.	Developed rapid monitoring protocol (Health Check) to pair with the standard, in-depth (Full) monitoring protocol utilizing Survey123.	☑ Achieved	Standardize a monitoring protocol that is more applicable to novice field staff to track habitat establishment/success and loosely based on Candidate Conservation Agreement with Assurances (CCAA) mitigation effort reporting requirements.
Seed Mix Evaluation	Test multiple native seed mixes and seeding rates.	Refine mixes based on 2023 performance, if necessary.	Assess overall seed mix performances and progress in selecting a few mixes to advance in the pollinator program.	Applied lessons learned to ASP. PTC Monarch Specialty Mix and Deer Resistant Meadow Mix showed strong establishment; adjustments made for early bloomers, and tracked species germination rates.	☑ Achieved	Develop seed mix recommendations associated with germination rates/substitutions, and match them for regions/management strategies. Select standard pollinator seed mixes, make final refinements, and incorporate into PA Turnpike standards.
Pollinator Usage (Richness/ Abundance)	Establish habitats that support diverse pollinator species.	Track seasonal activity and species diversity.	Continue tracking seasonal activity/species diversity to determine if changes can be made to seed mix composition to increase richness.	Pollinator counts were higher in 2025 than in previous years (sans HRSP). Association between dominant species (i.e., *Heliopsis helianthoides* [oxeye sunflower], *Monarda fistulosa* [wild bergamot], etc.) in bloom and increased pollinator counts was suggested. Additional monitoring to focus on whether correlation is seen in 2026 site visits.	☑ Achieved	Continue to track seasonal activity and species diversity as a measure of success with the pollinator habitats. Determine if seed mix changes are needed to target pollinator species (increase richness).
Invasive Species Management	Identify and control aggressive non-seed mix species.	Adapt herbicide and mowing strategies.	Develop methods for early treatment response to problematic species. Assess the effectiveness of using a pre-emergent.	Health Check forms were submitted monthly, providing mapped locations of problem areas to be addressed. Noted persistent challenges with American pokeweed [*Phytolacca decandra*], porcelain berry [*Ampelopsis brevipedunculata],* and thistle [*Cirsium* spp.]; targeted herbicide use improved, but remains labor intensive.	⚠ Partially achieved	1. BEN: Determine effective control of porcelain berry, or if more cost effective to return to regular mowing. 2. Test less-intensive approach for sites that are established (along with less monitoring) in an effort to reduce overall cost of pollinator habitat compared to that of previous management. 3. Determine additional sites to test effectiveness of pre-emergent herbicide.
Maintenance and Emissions	Reduce mowing and emissions through habitat conversion.	Reduce mowing and emissions through habitat conversion.	Reduce mowing and emissions through habitat conversion.	Mowing reduced at most sites, but invasive control offset some labor savings. Savings associated with reduced mowing was not tracked at Pilot Habitat sites; however, savings were realized with application of Integrated Roadside Vegetation Management (IRVM) at Pilot Maintenance Sheds (Gibsonia/Newville).	⚠ Partially achieved	Determine if cost savings can be tracked at seven (7) Pilot Habitat sites.
IRVM Integration	Align habitat with IRVM Manual (in development).	Finalize IRVM Manual and embed pollinator zones.	Implement planned mowing strategies at IRVM pilots.	IRVM Manual finalized in 2025; pollinator zones formally integrated into vegetation management strategy. IRVM applied to Newville and Gibsonia Maintenance Sheds.	☑ Achieved	1. IRVM Manual Updates (revamp to focus on Zones 0 and 1). 2. Determine whether IRVM can be applied to additional sheds.
Statewide Expansion Planning	Use pilot data to inform future site selection.	Prepare for 2025-2026 expansion.	Identify sites within the IRVM pilot areas for potential beautification retrofits.	Used 2025 data to prioritize new sites and refine work orders (e.g., WO #8). Beautification zones (wildflower areas) created in Blue Mountain Interchange and Carlisle Interchange.	☑ Achieved	1. Monitor the beautification zones (qualitative inspection/pictures). 2. Engage PA Turnpike staff to expand IRVM to additional sheds or within current districts, or expand in current Pilot Maintenance Sheds (Gibsonia/Newville)

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Introduction

The *Pollinator Initiative* originated from the Pennsylvania Turnpike Commission's (PA Turnpike) stewardship goal: to embrace sustainable practices and build a culture of sustainability that considers their economic, environmental, and social impacts; and become known as America's First Sustainable Superhighway (PA Turnpike n.d.b). The *Pollinator Initiative* has three (3) main objectives (PA Turnpike n.d.a):

1. To provide increased ecological benefits associated with pollinators and the local ecosystem surrounding the PA Turnpike properties. This objective seeks to:
    a. Promote increased diversity of pollinator species;
    b. Provide foraging, nesting, and overwintering habitat for several pollinator species;
    c. Encourage native species diversity, which contributes to local biodiversity and other ecological benefits;
    d. Improve soil infiltration and reduce compaction, and
    e. Improve habitat connectivity.
2. To provide human benefits in which the project offers opportunities for public education and awareness, sites that are aesthetically pleasing, and sites that benefit the local agricultural community through added pollinator support. For example, insect pollination services alone contribute an estimated $29 billion to U.S. agriculture (U.S. Department of Agriculture [USDA] n.d.).
3. To reduce the costs associated with vegetation management on PA TURNPIKE property. This objective also seeks to provide a cost-effective alternative to mechanical management practices.

The Pollinator Habitat Project, as a component of the *Pollinator Initiative*, provides an opportunity to meet these objectives by converting maintained lawns in PA Turnpike right-of-way (ROW) into habitats that support a diversity of plant and pollinator communities. In addition, these habitats are "outdoor laboratories" that offer opportunities to test various seed mixes, maintenance practices, and monitoring procedures prior to developing new PA Turnpike vegetation management policies and guidance. The lessons learned will support employee education and innovation, and be applied to reduce greenhouse gas emissions and operating costs while creating more aesthetically pleasing and higher functioning landscapes.

This 2025 (Year 4) report has been prepared to document the annual monitoring efforts for the Pollinator Habitat Project and discuss the findings from the seven (7) pollinator habitats. See Figure 1 for the locations of the seven (7) pollinator habitat sites.

Hickory Run Service Plaza (HRSP)

Allentown Service Plaza (ASP)

Bensalem Interchange (BEN)

Central Administration Building (CAB)

Harrisburg West Interchange (HBGW)

T-168.4 Salt Shed Westbound (SS)

Irwin Interchange (IRW)

Pollinator Habitat Sites

Turnpike Roadway Network

PA County

Figure 1

Pollinator Habitat Site Location Map
Pennsylvania Turnpike Commission
Pollinator Project
Pennsylvania

Source: ESRI Streaming - World Topographic Map

N W E S

0 10 20 Miles

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New Sites and Maintenance Changes in 2025

From 2022-2023, five (5) sites were developed as part of the initial Pollinator Habitat Project (Appendix A: Pollinator Site Summaries 1-5). By 2025, two (2) additional sites were developed and routinely monitored: Allentown Service Plaza (ASP) and the T-168.4 Salt Shed Westbound (SS; Appendix A: Pollinator Site Summaries 6-7). See Figure 1 for the location of the seven (7) pollinator habitat sites. Table 1 notes the year that each site was established and its current year of monitoring.

Table 1: Pollinator Habitat Sites, Year of Monitoring

Site Name	Year Initiated	Year of Monitoring
Central Administration Building (CAB)	2022	4th
Hickory Run Service Plaza (HRSP)	2022	4th
Irwin Interchange (IRW)	2023	3rd
Harrisburg West Interchange (HBGW)	2023	3rd
Bensalem Interchange (BEN)	2023	3rd
Allentown Service Plaza (ASP)	2024	2nd
T-168.4 Salt Shed Westbound (SS)	2024	1st

SS was added to the Pollinator Habitat Program in 2025 following stormwater management improvements to the site in 2024. These improvements involved the removal of pavement and the creation of three triangular pollinator plots protected by berms and rock-lined swales. The plots were seeded with a short native grass seed mix following construction. The Short Native Grass Mix was added to the ongoing list of seed mixes used throughout the pollinator program. See Table 2 for the 2025 pollinator site update.

Table 2: Pollinator Sites, Plot Numbers, and Seed Mixes (2025)

Site	Seed Mix Plot #	Seed Mix in Plot	1-Meter Monitoring Plots
Central Administration Building (CAB)	1	PA Central Lowland Province Upland (UPL) Meadow Mix	1A, 1B
	2	Butterfly & Hummingbird Garden Mix	2A, 2B
	3A	2022 PennDOT Pollinator Habitat Mix	3A
	3B	Modified PennDOT Pollinator Habitat Mix	3B
Hickory Run Service Plaza (HRSP)	1A	Butterfly & Hummingbird Garden Mix	1A
	1B	PA Blue Ridge Province UPL Meadow Mix	1B
	2A	2022 PennDOT Pollinator Habitat Mix	2A
	2B	Modified PennDOT Pollinator Habitat Mix	2B
	3	Deer Resistant Meadow Mix #1	1, 2
Irwin Interchange (IRW)	1	PTC Pollinator ROW Mix	1A
	2	PTC Monarch Specialty Mix	2A
	3	PTC Pollinator Interchange Mix	3A
	4	PA Southern Allegheny Plateau Province UPL Meadow Mix with Nurse Crop	4A
Harrisburg West Interchange (HBGW)	1	PTC Pollinator Interchange Mix	1A, 1B, 1C
	2A	PTC Pollinator ROW Mix	2A

Site	Seed Mix Plot #	Seed Mix in Plot	1-Meter Monitoring Plots
	2B	PTC Pollinator ROW Mix with Nurse Crop	2B
	3	Deer Resistant Meadow Mix #1	3A
	4	Deer Resistant Meadow Mix #2	4A
	5	PTC Monarch Specialty Mix	5A
Bensalem Interchange (BEN)	1	PTC Pollinator ROW Mix	1
	2A	2023 PennDOT Pollinator Habitat Mix	2A
	2B	Modified PennDOT Pollinator Habitat Mix	2B
	3	PTC Wet Habitat Mix	3
	4	PTC Pollinator Interchange Mix	4
Allentown Service Plaza (ASP)	1	PTC Monarch Specialty Mix	A
	2	PTC Wet Habitat Mix	B
	3	PTC Pollinator ROW Mix	C
	4	PTC Pollinator Interchange Mix	D
	5	PTC Pollinator Interchange Mix	E
	6	Deer Resistant Meadow Mix #1	F
	7	PTC Pollinator Interchange Mix	G
T-168.4 Salt Shed Westbound (SS)	1	Short Native Grass Mix	A
	2	Short Native Grass Mix	B
	3	Short Native Grass Mix	C

PennDOT – Pennsylvania Department of Transportation

To address a concern that CAB Plot 1 was starting to become a grass-dominant habitat, the plot was overseeded in the winter of 2023 with the same meadow mix without grass species to reduce competition with flowering species. This approach was determined to be successful in promoting a nectar-producing cover in 2024 and supporting more pollinators. This approach was repeated in the winter of 2024 and fall of 2025 to continue this highly visible plot's transition into a more flowering dominant cover.

To bring consistency in site monitoring events and frequency of monitoring, changes were added to the monitoring protocol for 2025. This included visiting each site twice a month and recording observation via a brief assessment (Health Check) or an in-depth (Full) monitoring event. Details of these monitoring methods are further described in the Monitoring Methodology section.

Monitoring Methodology

Success Criteria

Monitoring of the Pollinator Habitats began with pilot plots at the CAB and HRSP in 2022, with subsequent sites being established from 2023 to 2025 (Table 2; above, page 3). While monitoring efforts have evolved during this timeframe, the PA Turnpike has primarily focused on several parameters to evaluate whether the pilot sites are successfully meeting the goals and objectives of the *Pollinator Initiative*.

POLLINATOR HABITAT SUCCESS is defined as a plot that maintains a dominant cover of the desired seed mix and supports a medium to high number of pollinator species, while requiring minimal management.

The level of success of the Pollinator Habitats and their individual plots in 2025 was determined by their ability to satisfy three (3) parameters:

1. *Seed Mix Vegetation*: Germinating a high percentage of seed mix species (>75%) and developing a dominant areal cover (>50%) of these species. This parameter would indicate a successful match of seed mix to site conditions and a likelihood of developing a self-sustaining site.
2. *Insect Pollinators*: Attracting a *Medium* to *High* (**Medium** [M; 25-49 insect pollinators] to **High** [H; >50 insect pollinators]) number of insect pollinators during the monitoring season. This parameter would indicate whether the sites are supporting pollinator species throughout their life cycles.
3. *Reduced Maintenance*: Demonstrating reduction in maintenance required to sustain a dominant cover of the desired seed mix, with a reduction in invasive/undesirable intrusion. This parameter would indicate whether the seed mix is a cost-effective option for developing pollinator habitat in PA Turnpike ROW.

Monitoring Protocol

Monitoring protocols focused on documenting germination rates and areal cover of seed mix species, the site's resistance to invasive/undesirable plant species intrusions, and the ability of the sites to attract pollinator species.

In 2025, the monitoring protocol consisted of two (2) site visits each month, from May to October, to observe and document the herbaceous cover and pollinators at each site during the growing season. Monthly site visits included one (1) "Health Check" protocol and one (1) "Full" monitoring protocol. The Health Checks were conducted within the first two (2) weeks of the month and were designed to be a cursory review of current blooms and pollinator presence, and to note any site disturbances or items needing immediate corrective action. These Health Check assessments were a new addition to the

monitoring methods in 2025, and were created for the purposes of expediting corrective action(s) where needed and to provide a greater level of attention on the sites. Documentation for the Health Checks was completed electronically on-site using the ArcGIS Survey123 application. The data forms captured the current blooming species via checkbox selection, which were organized by bloom color, and noted if pollinators were present using Yes/No options. Text fields were included for "additional site notes" and "problem areas that need addressed." Problem areas were drawn on a site map aerial within the Survey123 application to provide a location guide for corrective action when needed. Completed Health Check forms were submitted within two weeks of a field view, and field summaries were emailed to provide timely opportunity for corrective action response. The monthly Health Check forms and the field summaries log are housed in PA Turnpike's Pollinator Teams folder.

Full monitoring events were conducted within the last two weeks of each month and followed the same data collection methods and reporting procedures as in 2024. This included the documentation of seed mix and non-seed mix species germination and blooms, areal cover of these species, the number and abundance of pollinator species, and photographs of each plot. For consistency in pollinator data collection, methodology was implemented to conduct pollinator observations for 10 minutes per plot, while 1-meter plot surveys were conducted over 5-minute periods. At the end of the monitoring season, the monthly counts were averaged across the number of observations in the season to determine the overall pollinator abundance ranking (i.e., low, medium, high).

New to the data form for 2025 was the addition of a field to indicate whether invasive and undesirable plant species required herbicide control. Data were collected with the Survey123 application via tablets/phones on forms created for the sites with pre-loaded seed mixes and site-specific plot tables to improve consistency and efficiency. Monitoring reports were automatically generated through the Survey123 application.

To improve the likelihood of encountering pollinators, care was taken to complete monitoring visits during optimal conditions (i.e., sunny, calm days versus rainy or windy days). Weather conditions at the time of site monitoring were recorded on both the Health Check and Full monitoring forms. The Full monitoring forms also provided a field for noting 72-hour precipitation amounts. Table 3 summarizes the protocols for each of the monitoring forms.

Table 3: Monthly Monitoring Protocols (2025)

Health Check	• Complete a cursory review of flowering species and pollinators sitewide. • Document invasive/undesirable species, effectiveness of herbicide treatments, and presence of stressors (e.g., debris, disturbances to plant cover) in each plot. • Use Survey123 to complete electronic field assessment data forms which are automated into reports for PA Turnpike technical files. • Site visits conducted monthly, with early spring (March/April) field visits to document undesirable vegetation control needs and estimate the start of Full monitoring. Late October/November monthly field view conducted to document conservation mowing.
Full Monitoring	• Collect data for each plot to assess the success of the pilot sites, including the presence of seed mix species (including those blooming) and pollinators, as well as the presence of stressors (e.g., debris, disturbances to plant cover). • Complete 1x1-meter square plot vegetative surveys in each pollinator plot. • Use Survey123 to complete electronic field assessment data forms which are automated into reports for PA Turnpike technical files.

Within each plot, one (1) or two (2) 1x1-meter square monitoring plots were installed approximately 10 feet from the edge of each individual seed mix plot to collect sample data. The site monitoring plots are outlined in Table 2 (above, page 3).

The following parameters were recorded during each Full monitoring event in both the overall and 1x1-meter square assessments for each plot.

- Plant Species – Observed species (*noting ones in bloom*) from the planted seed mix, as well as volunteer (non-seed mix) species. Absolute percent cover for each species was estimated at the time of monitoring.
- Overall Growth Percentage – The absolute areal cover percentage of vegetation.
- Pollinator Presence – A list of insect pollinator species, including total number of each species, observed within each seed mix plot.

Pollinator species were identified using the *Kaufman Field Guide to Butterflies of North America* (Brock and Kaufman 2003), *Kaufman Field Guide to Insects of North America* (Eaton and Kaufman 2007), *Petersons Field Guide to Insects* (Borror and Peterson 1998), *National Wildlife Federation Field Guide to Insects & Spiders & Related Species of North America* (Evans 2007), and various online sources. Pollinators observed within each plot were recorded to obtain an overall estimate of **pollinator species richness** (total number of species observed) and **pollinator species abundance** (total number of individuals observed).

Monitoring Results

General Site Conditions (2025)

Nectar production and availability are influenced by climatic conditions which can have a deleterious effect on pollinators. For example, drought may cause plants to produce less nectar, while warmer temperatures can encourage plants to bloom sooner than usual (USDA n.d.). These weather-related effects on nectar availability may impact the survivability of pollinators who emerge too late to access the earlier stores of nectar, or that find limited supply at critical times of development in the growing season.

In 2025, the pollinator habitat sites experienced moderate to severe drought conditions in early spring (April) that would have limited early sources of nectar. Only the western region (IRW site) experienced a normal level of precipitation during the start of the growing season (Table 4). The remainder of the season was relatively normal until all sites experienced at least abnormally dry conditions in September and October. Drought data was collected for each of the sites from the U.S. Drought Monitor website (accessed November 11, 2025). Included with the drought data is the length of the growing season by site location. The last and first freezes of the 2025 season were gathered from the nearest weather station (National Oceanic and Atmospheric Administration [NOAA] 2025).

Table 4: Drought Conditions, 2025 Monitoring Season (May-October)

Site	Drought Monitor Data During 2025 Growing Season						
	April	**May**	**June**	**July**	**August**	**September**	**October**
CAB (Dauphin County)	Moderate Drought	Abnormally Dry	None	None	None	Abnormally Dry	Abnormally Dry
	Last freeze: 4/09/25	-	(211 days)			-	First freeze: 11/07/25
HRSP (Carbon County)	Moderate Drought	None	None	None	None	Abnormally Dry	Moderate Drought
	Last freeze: 4/19/25	-	(173 days)			-	First freeze: 10/10/25
IRW (Westmoreland County)	None	None	None	None	None	Abnormally Dry	Abnormally Dry
	Last freeze: 4/18/25	-	(189 days)			-	First freeze: 10/25/25
HBGW (Cumberland County)	Moderate Drought	Abnormally Dry	None	None	None	Abnormally Dry	Abnormally Dry
	Last freeze: 4/18/25	-	(175 days)			-	First freeze: 10/11/25
BEN (Bucks County)	Abnormally Dry	None	None	None	None	None	Moderate Drought
	Last freeze: 4/18/25	-	(191 days)			-	First freeze: 10/27/25
ASP (Lehigh County)	Severe Drought	Moderate Drought	None	None	None	Abnormally Dry	Moderate Drought
	Last freeze: 4/18/25	-	(174 days)			-	First freeze: 10/10/25
SS (Fulton County)	Abnormally Dry	None	None	None	None	Abnormally Dry	Abnormally Dry
	Last freeze: 4/10/25	-	(200 days)			-	First freeze: 10/25/25

It is expected that April drought conditions would have impacted the early development of these habitats and reduced the availability of nectar for pollinators in April and even early May. However, as drought

conditions subsided in May or June, the plots may have recovered by early summer, with a proportionate increase in pollinator observations.

Pollinator Habitat Site Results

The results of the 2025 monitoring season for the seven (7) pollinator habitats are discussed below, including the details of the seed mix germination rates, percent areal cover, and pollinator species observed. In addition, maintenance activities required to control invasive or undesirable species are discussed. Each site summary includes a table showing trends over the years of monitoring, while a detailed summary table outlining the 2025 monitoring results is provided in Appendix B. Photographs of the sites during early and late summer monitoring events are provided in Appendix C. It should be noted that monitoring in 2025 took place over six (6) monthly site visits (May-October). This is a change from 2024, during which time the sites planted in 2022 (CAB and HRSP) were monitored four (4) times (April-September) and the sites planted in 2023 (IRW, HBGW, and BEN) were monitored eight (8) times (April-October). ASP, planted in 2024, was monitored two (2) times (July and September). The results discussed below are grouped by the age of the sites, with the older established sites discussed first and more recent ones discussed at the end.

Central Administration Building (CAB)

Year 4 of monitoring at CAB demonstrated that the four seed mixes (Table 5) are successfully establishing a dense cover of desired species across all plots. Cover in Plot 2 consisted of a larger majority of seed mix flowering species than previously observed, while other plots featured an increase in graminoid areal cover (Plot 3B) or an equal dominance between seed mix species (Plots 1 and 3A). Generally, all plots performed similar to previous years except for Plot 1, which improved with higher seed mix species germination rates, greater seed mix areal coverage, and increased pollinator species richness since its establishment. This is likely related to the overseeding of Plot 1 with a flowering species only mix during each of the last two years to promote more blooms.

Table 5: Central Administration Building (CAB) Plot Seed Mixes

Site	Seed Mix Plot #	Seed Mix in Plot
Central Administration Building (CAB)	1	PA Central Lowland Province UPL Meadow Mix
	2	Butterfly & Hummingbird Garden Mix
	3A	2022 PennDOT Pollinator Habitat Mix
	3B	Modified PennDOT Pollinator Habitat Mix

1. Vegetation Monitoring

A. Seed mix species germination and average areal cover observed during 2025 monthly events.

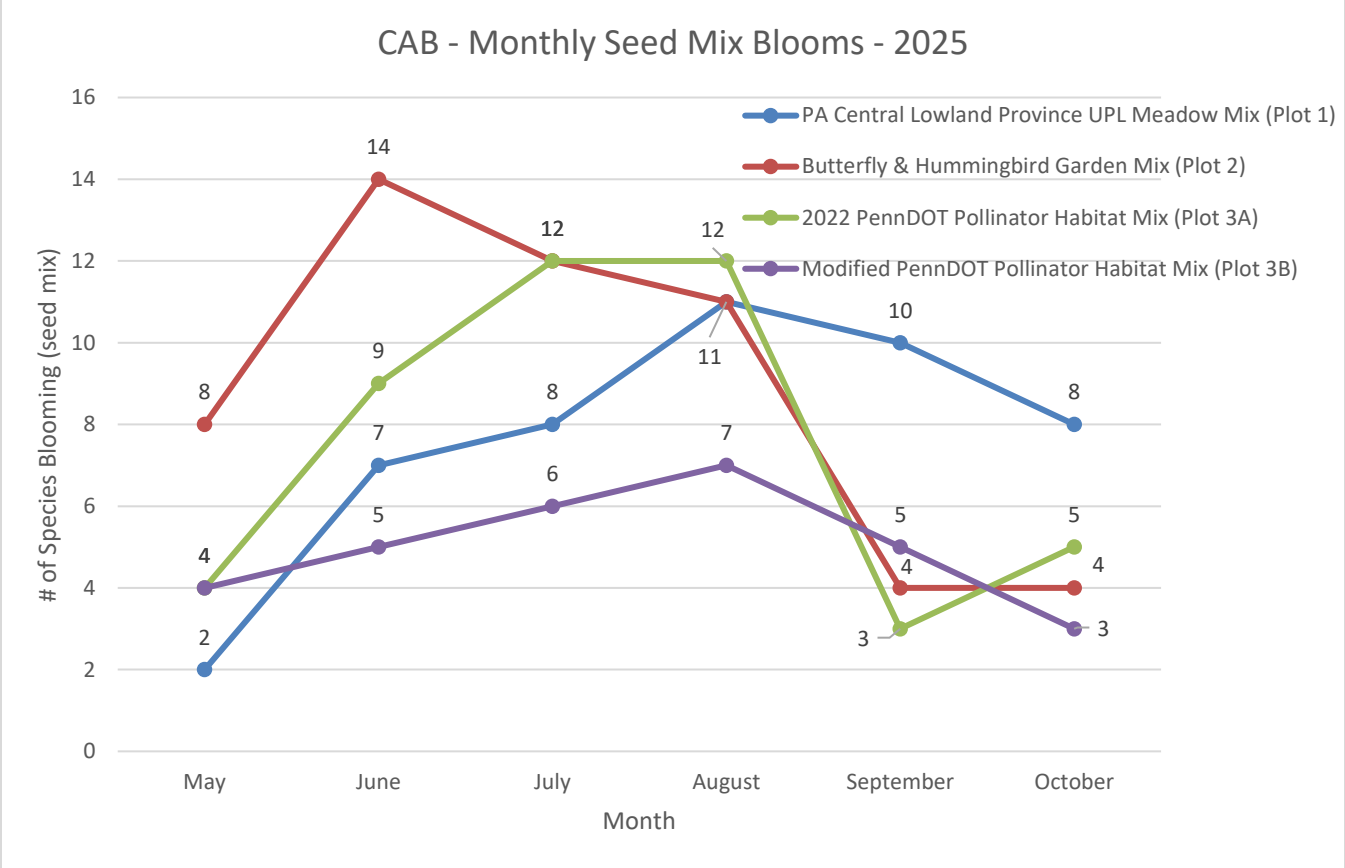
The number of species that germinated from the applied seed mix reached a high at all four plots since their establishment in 2022. Plot 1 had the highest seed mix success rate, with 17 out of 19 seed mix species (89%) observed; followed by Plot 3A with 21 out of 24 species (88%); Plot 3B with 15 out of 19 species (79%); and Plot 2 with 24 out of 34 species (71%) observed, respectively. It is of note that blue false indigo (*Baptisia australis*) was observed and blooming for the first time in Plot 3A.

During each monthly monitoring event, seed mix areal coverages were noted in each plot to estimate their resistance to incursions of non-seed mix coverage and averaged over the entire monitoring period during the growing season. The applied seed mix was the dominant cover in all CAB plots: Plot 1 (64%), Plot 2 (72%), Plot 3A (70%), and Plot 3B (57%).

B. When was the highest number of seed mix blooms observed in 2025?

The highest number of seed mix species in bloom for 2025 occurred in June for Plot 2, and August for Plots 1 and 3B (Figure 2). Plot 3A had the highest number of seed mix species in bloom (12) for both July and August. Overall, CAB had a greater number of blooming species in 2025 than in previous years. This was due in part to a greater number of nectar-producing species that colonized the plots.

Figure 2: Monthly Seed Mix Blooming Species at CAB, Monthly (2025)



C. <u>What were the dominant blooming species in 2025 and trends over the monitoring years?</u>

Seed mix individuals providing the greatest areal coverage in a plot, and in bloom at the time of the monthly monitoring events, were identified as the "dominant blooming species" and included in Table 6. Blooming species coinciding with the highest pollinator counts are identified in bold text. Table 7 provides the yearly trends of dominant blooming species since site planting.

Table 6: Dominant Blooming Species* at CAB By Month - 2025

2025	Plot 1	Plot 2	Plot 3A	Plot 3B
May	tall white beardtongue	shasta daisy	tall white beardtongue	tall white beardtongue
June	oxeye sunflower	oxeye sunflower	oxeye sunflower	purple coneflower
July	**oxeye sunflower**	**wild bergamot**	**oxeye sunflower, wild bergamot**	**wild bergamot**
Aug.	calico aster	purple coneflower	purple coneflower, roundhead lespedeza	common boneset
Sept.	heath aster, calico aster	heath aster	calico aster	common boneset
Oct.	heath aster	heath aster	calico aster	common boneset

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.
BOLD text denotes the dominant bloom coinciding with the highest pollinator count in each plot in 2025.

Table 7: Yearly Trends of Dominant Blooms* - CAB

	2022	2023	2024	2025
Plot 1	blackeyed Susan	blackeyed Susan, oxeye sunflower	blackeyed Susan, oxeye sunflower	oxeye sunflower, tall white beardtongue, calico aster, heath aster
Plot 2	bachelor's button/cornflower	bachelor's button/cornflower, lanceleaf coreopsis	bachelor's button/ cornflower, lanceleaf coreopsis	shasta daisy, oxeye sunflower, wild bergamot, purple coneflower, heath aster
Plot 3A	oxeye sunflower, lanceleaf coreopsis, partridge pea	oxeye sunflower, lanceleaf coreopsis, partridge pea	oxeye sunflower	oxeye sunflower, tall white beardtongue, wild bergamot, purple coneflower, roundedhead lespedeza, calico aster
Plot 3B	partridge pea blackeyed Susan	blackeyed Susan	common boneset, heath aster	common boneset, tall white beardtongue, wild bergamot, purple coneflower
Text Color: Blue – 1st year emergent; Orange – 2nd year emergent; Plum – 3rd year emergent, Black – 4th year emergent				

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.

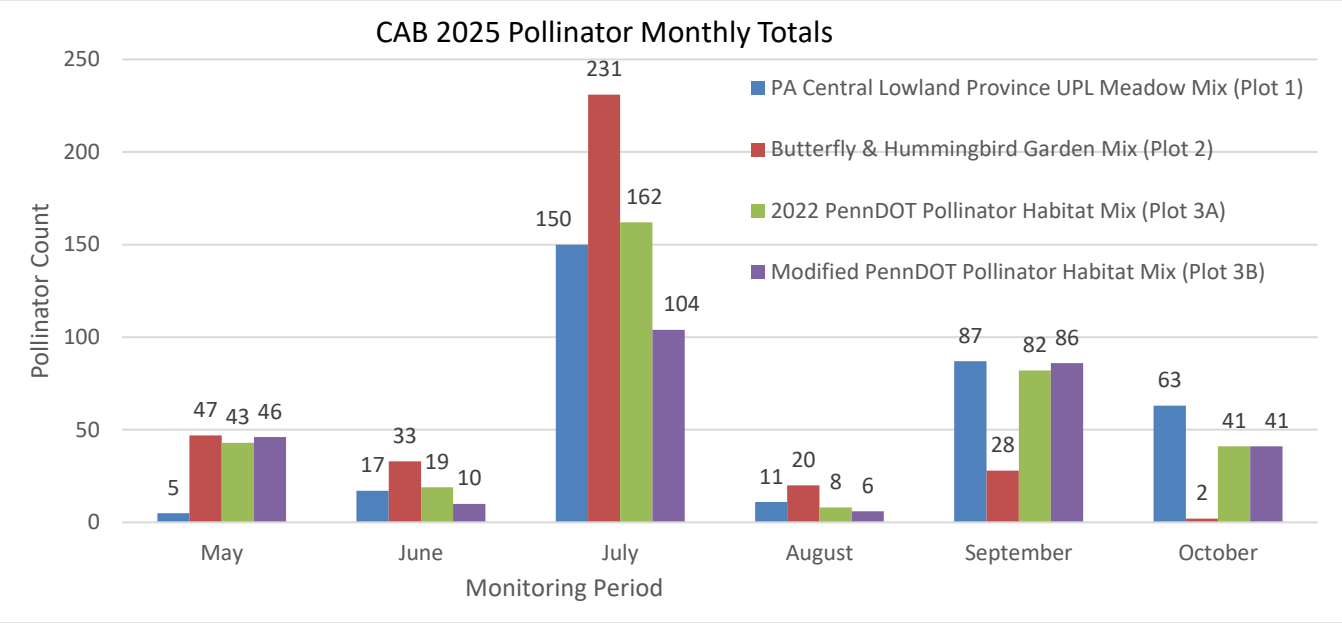
D. Were undesirable species/invasive species present, and what change occurred over previous years?

In 2025, dominant undesirable species included butterfly bush (excluding 3B), tree-of-heaven, princess tree, and grape vine species. All plots at the CAB site have incursions of mugwort, primarily around the plot perimeters. In previous years, American pokeweed and Canada thistle in all plots (excluding Plot 3A) were targeted and have been significantly reduced. However, control of incursions has been problematic due to their presence in adjacent properties. For example, mature trees-of-heaven are found in an adjacent cemetery and continue to colonize the plots. In such cases, management of incursions remains reactive when sources of undesirable/invasive species cannot be eliminated.

2. Pollinator Monitoring

Plots 1, 2, and 3A rated as having a *High* pollinator presence throughout the year, while Plot 3B had a *Medium* pollinator presence. Pollinator richness varied between plots, but typically ranged between 13 and 19 species. Individual pollinator counts varied widely between monitoring events and plot locations; however, July provided the highest individual pollinator counts for all four plots. The highest individual pollinator counts for each site are as follows: 150 (Plot 1, July), 231 (Plot 2, July), 162 (Plot 3A, July), and 104 (Plot 3B, July; Figure 3).

Figure 3: Number of Individual Pollinators Observed at CAB Plots, Monthly (2025)



There were 26 different pollinator species observed at CAB in 2025. Common pollinators observed across all plots included various species of bumblebees and honeybees, carpenter bees, hoverflies, cabbage white butterflies, yellow jackets, clouded sulphurs, skippers, and monarchs. Occasional or seasonal emergent visitors included hummingbird moths, margined leather winged beetles, sachem skippers, painted ladies, tiger swallowtails, wild indigo duskywings, false milkweed beetles, eastern tailed blues, and mud daubers.

3. Implementation Techniques/Management Practices

CAB Plots 1 and 2 received a spot spray herbicide application of Milestone® in early June. These applications were conducted using a backpack sprayer and primarily targeted American pokeweed, thistle, and other common broadleaf species not in the seed mix. All CAB plots received a fall herbicide application of Milestone® in early October to target common unwanted broadleaf species and was followed by the annual fall mowing of the plots on October 27, 2025. In 2022, Plots 1, 3A, and 3B were subjected to chemical herbicide treatments and manual removal of undesirable species to reduce competition with seed mix species. This early intervention helped to reduce management efforts in 2023 and 2024 beyond the occasional targeted herbicide treatments of problematic undesirable species and the

manual removal of prickly lettuce from Plot 3B in 2023. Finally, Plot 1 was reseeded prior to the 2024 and 2025 growing seasons with the PA Central Lowland Province UPL Meadow Mix sans grass species to promote the growth of nectar-producing species and reduce the dominance of grasses. Table 8 provides a review of the yearly trends for seed mix and pollinator data at CAB since the site planting. Prevalent undesirable species present in 2025 are also provided.

Table 8: Central Administration Building (CAB)

Seed Mix Plot	Seed Mix Type	# Species in Mix	# Species Observed from Seed Mix				Peak Coverage (%)[1]				2025 Prevalent Undesirable Species[2] Present	Pollinator Species Richness (# of Species)				Pollinator Abundance[3] (# of Individuals)			
			2022	2023	2024	2025	2022	2023	2024	2025		2022	2023	2024	2025	2022	2023	2024	2025
1	PA Central Lowland Province UPL Meadow Mix	19	7	14	16	17	45	61	58	77	creeping thistle, mugwort, crown vetch, prickly lettuce, pokeweed, butterfly bush, tree-of-heaven, princess tree, vitis spp.	11	22	6	19	Med	Med	Low	High
2	Butterfly & Hummingbird Garden Mix	34	13	21	22	24	100	100	87	88	mugwort, staghorn sumac (beneficial, but not goal of herbaceous plot), tree-of-heaven, vitis spp., honeysuckle, princess tree, butterfly bush	15	19	7	14	High	High	Low	High
3A	2022 PennDOT Pollinator Habitat Mix	24	10	17	19	21	52	96	48	84	mugwort, tree-of-heaven, pokeweed, oriental bittersweet, princess tree, butterfly bush, creeping thistle	11	13	7	19	Low	High	Low	High
3B	Modified PennDOT Pollinator Habitat Mix	19	7	12	14	15	40	85	82	65	mugwort, creeping thistle, tree-of-heaven, vitis spp., princess tree, pokeweed, Virginia creeper	10	19	3	13	Low	High	Low	Med

[1]Peak Coverage – highest percent areal cover of the seed mix during the growing season.
[2] The Summary Data Tables in Appendix B provide the scientific names of the species listed in this column.
[3]Pollinator Abundance (average monthly number of individual pollinators observed over growing season in the plot) – High (>50 pollinators observed), Medium (25-49 pollinators observed), Low (<25 pollinators observed).

Hickory Run Service Plaza (HRSP)

HRSP has increasingly developed a dominant cover of seed mix species with an abundance of seasonal blooms by Year 4. As the northernmost pollinator site, HRSP also has one of the shorter growing seasons (Table 4; above, page 8; 173 days in 2025) of the PA Turnpike pollinator sites and may limit plant growth sitewide, with plot heights often reaching no more than 3 feet. These reasons may help to resist incursions of undesirable and invasive species, and HRSP remains the only pollinator site that has not received herbicide treatments to date.

While most plots are showing an abundance of seed mix species, Plot 2A had the least number of seed mix species in comparison to the other plots. It is suspected that stormwater runoff conveyed to the plot is hindering seed mix development by maintaining soil moisture levels higher than is optimal for the desired seed mix. Observations of both hydrophytes (woolgrass, bulrush, rushes, etc.) within the eastern end and saturated soils in July support this hypothesis. Table 9 provides the list of plots and associated seed mixes at HRSP.

Table 9: Hickory Run Service Plaza (HRSP) Plot Seed Mixes

Site	Seed Mix Plot #	Seed Mix in Plot
Hickory Run Service Plaza (HRSP)	1A	Butterfly & Hummingbird Garden Mix
	1B	PA Blue Ridge Province UPL Meadow Mix
	2A	2022 PennDOT Pollinator Habitat Mix
	2B	Modified PennDOT Pollinator Habitat Mix
	3	Deer Resistant Meadow Mix #1

1. Vegetation Monitoring

A. Seed mix species germination and average areal cover observed during 2025 monthly events.

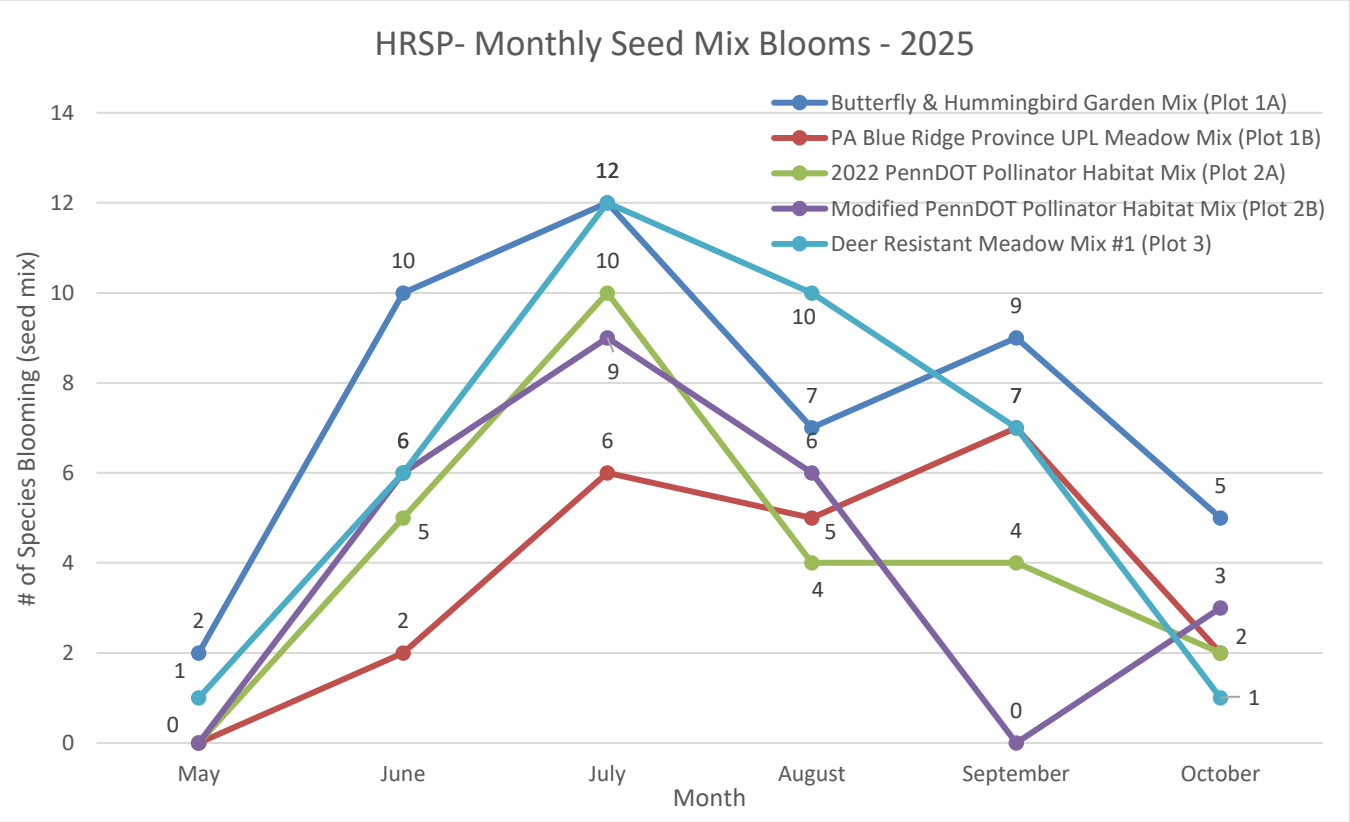
Germination rates at HRSP continually show progressive gains from year to year, with the 2025 monitoring season recording the most seed mix species observed to date (Table 12; below, page 20). For example, PA Blue Ridge Province UPL Meadow mix (Plot 1B) germinated all 16 seed mix species (100%) for the first time. Germination rates for the remaining plots in 2025 is as follows: Plot 1A (68%), Plot 2A (75%), Plot 2B (79%), and Plot 3 (88%). The data tables in Appendix B provide a list of seed mix species that were not observed in 2025.

During each monthly monitoring event, seed mix areal coverages were noted for each plot to estimate their resistance to incursions of non-seed mix coverage and averaged over the entire monitoring period during the growing season. At HRSP, this demonstrated that the applied seed mix produced dominant areal coverage in all plots: Plot 1A (70%), Plot 1B (60%), Plot 2B (55%), and Plot 3 (78%). Plot 2A, at 42%, did not meet dominant seed mix coverage.

B. When was the highest number of seed mix blooms observed in 2025?

The highest number of seed mix species in bloom occurred in July for Plots 1A, 2A, 2B, and 3, while September was the highest for Plot 1B (Figure 4). This data is similar to 2024 observations, with the exception of Plot 3, which shifted dominant blooms from September 2024 to July 2025.

Figure 4: Monthly Seed Mix Blooming Species at HRSP, Monthly (2025)



C. What were the dominant blooming species in 2025 and trends over the monitoring years?

The dominant blooming species by month for each plot at HRSP in 2025 is provided in Table 10. The yearly trends of dominant blooming species since site planting are provided in Table 11.

Table 10: Dominant Blooming Species* at HRSP By Month - 2025

2025	Plot 1A	Plot 1B	Plot 2A	Plot 2B	Plot 3
May	golden alexander	no blooms	no blooms	no blooms	golden alexander
June	lanceleaf coreopsis	tall white beardtongue	lanceleaf coreopsis	lanceleaf coreopsis	tall white beardtongue, lanceleaf coreopsis
July	**purple coneflower**	**early goldenrod**	**wild bergamot**	**wild bergamot**	purple coneflower oxeye sunflower

2025	Plot 1A	Plot 1B	Plot 2A	Plot 2B	Plot 3
Aug.	purple coneflower, greyheaded coneflower	grey goldenrod, early goldenrod	purple coneflower	lanceleaf coreopsis	**purple coneflower**
Sept.	blackeyed Susan, purple coneflower, greyheaded coneflower, New England aster	New England aster, early goldenrod, gray goldenrod	narrowleaf mountainmint	no blooms	calico aster, aromatic aster
Oct.	gray goldenrod	gray goldenrod, New England aster	purple coneflower	aromatic aster	gray goldenrod

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.
BOLD text denotes the dominant bloom coinciding with the highest pollinator count in each plot in 2025.

Table 11: Yearly Trends of Dominant Blooms* - HRSP

Plots	2022	2023	2024	2025
Plot 1A	bachelor's button California orange poppy	bachelor's button, lanceleaf coreopsis, shasta daisy, sweet William, oxeye sunflower	sweet William, greyheaded coneflower, purple coneflower, gray goldenrod	lanceleaf coreopsis, purple coneflower, greyheaded coneflower, gray goldenrod, New England aster, blackeyed Susan, golden alexander
Plot 1B	--	browneyed Susan, heath aster, early goldenrod	hairy beardtongue, browneyed Susan, gray goldenrod	early goldenrod, gray goldenrod, tall white beardtongue, new England aster
Plot 2A	partridge pea	partridge pea, lanceleaf coreopsis, swamp milkweed, purple coneflower, wild bergamot, oxeye sunflower, anise hyssop	purple coneflower, lanceleaf coreopsis, narrowleaf mountainmint	wild bergamot, purple coneflower, lanceleaf coreopsis, narrowleaf mountainmint
Plot 2B	partridge pea	lanceleaf coreopsis, purple coneflower, blackeyed Susan	lanceleaf coreopsis	lanceleaf coreopsis, wild bergamot, aromatic aster
Plot 3	partridge pea	lanceleaf coreopsis, purple coneflower, blackeyed Susan oxeye sunflower, wild bergamot, gray goldenrod	purple coneflower, lanceleaf coreopsis, hairy beardtongue	gray goldenrod purple coneflower, lanceleaf coreopsis, oxeye sunflower, calico aster, aromatic aster, tall white beardtongue
Text Color: Blue – 1st year emergent; Orange – 2nd year emergent; Plum – 3rd year emergent, Black – 4th year emergent				

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.

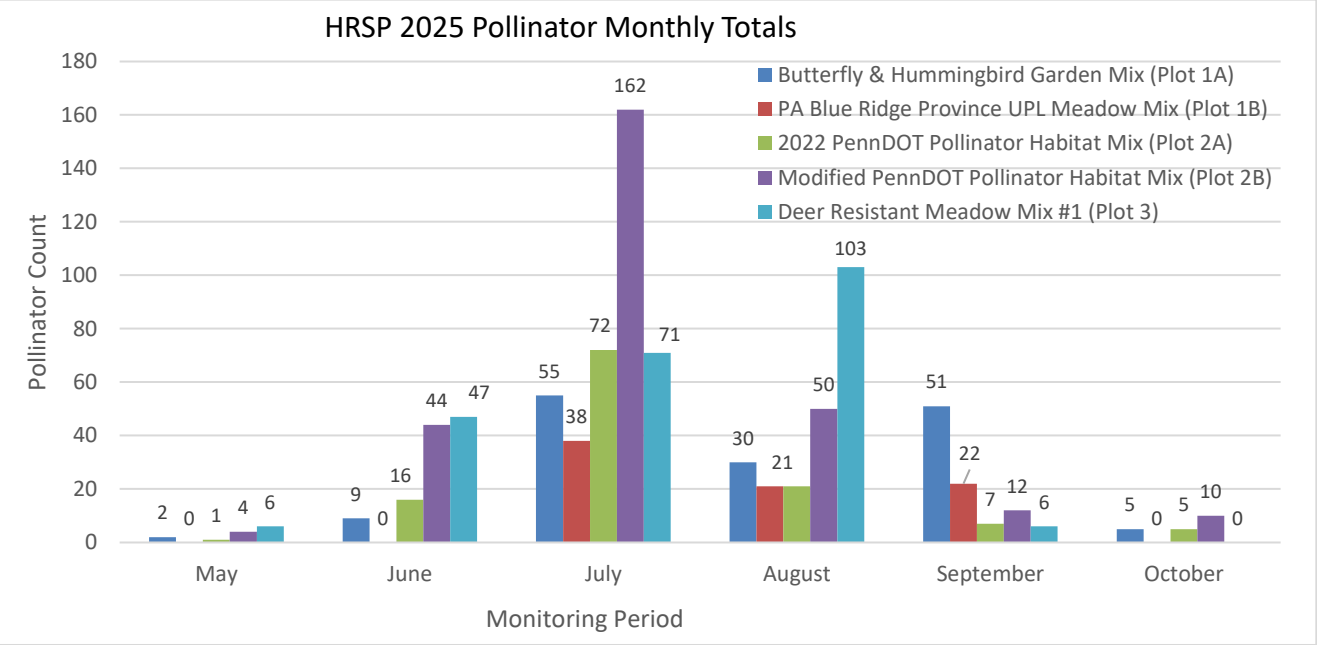
2. Pollinator Monitoring

The plots at HRSP were rated as having *Medium* (Plots 1A, 2B, and 3) and *Low* (Plots 1B and 2A) pollinator presences throughout the year. Pollinator richness varied between plots, but typically ranged between 13 and 19 different species. Individual pollinator counts varied widely between monitoring events

and plot locations. The highest counts for each plot are as follows: 55 (Plot 1A, July), 38 (Plot 1B, July); 72 (Plot 2A, July); 162 (Plot 2B, July), and 103 (Plot 3, August; Figure 5).

There were 30 different pollinator species observed at HRSP in 2025. Common pollinators observed across all plots included various species of bumblebees and honeybees, carpenter bees, cabbage white butterflies, orange sulfurs, and monarch butterflies. Occasional or seasonal emergent visitors include solider beetles, black swallowtails, great spangled fritillaries, spicebush swallowtails, tiger swallowtails, golden solider beetles, pearl crescents, eastern tailed blues, and spring azures.

Figure 5: Number of Individual Pollinators Observed at HRSP Plots, Monthly (2025)



3. Implementation Techniques/Management Practices

Undesirable species control was never implemented at HRSP in previous years, and this did not change in its Year 4 of management in 2025. While monitoring events at HRSP noted multiple non-seed mix species as well as a few invasive species present, the overall coverage of these species did not rise to the level of requiring control. For example, crown vetch, birds-foot trefoil, spotted knapweed, Canada thistle, and tall fescue were the primary undesirables detected during the monitoring events in 2024 and 2025, and they were not identified as problematic. The annual fall mow occurred on November 5, 2025, and was the only mow conducted at HRSP in 2025. Table 12 provides a review of the yearly trends for seed mix and pollinator data at HRSP since site planting.

Table 12: Hickory Run Service Plaza (HRSP)

Seed Mix Plot	Seed Mix Type	# Species in Mix	# Species Observed from Seed Mix				Peak Coverage (percent)[1]				2025 Prevalent Undesirable Species[2] Present	Pollinator Species Richness (# of Species)				Pollinator Abundance[3] (# of Individuals)			
			2022	2023	2024	2025	2022	2023	2024	2025		2022	2023	2024	2025	2022	2023	2024	2025
1A	Butterfly & Hummingbird Garden Mix	34	11	20	21	23	75	75	64	81	undesirables present, not requiring control	17	39	19	14	Med	High	High	Med
1B	PA Blue Ridge Province UPL Meadow Mix	16	4	12	13	16	15	73	60	86	undesirables present, not requiring control	13	17	18	13	Low	Med	Med	Low
2A	2022 PennDOT Pollinator Habitat Mix	24	6	16	18	18	40	44	48	49	undesirables present, not requiring control	12	26	22	15	Low	High	Med	Low
2B	Modified PennDOT Pollinator Habitat Mix	19	9	13	13	15	50	50	68	72	undesirables present, not requiring control	12	29	16	19	Med	High	High	Med
3	Deer Resistant Meadow Mix #1	25	5	18	18	22	33	87	78	94	undesirables present, not requiring control	14	23	24	19	Med	High	High	Med

[1]Peak Coverage – highest percent areal cover of the seed mix during the growing season.
[2] The Summary Data Tables in Appendix B provide the scientific names of the species listed in this column.
[3]Pollinator Abundance (average monthly number of individual pollinators observed over growing season in the plot) – High (>50 pollinators observed), Medium (25-49 pollinators observed), Low (<25 pollinators observed).

Irwin Interchange (IRW)

IRW plots showed a moderate improvement in seed mix dominance and resistance to incursions of undesirable species in its Year 3 of development. A herbicide application was completed in the spring of 2025 for all plots; however, Plots 2 and 4 continue to experience a dominance of undesirable species cover, while Plots 1 and 3 have progressed toward maintaining a dominant cover of seed mix species. Table 13 provides the list of plots and associated seed mixes at IRW.

Table 13: Irwin Interchange (IRW) Plot Seed Mixes

Site	Seed Mix Plot #	Seed Mix in Plot
Irwin Interchange (IRW)	1	PTC Pollinator ROW Mix
	2	PTC Monarch Specialty Mix
	3	PTC Pollinator Interchange Mix
	4	PA Southern Allegheny Plateau Province Upland Meadow Mix with Nurse Crop

1. Vegetation Monitoring

A. Seed mix species germination and average areal cover observed during 2025 monthly events

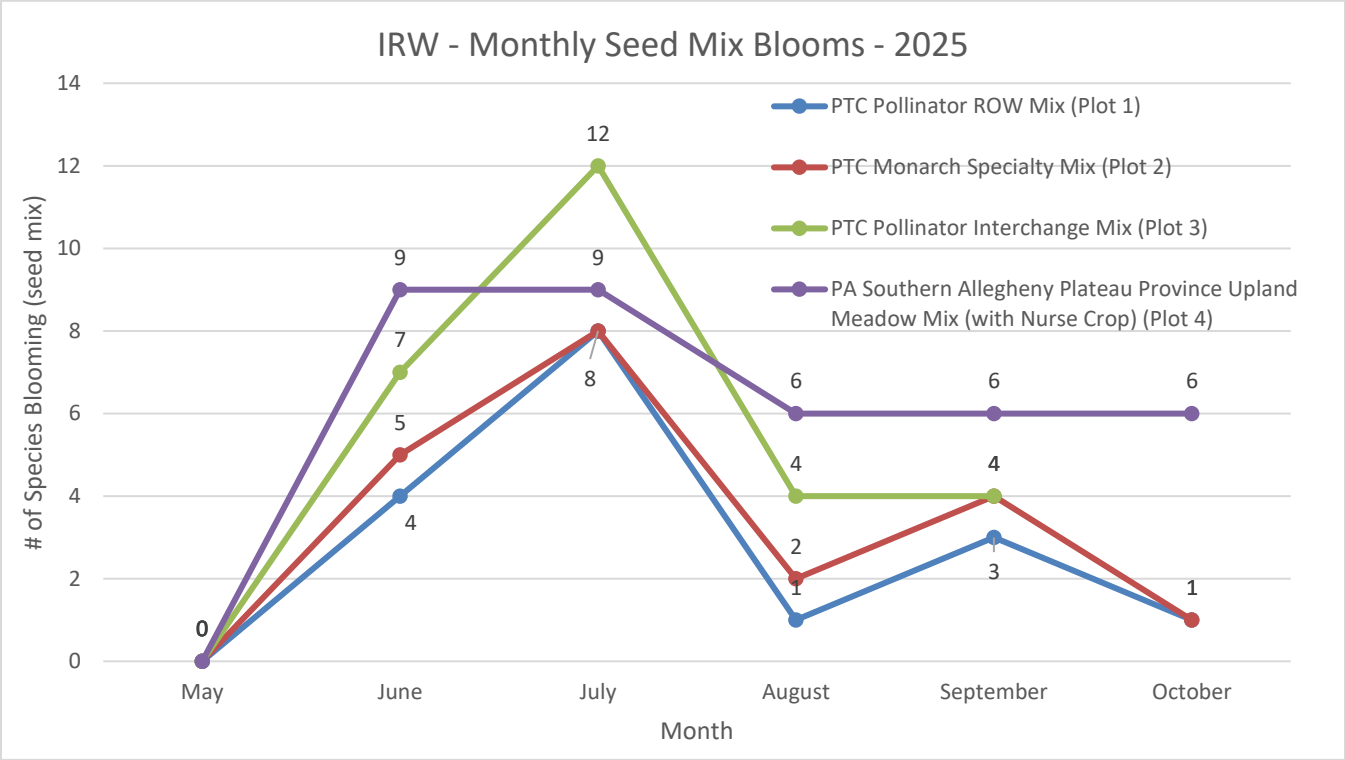
Germination rates at IRW show progressive gains from year to year, with the 2025 monitoring season recording the most seed mix species observed to date for all plots (Table 16; below, page 25). When comparing the planted versus germinated species at each plot, Plots 3 (PTC Pollinator Interchange Mix) and 4 (PA Southern Allegheny Plateau Province Upland Meadow Mix) produced all the species planted from the seed mix, which is the first record of occurrence since planting at this site. Germination rates for the remaining plots in 2025 include Plot 1 (PTC Pollinator ROW Mix) at 88%, and Plot 2 (PTC Monarch Specialty Mix) at 76%. The data tables in Appendix B provide a list of seed mix species that were not seen in 2025.

During each monthly monitoring event, seed mix areal coverages were noted in each plot to estimate their resistance to incursions of non-seed mix coverage and averaged over the entire monitoring period during the growing season. At IRW, this demonstrated that the applied seed produced dominant areal coverage in Plot 1 (59%) and Plot 3(60%), but not in Plot 2 (24%) or Plot 4 (43%).

B. When was the highest number of seed mix blooms observed in 2025?

The highest number of seed mix species in bloom occurred in July for all plots. Plot 4 also had the same number of blooming species observed in June (Figure 6). This is a slight shift to earlier than observed in 2024, where the highest number of blooms were noted later in the season: Plot 1 (August and September), Plot 2 (July and August), Plot 3 (August), and Plot 4 (September).

Figure 6: Monthly Seed Mix Blooming Species at IRW, Monthly (2025)



C. What were the dominant blooming species in 2025 and trends over the monitoring years?

The dominant blooming species by month for each plot at IRW in 2025 is provided in Table 14. The yearly trends of dominant blooming species since site planting are provided in Table 15.

Table 14: Dominant Blooming Species* at IRW By Month - 2025

2025	Plot 1	Plot 2	Plot 3	Plot 4
May	no blooms	no blooms	purple coneflower	no blooms
June	oxeye sunflower	yellow wingstem, wild bergamot	lanceleaf coreopsis	browneyed Susan
July	**oxeye sunflower**	blackeyed Susan	**purple coneflower**	oxeye sunflower
Aug.	oxeye sunflower	**blackeyed Susan**	oxeye sunflower	browneyed Susan, oxeye sunflower, gray goldenrod
Sept.	oxeye sunflower	blackeyed Susan, New England aster	purple coneflower, oxeye sunflower	**browneyed Susan**
Oct.	showy tickseed	blackeyed Susan	purple coneflower	gray goldenrod

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.
BOLD text denotes the dominant bloom coinciding with the highest pollinator count in each plot in 2025.

Table 15: Yearly Trends of Dominant Blooms* - IRW

	2023	2024	2025
Plot 1	butterfly milkweed, showy tickseed	showy tickseed, butterfly milkweed, blackeyed Susan, oxeye sunflower, New England aster	showy tickseed, oxeye sunflower
Plot 2	blackeyed Susan, partridge pea	blackeyed Susan, yellow wingstem, butterfly milkweed	blackeyed Susan, yellow wingstem, wild bergamot, New England aster
Plot 3	oxeye sunflower, blackeyed Susan, partridge pea	blackeyed Susan, oxeye sunflower, heath aster, lanceleaf coreopsis	oxeye sunflower, lanceleaf coreopsis, purple coneflower
Plot 4	blackeyed Susan	blackeyed Susan, oxeye sunflower, browneyed Susan	oxeye sunflower, browneyed Susan, gray goldenrod
Text Color: Blue – 1st year emergent; Orange – 2nd year emergent; Plum – 3rd year emergent, Black – 4th year emergent			

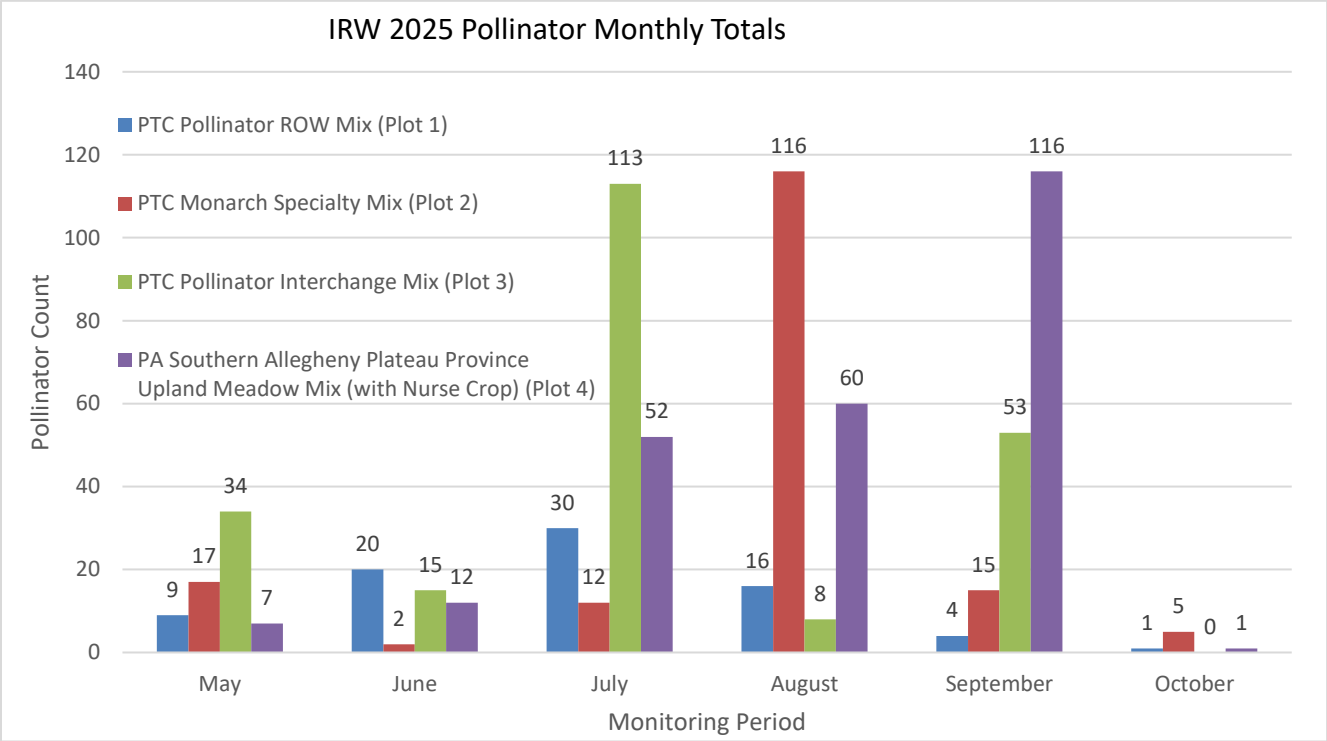
*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.

2. Pollinator Monitoring

All plots at IRW are rated as having a *Medium* pollinator presence throughout the year, except for Plot 1 (*Low*). Pollinator richness varied between plots, ranging between 12 and 22 different species. Individual pollinator counts varied widely between monitoring events and plot locations. The highest count for each plot is as follows: 30 (Plot 1, July), 116 (Plot 2, August); 113 (Plot 3, July); and 116 (Plot 4, September) (Figure 7).

There were 32 different pollinator species observed throughout IRW in 2025. Common pollinators observed across all plots included various species of bumblebees and honeybees, hoverflies, cabbage white butterflies, clouded sulfurs, skippers, and pearl crescents. Occasional or seasonal emergent visitors included monarch butterflies, great spangled fritillaries, eastern pine elfins, eastern tailed blues, meadow fritillaries, and golden soldier beetles.

Figure 7: Number of Individual Pollinators Observed at IRW Plots, Monthly (2025)



3. Implementation Techniques/Management Practices

To mitigate for the undesirable species incursions noted in 2023, Plots 2, 3, and 4 were mowed in May 2024 to a 4-inch height and mulched to expedite vegetation breakdown. Follow-up herbicide treatments were conducted on Plots 1 and 2 in May to remove grasses, and later (August) in Plots 1, 2, and 3 to remove problematic broadleaf species (creeping thistle, American pokeweed, and crown vetch). In 2025, a spring herbicide spot spray application using a backpack sprayer with Crossbow (active ingredient [ai]:triclopyr and 2,4-D) was applied to all plots at IRW targeting thistle and common broadleaf species. Observations of Plot 1 noted the growth of thistle and foxtails, but not at a rate or spread requiring corrective action. Plots 2 and 4 did not show any singular problematic species, but feature an overall abundance of undesirable and non-seed mix species that was outcompeting the seed mix coverage. Plot 3 with the PTC Interchange Mix appears to show the most progress with establishment and limiting undesirable species spread, as there were no recommendations for treatment, and the seed mix consistently dominates the areal cover of vegetation. The annual fall mow occurred on October 27, 2025, and included all four plots at IRW.

Table 16 provides a review of the yearly trends for seed mix and pollinator data at IRW since the site planting. Prevalent undesirable species present in 2025 are also provided.

Table 16: Irwin Interchange (IRW)

Seed Mix Plot	Seed Mix Type	# Species in Mix	# Species Observed from Seed Mix			Peak Coverage (percent)[1]			2025 Prevalent Undesirable Species[2] Present	Insect Pollinator Species Richness			Pollinator Species Abundance[3]		
			2023	2024	2025	2023	2024	2025		2023	2024	2025	2023	2024	2025
1	PTC Pollinator ROW Mix	16	5	14	14	35	63	70	thistle, foxtail	3	10	17	Low	Low	Low
2	PTC Monarch Specialty Mix	17	2	10	13	10	26	35	no singular problematic species, but overall non-seed mix species are dominance	6	5	19	Med	Low	Med
3	PTC Pollinator Interchange Mix	19	3	11	19	50	55	73	undesirables present, not requiring control	3	11	12	Low	Low	Med
4	PA Southern Allegheny Plateau Province Upland Meadow Mix (with Nurse Crop)	17	3	11	17	50	26	50	no singular problematic species, but overall non-seed mix species dominance	2	11	22	Low	Low	Med

[1]Peak Coverage – highest percent areal cover of the seed mix during the growing season.
[2] The Summary Data Tables in Appendix B provide the scientific names of the species listed in this column.
[3]Pollinator Abundance (average monthly number of individual pollinators observed over growing season in the plot) – High (>50 pollinators observed), Medium (25-49 pollinators observed), Low (<25 pollinators observed).

Harrisburg West Interchange (HBGW)

The majority of the eight seed mixes (Table 17) are successfully establishing a dense cover of desired species across all plots in Year 3 of monitoring. Cover in Plots 1A, 1B, 1C, 2A, 4, and 5 consisted of a larger majority of seed mix flowering species in the spring and summer, before graminoids (little bluestem and switchgrass) areal cover became the dominant cover in the late summer and fall. In comparison, Plots 2B and 3 generally established less dense seed mix cover (60% rather than 70-85%) than the others, but were still the dominant cover with high seed mix germination rates. This may be due to differences in soil quality and moisture retention, as these plots tended to exhibit effects of drought more than adjacent plots (Plots 1A, 1B, and 1C). Overall, all plots either performed equally or better than previous years, including attracting the highest pollinator species richness since the HBGW's establishment in 2023.

Table 17: Harrisburg West Interchange (HBGW) Plot Seed Mixes

Site	Seed Mix Plot #	Seed Mix in Plot
Harrisburg West Interchange (HBGW)	1A/1B/1C	PTC Pollinator Interchange Mix
	2A	PTC Pollinator ROW Mix
	2B	PTC Pollinator ROW Mix with Nurse Crop
	3	Deer Resistant Meadow Mix #1
	4	Deer Resistant Meadow Mix #2
	5	PTC Monarch Specialty Mix

1. Vegetation Monitoring

A. Seed mix species germination and average areal cover observed during 2025 monthly events

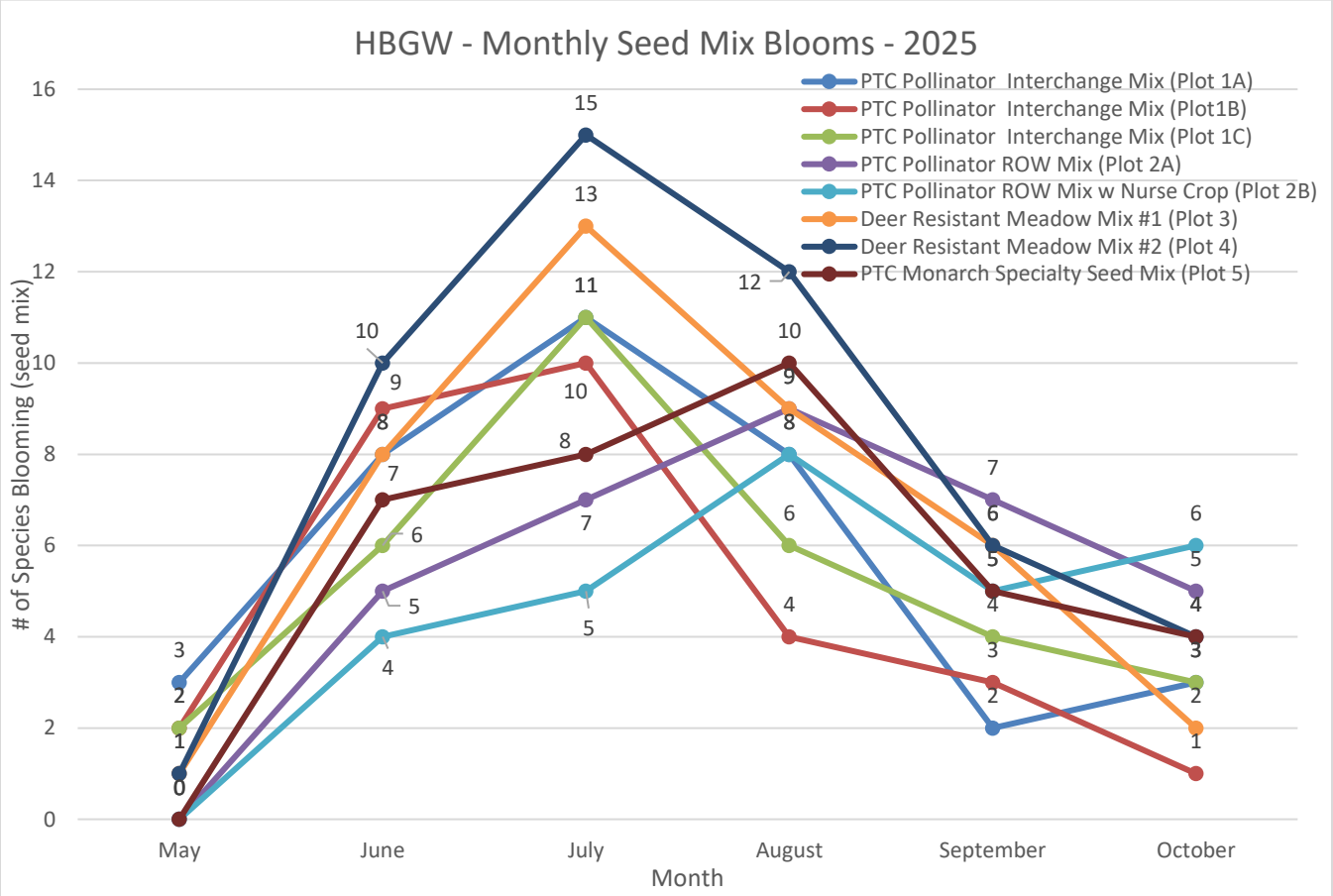
The number of species that germinated from the applied seed mix either remained the same or increased at seven plots since the first year of monitoring in 2023, except for Plot 1B, which decreased by one species. The seed mix in Plot 2A had the highest rate with all 16 species (100%) germinating, followed by Plot 4 with 22 out of 25 species (88%), Plot 1A with 16 out of 19 species (84%), Plot 5 with 14 out of 17 species (81%), Plot 1C with 15 out of 19 species (79%), Plot 1B with 14 out of 19 species (74%), Plot 2B with 13 out of 18 species (72%), and by Plot 3 with 18 out of 28 species (64%) of the seed mix species. A nurse crop species was included in the mix for Plot 2B, which was not expected to remain part of the cover after the initial year of establishment.

During each monthly monitoring event, seed mix areal coverages were noted in each plot to estimate their resistance to incursions of non-seed mix coverage and averaged over the entire monitoring period during the growing season. At HBGW, this demonstrated that the applied seed produced dominant areal coverage in all plots: Plot 1A (72%), Plot 1B (84%), Plot 1C (83%), Plot 2A (72%), Plot 2B (59%), Plot 3 (61%), Plot 4 (86%), and Plot 5 (70%), respectively.

B. When was the highest number of seed mix blooms observed in 2025?

The highest number of seed mix species in bloom occurred in July for Plots 1A, 1B, 1C, 3, and 4; and in August for Plots 2A, 2B, and 5. Plot 4 had the highest number of seed mix species in bloom (15) in July (Figure 8). Typically, when plants are established in Year 1, bloom times will remain consistent during the growing season except when weather conditions vary that influence both soil temperatures and moisture levels. Overall, HBGW had a greater number of blooming species in 2025 than in previous years. This was due in part to a greater number of nectar producing species that colonized the plots.

Figure 8: Monthly Seed Mix Blooming Species at HBGW, Monthly (2025)



C. What were the dominant blooming species in 2025 and trends over the monitoring years?

The dominant blooming species by month for each plot at HBGW in 2025 is provided in Table 18. The yearly trends of dominant blooming species since site planting are provided in Table 19.

Table 18: Dominant Blooming Species* at HBGW By Month - 2025

2025	Plot 1A	Plot 1B	Plot 1C	Plot 2A	Plot 2B	Plot 3	Plot 4	Plot 5
May	oxeye sunflower	oxeye sunflower	**lanceleaf coreopsis**	no blooms	no blooms	lanceleaf coreopsis	lanceleaf coreopsis	no blooms
June	**oxeye sunflower**	**oxeye sunflower**	lanceleaf coreopsis	**oxeye sunflower**	**oxeye sunflower**	**oxeye sunflower**	**greyheaded coneflower, oxeye sunflower**	wild bergamot
July	oxeye sunflower	oxeye sunflower	lanceleaf coreopsis	oxeye sunflower	oxeye sunflower	oxeye sunflower	greyheaded coneflower	**wild bergamot**
Aug.	oxeye sunflower	oxeye sunflower	oxeye sunflower	oxeye sunflower	oxeye sunflower	purple coneflower	greyheaded coneflower	purple coneflower
Sept.	no blooms	heath aster	heath aster	showy tickseed	New England aster, showy tickseed	narrowleaf mountain-mint	hairy mountain mint showy tickseed	yellow wingstem
Oct.	heath aster	heath aster	heath aster	showy tickseed	showy tickseed	heath aster	narrow-leaved sunflower	yellow wingstem

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.
BOLD text denotes the dominant bloom coinciding with the highest pollinator count in each plot in 2025.

Table 19: Yearly Trends of Dominant Blooms* - HBGW

	2023	2024	2025
Plot 1A	blackeyed Susan, partridge pea	blackeyed Susan, lanceleaf coreopsis, wild bergamot,	oxeye sunflower, heath aster
Plot 1B	blackeyed Susan, partridge pea	blackeyed Susan, lanceleaf coreopsis, wild bergamot, butterfly milkweed	oxeye sunflower, heath aster
Plot 1C	blackeyed Susan, partridge pea	blackeyed Susan, lanceleaf coreopsis, wild bergamot,	lanceleaf coreopsis, oxeye sunflower, heath aster
Plot 2A	partridge pea	blackeyed Susan	oxeye sunflower, showy tickseed
Plot 2B	blackeyed Susan	blackeyed Susan	oxeye sunflower, showy tickseed, New England aster
Plot 3	lanceleaf coreopsis, oxeye sunflower, purple coneflower	lanceleaf coreopsis, oxeye sunflower, purple coneflower	lanceleaf coreopsis, oxeye sunflower, purple coneflower, narrowleaf mountainmint, heath aster

	2023	2024	2025
Plot 4	oxeye sunflower, blackeyed Susan, bearded beggartick	oxeye sunflower, blackeyed Susan, wild bergamot, greyheaded coneflower,	oxeye sunflower, greyheaded coneflower, hairy mountain mint, showy tickseed, narrow-leaved sunflower, lanceleaf coreopsis,
Plot 5	blackeyed Susan, partridge pea, butterfly milkweed	blackeyed Susan, partridge pea, butterfly milkweed, swamp milkweed, wild bergamot, purple coneflower, yellow wingstem	wild bergamot, purple coneflower, yellow wingstem
Text Color: Blue – 1st year emergent; Orange – 2nd year emergent; Plum – 3rd year emergent, Black – 4th year emergent			

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.

D. Were undesirable species/invasive species present, and what change occurred over previous years?

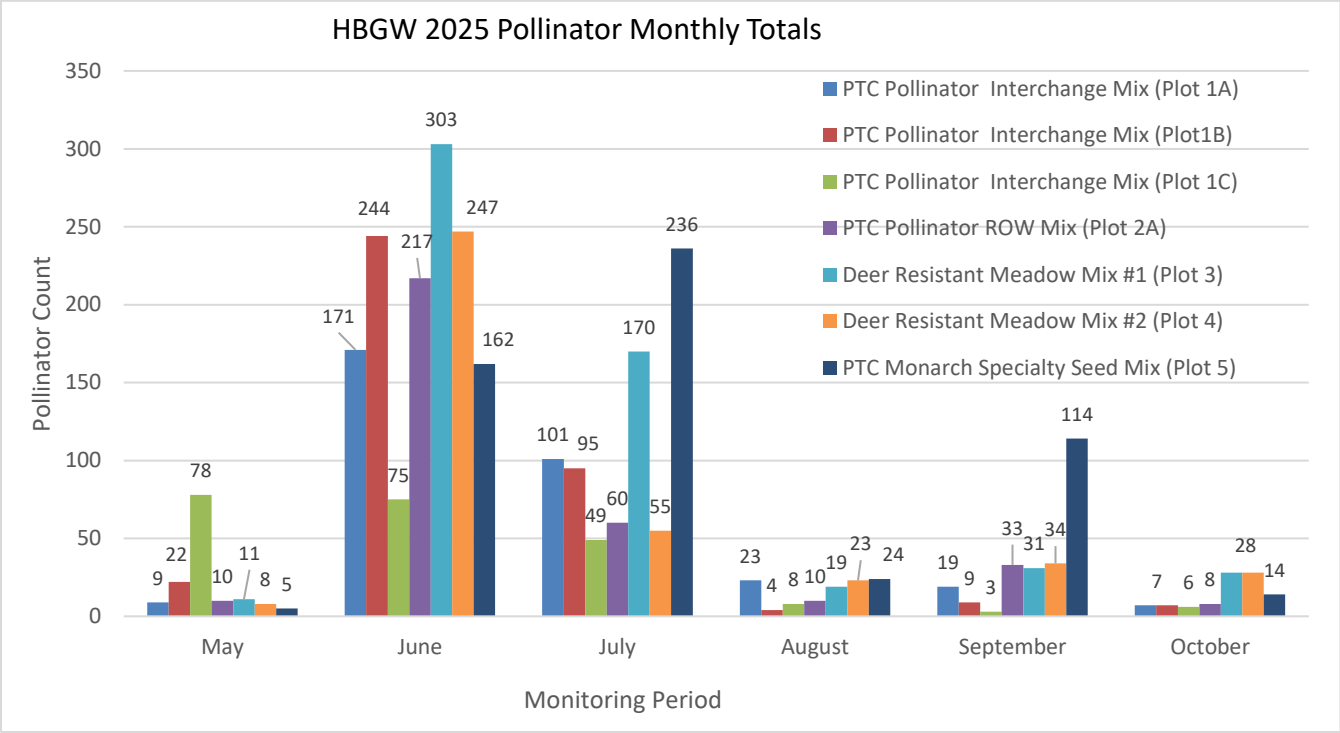
Prevalent undesirable species observed in 2025 consisted largely of crown vetch, American pokeweed, tree-of-heaven, Canada thistle, English plantain, yellow toadflax (butter and eggs), black locust, and staghorn sumac. Crown vetch is typically thickest around the plot perimeters where it borders areas that have not been chemically treated with the exception of Plot 2B, which has interior patches of crown vetch. Plot 5 has been most susceptible to incursions of undesirable species due to the high degree of edge versus interior habitat associated with its narrow profile. Previously, Japanese bristle grass and foxtail grasses were dominant in 2023, but incursions in 2024 reflect those noted above that were observed in 2025.

2. Pollinator Monitoring

Plots 1A, 1B, 2A, 3, 4 and 5 at HBGW were rated as having a *High* pollinator presence throughout the year, while Plots 1C and 2B had a *Medium* pollinator presence. Pollinator richness varied between plots, but typically ranged from 14 to 15 different species. Individual pollinator counts varied widely between monitoring events and plot locations. The highest individual pollinator count for each site is as follows: 171 (Plot 1A, June); 244 (Plot 1B, June); 78 (Plot 1C, May); 217 (Plot 2A, June); 159 (Plot 2B, June); 303 (Plot 3, June); 247 (Plot 4, June) and 236 (Plot 5, July; Figure 9).

There were 35 different pollinator species observed at HBGW in 2025. Common pollinators observed across all plots included, various species of bumblebees and honeybees, carpenter bees, hoverflies, cabbage white butterfly, yellow jacket, clouded and cloudless sulphurs, silver spotted skippers, Eastern tailed blues, and monarchs. Occasional or seasonal emergent visitors included ruby throated hummingbird, painted lady, tiger swallowtail, wild indigo duskywing, false milkweed beetle, stolid wasps, comma/question mark butterflies, orange sulphur, spicebush swallowtail, red spotted purple, and mud daubers.

Figure 9: Number of Individual Pollinators Observed at HBGW Plots, Monthly (2025)



3. Implementation Techniques/Management Practices

HBGW Plots 1A, 1B, 1C, 2A, 2B, and 5 received a spot spray herbicide application of Milestone® in mid-July. These applications were conducted using a backpack sprayer and were primarily targeting crown vetch, yellow toadflax, American pokeweed, tree-of-heaven, and staghorn sumac. No additional herbicide treatments were completed during 2025, and Plots 3 and 4 were not targeted with any herbicide. Annual fall mowing occurred on October 29, 2025, across all sites at HBGW. Initially, Plots 2A and 2B received a herbicide treatment targeting grasses in 2023, and a variety of undesirable species were manually removed from Plot 5. Herbicide treatments in 2024 targeted similar species to those noted in 2025. Table 20 provides a review of the yearly trends for seed mix and pollinator data at HBGW since the site planting. Prevalent undesirable species present in 2025 are also provided.

Table 20: Harrisburg West Interchange (HBGW)

Seed Mix Plot	Seed Mix Type	# Species in Mix	# Species Observed from Seed Mix			Peak Coverage (percent)[1]			2024 Prevalent Undesirable Species[2] Present	Pollinator Species Richness (# of Species)			Pollinator Abundance[3] (# of Individuals)		
			2023	2024	2025	2023	2024	2025		2023	2024	2025	2023	2024	2025
1A	PTC Pollinator Interchange Seed Mix	19	5	15	16	29	83	85	crown vetch, pokeweed, tree-of-heaven, staghorn sumac (beneficial, but not goal of herbaceous plot), yellow foxtail	8	7	24	Medium	Low	High
1B	PTC Pollinator Interchange Seed Mix	19	5	15	14	29	86	94	crown vetch	8	9	15	Medium	Low	High
1C	PTC Pollinator Interchange Seed Mix	19	5	14	15	29	85	88	crown vetch, tree-of-heaven, trumpet vine	8	6	17	Medium	Low	Medium
2A	PTC Pollinator ROW Mix	16	5	15	16	36	66	82	crown vetch, Canada thistle, staghorn sumac (beneficial, but not goal of herbaceous plot), pokeweed, bristle grass, tree-of-heaven, black locust	9	13	15	Low	Low	High
2B	PTC Pollinator ROW Mix with Nurse Crop	18	3	13	13	100	66	68	crown vetch, English plantain, Canada thistle	4	5	15	Low	Low	Medium
3	Deer Resistant Meadow Mix #1	28	4	13	18	60	88	69	crown vetch, English plantain, Canada thistle	13	8	22	Medium	Low	High
4	Deer Resistant Meadow Mix #2	25	9	20	22	90	93	94	crown vetch, Canada thistle, pokeweed, black locust	13	9	22	Low	Low	High
5	PTC Monarch Specialty Seed Mix	17	6	14	14	70	72	81	crown vetch, pokeweed, Canada thistle, butter and eggs, staghorn sumac (beneficial, but not goal of herbaceous plot)	12	17	21	Low	Low	High

[1]Peak Coverage – highest percent areal cover of the seed mix during the growing season.
[2] The Summary Data Tables in Appendix B provide the scientific names of the species listed in this column.
[3]Pollinator Abundance (average monthly number of individual pollinators observed over growing season in the plot) – High (>50 pollinators observed), Medium (25-49 pollinators observed), Low (<25 pollinators observed).

Bensalem Interchange (BEN)

Year 3 of monitoring at BEN demonstrated that the majority of the five plots are developing a dense seed mix cover with a variety of flowering and grass species. Specifically, Plots 1, 2A, 2B, and 4 displayed the majority of flowering species in the spring and early summer months, with plots transitioning to graminoid-dominated plots mid-summer through the fall. Flowering plants were concentrated primarily in the western ends of Plots 1, 2A, and 4 with the rest of the plots dominated by graminoids or non-seed mix species for most of the growing season. Plot 2B was almost entirely dominated by graminoid plants for much of the growing season, and displayed the lowest number of seed mix species; this may be related to why monitors observed the fewest species of pollinators in the plot in comparison to the others. Finally, Plot 3 was the only plot which maintained a dominant cover of flowering seed mix species throughout the growing season, with blooms of showy tickseed, sawtooth sunflower, and swamp milkweed noted in October. Table 21 provides the list of plots and associated seed mixes at BEN.

Table 21: Bensalem Interchange (BEN) Plot Seed Mixes

Site	Seed Mix Plot #	Seed Mix in Plot
Bensalem Interchange (BEN)	1	PTC Pollinator ROW Mix
	2A	2023 PennDOT Pollinator Habitat Mix
	2B	Modified PennDOT Pollinator Habitat Mix
	3	PTC Wet Habitat Mix
	4	PTC Pollinator Interchange Mix

1. Vegetation Monitoring

A. Seed mix species germination and average areal cover observed during 2025 monthly events

All germination rates for plots in 2025 were higher than in Year 1 of monitoring (2023). However, in comparison to 2024, the number of species that germinated in 2025 from the applied seed mix decreased or remained constant in all plots (except for Plot 2A, which increased from 16 to 19 species).

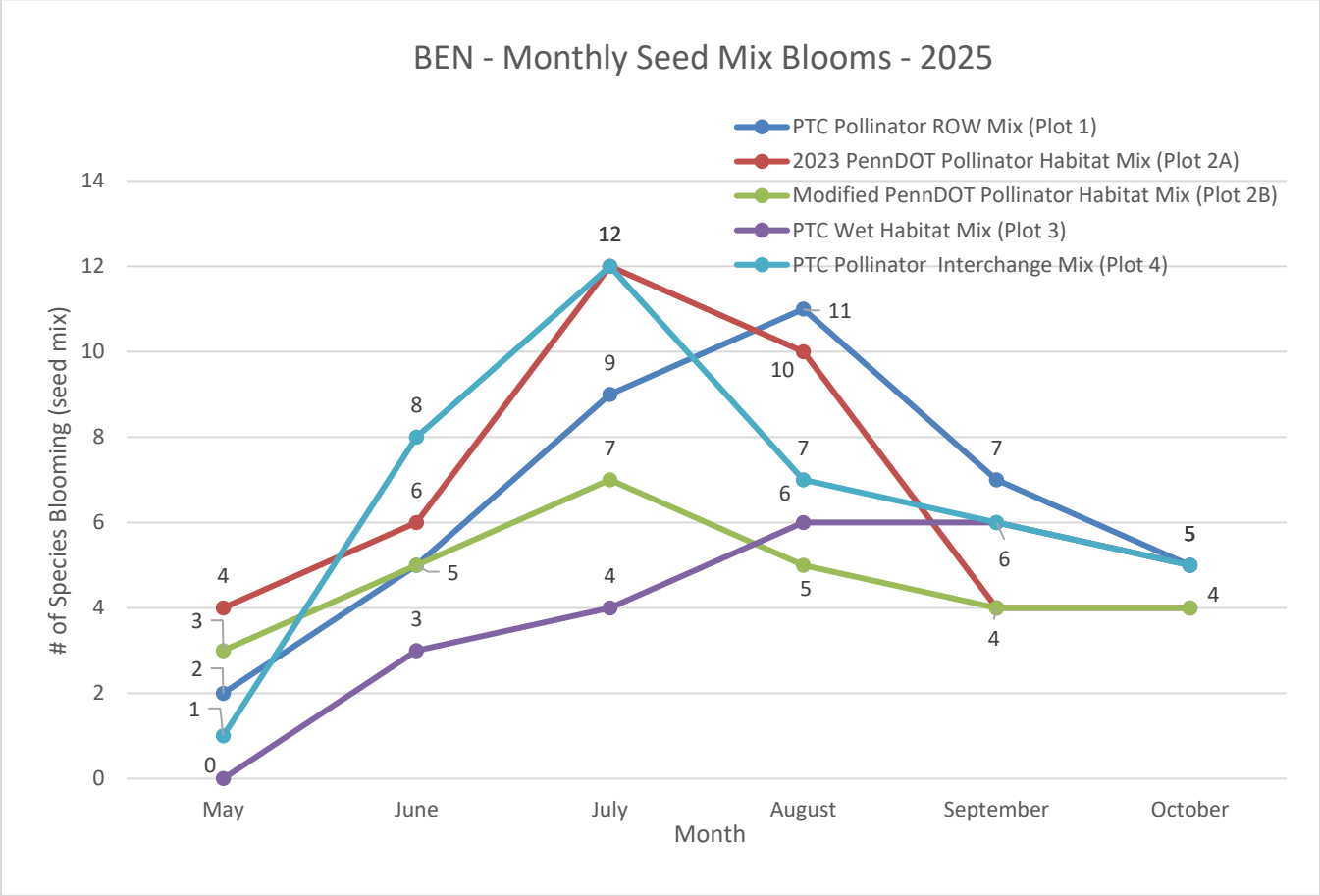
In 2025, the seed mix in Plot 1 had the highest germination success rate, as it did in 2024, of 14 out of 16 species (87%), followed by Plot 4 with 16 out of 19 species (84%), Plot 2A with 19 out of 24 species (79%), Plot 2B with 12 out of 19 species (63%), and Plot 3 with 14 out of 23 species (61%) of the seed mix species observed.

During each monthly monitoring event, seed mix areal coverages were noted in each plot to estimate their resistance to incursions of non-seed mix coverage and was averaged over the entire monitoring period during the growing season. In 2025, this demonstrated at BEN that the applied seed produced dominant areal coverage in all plots: Plot 1 (67%), Plot 2A (61%), Plot 2B (54%), Plot 3 (75%), and Plot 4 (60%).

B. When was the highest number of seed mix blooms observed in 2025?

The highest number of seed mix species in bloom occurred in July for Plots 2A, 2B, and 4; in August for Plot 1; and in August/September for Plot 3 (Figure 10).

Figure 10: Monthly Seed Mix Blooming Species at BEN, Monthly (2025)



C. What were the dominant blooming species in 2025 and trends over the monitoring years?

The dominant blooming species by month for each plot at BEN in 2025 is provided in Table 22. The yearly trends of dominant blooming species since site planting are provided in Table 23.

Table 22: Dominant Blooming Species* at BEN By Month - 2025

2025	Plot 1A	Plot 2A	Plot 2B	Plot 3	Plot 4
May	oxeye sunflower	tall white beardtongue	tall white beardtongue	no blooms	lanceleaf coreopsis
June	blackeyed Susan	blackeyed Susan	**blackeyed Susan**	swamp milkweed	wild bergamot
July	oxeye sunflower, partridge pea	**wild bergamot, oxeye sunflower**	wild bergamot	swamp milkweed	**lanceleaf coreopsis**

2025	Plot 1A	Plot 2A	Plot 2B	Plot 3	Plot 4
Aug.	partridge pea	oxeye sunflower	blackeyed Susan, purple coneflower	showy tickseed	lanceleaf coreopsis
Sept.	**showy tickseed, New England aster, blackeyed Susan, narrowleaf mountainmint**	common boneset	common boneset	**showy tickseed**	lanceleaf coreopsis
Oct.	no blooms	common boneset	common boneset	sawtooth sunflower, showy tickseed	lanceleaf coreopsis

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.
BOLD text denotes the dominant bloom coinciding with the highest pollinator count in each plot in 2025.

Table 23: Yearly Trends of Dominant Blooms* - BEN

	2023	2024	2025
Plot 1	blackeyed Susan, showy tickseed	blackeyed Susan, butterfly milkweed, oxeye sunflower	blackeyed Susan, showy tickseed, oxeye sunflower, partridge pea, New England aster, narrowleaf mountainmint
Plot 2A	partridge pea	blackeyed Susan, lanceleaf coreopsis, common boneset, oxeye sunflower	blackeyed Susan, tall white beardtongue, wild bergamot, purple coneflower, common boneset
Plot 2B	partridge pea blackeyed Susan	blackeyed Susan, swamp milkweed, wild bergamot, showy tickseed, common boneset	blackeyed Susan, wild bergamot, common boneset, purple coneflower tall white beardtongue
Plot 3	showy tickseed, sawtooth sunflower	showy tickseed, sawtooth sunflower, swamp milkweed, tall white beardtongue	showy tickseed, sawtooth sunflower, swamp milkweed
Plot 4	blackeyed Susan	blackeyed Susan, oxeye sunflower, lanceleaf coreopsis	lanceleaf coreopsis, wild bergamot
Text Color: Blue – 1st year emergent; Orange – 2nd year emergent; Plum – 3rd year emergent, Black – 4th year emergent			

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.

D. Presence of undesirable species, change from previous years

Significant efforts were made in 2023 to address undesirable and invasive species within all of the BEN plots. Porcelain berry and American pokeweed were the focus of treatments, but a backpack spot spray was also completed to control the growth of non-seed mix graminoid species. These efforts were largely unsuccessful at the time.

In 2024, additional treatments were completed to target American pokeweed (twice) and porcelain berry (once) during the growing season. While the treatments did not eradicate these species, they were not observed as a dominant cover in the plots. Burnweed was the only species noted as dominant in 2024, and was contained in Plots 2A and 2B.

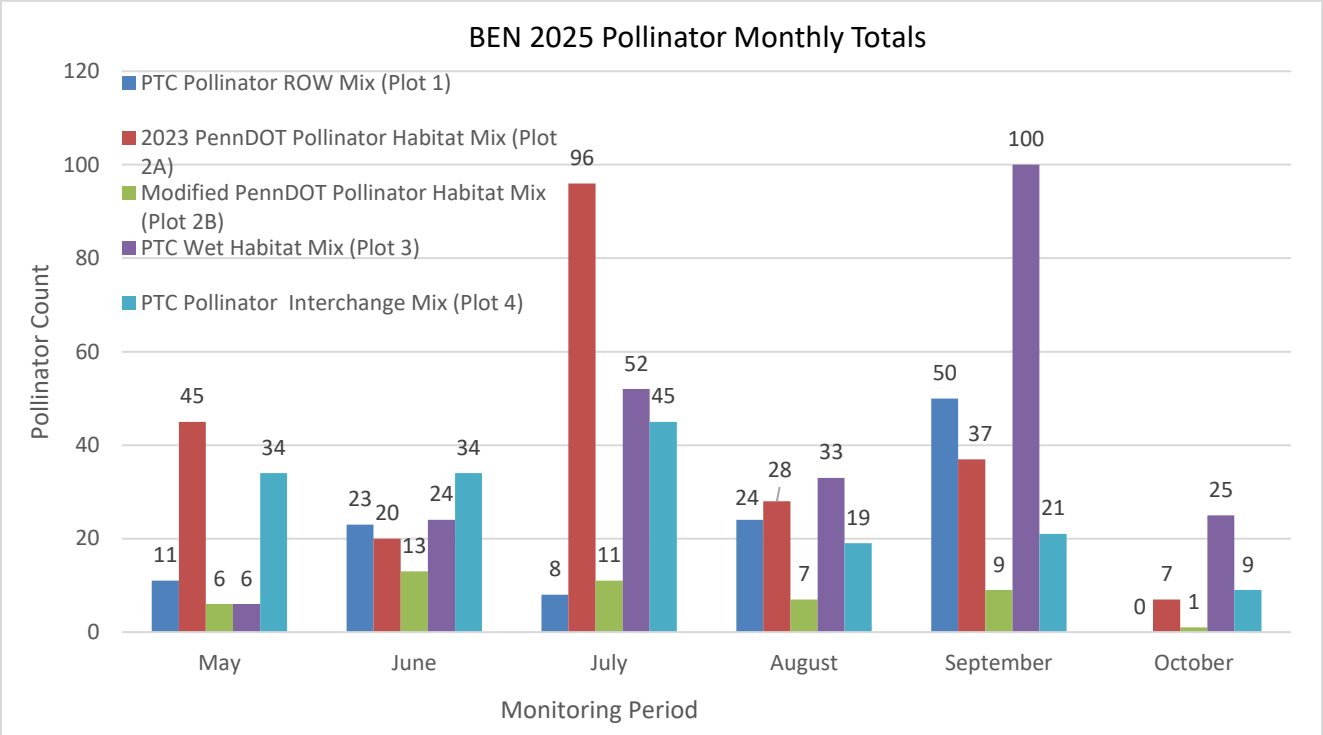
In 2025, prevalent undesirable species consisted largely of porcelain berry in all plots (except Plot 3), crown vetch in Plot 1, and creeping thistle and pokeweed in Plot 2B. The main undesirable species observed in Plot 3 was purple loosestrife, while Plot 4 contained pokeweed. In general, these species have been consistently found in the plots over the years, but have not developed a dominant cover. As noted below, herbicide applications have been employed to continually manage undesirable and invasive species.

2. Pollinator Monitoring

Overall pollinator presence throughout the 2025 growing season was *Medium* for Plots 2A, 3, and 4; and *Low* for Plots 1 and 2B. Pollinator richness varied between plots, but typically ranged between ten and 17 different species. Individual pollinator counts varied widely between monitoring events and plot locations. The highest count for each site is as follows: 50 (Plot 1, September), 96 (Plot 2A, July), 13 (Plot 2B, June); 100 (Plot 3, September), and 45 (Plot 4, July).

Twenty-five different pollinator species were observed at BEN in 2025. Common pollinators observed across all plots included various species of bumblebees and honeybees, cabbage white butterflies, cloudless sulphurs, grass skippers, monarch butterflies, and hoverflies. Occasional or seasonal emergent visitors included clouded sulphurs, common buckeyes, golden soldier beetles, orange sulphurs, indigo duskywing butterflies, red milkweed beetles, silver spotted/spotted skippers, soldier beetles, sootywing butterflies, yellow sulphurs, eastern tiger swallowtail butterflies, fireflies, eastern tailed blue butterflies, field skippers, and swamp milkweed leaf beetles.

Figure 11: Number of Individual Pollinators Observed at BEN Plots, Monthly (2025)



3. Implementation Techniques/Management Practices

In the 2025 growing season, all BEN plots received a spot spray herbicide application of Vision in May, an application of Roundup QuikPRO® in July, and an application of Milestone® in October. These applications were conducted using target spot spraying, and were primarily targeting pokeweed, porcelain berry, chickweed, common broadleaf, thistle, and purple loosestrife. Additionally, Plot 1 received an application of Fusilade in July, targeting selective grass species. Annual fall mowing occurred in November (11/06/2025) across all plots at BEN except Plot 1, which was too wet at the time of mowing. Table 24 provides a review of the yearly trends for seed mix and pollinator data at BEN since the site planting. Prevalent undesirable species present in 2025 are also provided.

Table 24: Bensalem Interchange (BEN)

Seed Mix Plot	Seed Mix Type	# Species in Mix	# Species Observed from Seed Mix			Peak Coverage (percent)[1]			2024 Prevalent Undesirable Species[2] Present	Pollinator Species Richness (# of Species)			Pollinator Abundance[3] (# of Individuals)		
			2023	2024	2025	2023	2024	2025		2023	2024	2025	2023	2024	2025
1	PTC Pollinator ROW Mix	16	8	15	14	33	65	78	porcelain berry, crown vetch	13	12	14	Medium	Medium	Low
2A	2023 PennDOT Pollinator Habitat Mix	24	12	16	19	66	70	86	porcelain berry	16	11	17	Low	Low	Medium
2B	Modified PennDOT Pollinator Habitat Mix	19	9	13	12	15	41	81	creeping thistle, porcelain berry, pokeweed	9	13	10	Low	Low	Low
3	PTC Wet Habitat Mix	23	6	17	14	97	76	89	purple loosestrife	9	12	15	Low	Medium	Medium
4	PTC Pollinator Interchange Mix	19	6	16	16	40	67	65	porcelain berry, pokeweed	8	13	17	Low	Medium	Medium

[1]Peak Coverage – highest percent areal cover of the seed mix during the growing season.
[2] The Summary Data Tables in Appendix B provide the scientific names of the species listed in this column.
[3]Pollinator Abundance (average monthly number of individual pollinators observed over growing season in the plot) – High (>50 pollinators observed), Medium (25-49 pollinators observed), Low (<25 pollinators observed).

Allentown Service Plaza (ASP)

Year 2 of development at ASP was marked by robust growth sitewide. The central plaza plots (Plots 1, 2, and 3) were dense with seed mix species that collectively reach 5 to 6 feet in height by the end of the fall season. The distal plots 4, 5, and 7 also saw robust growth in 2025, but seed mix composition was the lowest of the plots. Distal plot 6, bordered by a tree line, had full areal coverage of vegetation, but was short in growth stature, averaging around 3-foot in height. Table 25 provides the list of plots and associated seed mixes at ASP.

Table 25: Allentown Service Plaza (ASP) Plot Seed Mixes

Site	Seed Mix Plot #	Seed Mix in Plot
Allentown Service Plaza (ASP)	1	PTC Monarch Specialty Mix
	2	PTC Wet Habitat Mix
	3	PTC Pollinator ROW Mix
	4	PTC Pollinator Interchange Mix
	5	PTC Pollinator Interchange Mix
	6	Deer Resistant Meadow Mix #1
	7	PTC Pollinator Interchange Mix

1. Vegetation Monitoring

A. Seed mix species germination and average areal cover observed during 2025 monthly events.

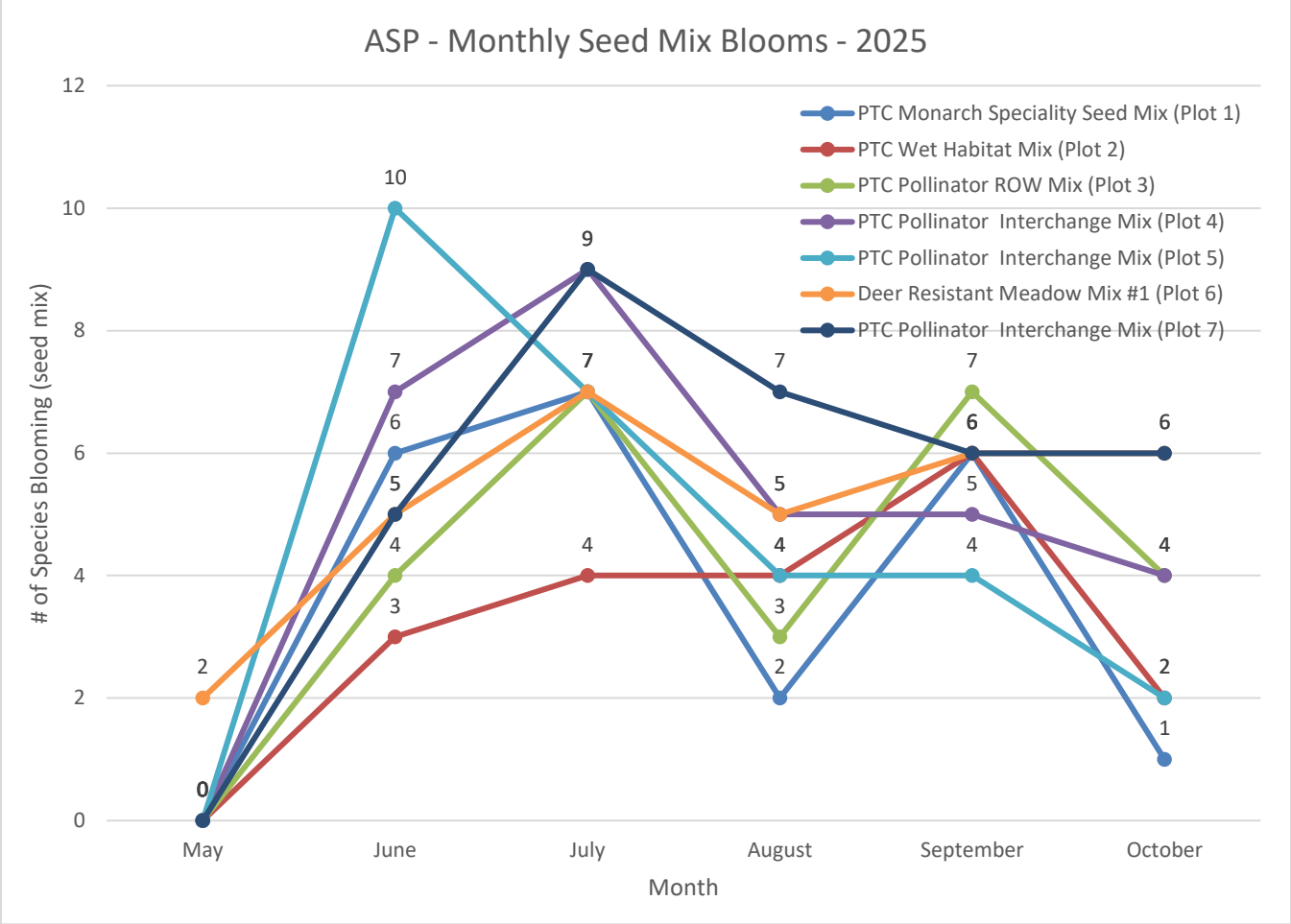
The number of species that germinated from the seed mix nearly doubled at all seven sites at ASP between 2024 and 2025. Plots 1 and 3 produced every species in the seed mix, while only one or two species were not observed from the desired mixes in Plots 4, 5, and 7. Plots 2 and 6 produced approximately 70 percent of the seed mix species. The data tables in Appendix B provide a list of seed mix species that were not seen in the year 2025.

During each monitoring event, seed mix coverage was calculated for each plot to determine the competition between seed mix and non-seed mix coverage. The monthly percent cover of seed mix species was later averaged across the growing season to get an overall estimate of seed mix presence at each plot, which resulted in the following: Plot 1 (66%), Plot 2 (78%), Plot 3 (85%), Plot 4 (65%), Plot 6 (68%), and Plot 7 (60%).

B. When was the highest number of seed mix blooms observed in 2025?

The highest number of seed mix species in bloom occurred in June for Plot 5; July for Plots 1, 3, 4, 6, and 7; and September for Plots 2 and 3 (Figure 12). In 2024, Year 1 of site development, September held the highest number of seed mix blooms for all plots.

Figure 12: Monthly Seed Mix Blooming Species at ASP, Monthly (2025)



C. <u>What were the dominant blooming species in 2025 and trends over the monitoring years?</u>

The dominant blooming species by month for each plot at ASP in 2025 is provided in Table 26. The yearly trends of dominant blooming species since site planting are provided in Table 27.

Table 26: Dominant Blooming Species* at ASP By Month - 2025

2025	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7
May	no blooms	no blooms	no blooms	no blooms	no blooms	lanceleaf coreopsis	no blooms
June	**blackeyed Susan**	swamp milkweed	oxeye sunflower	**oxeye sunflower**	blackeyed Susan	blackeyed Susan	blackeyed Susan
July	blackeyed Susan	swamp milkweed	blackeyed Susan	oxeye sunflower, blackeyed Susan	wild bergamot	blackeyed Susan	blackeyed Susan
Aug.	narrowleaf mountainmint	New England aster	oxeye sunflower	lanceleaf coreopsis, swamp milkweed	**oxeye sunflower**	**blackeyed Susan**	blackeyed Susan

2025	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7
Sept.	yellow wingstem, swamp milkweed	showy tickseed	showy tickseed	blackeyed Susan	blackeyed Susan	browneyed Susan	showy ticktrefoil
Oct.	early goldenrod	**common boneset**	**New England aster**	heath aster, narrowleaf mountainmint	blackeyed Susan	browneyed Susan	**wild bergamot**

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.
BOLD text denotes the dominant bloom coinciding with the highest pollinator count in each plot in 2025.

Table 27: Yearly Trends of Dominant Blooms* - ASP

	2024	2025
Plot 1	butterfly milkweed, blackeyed Susan	blackeyed Susan, narrowleaf mountainmint, yellow wingstem, swamp milkweed, early goldenrod
Plot 2	showy tickseed	showy tickseed, swamp milkweed, New England aster, common boneset
Plot 3	butterfly milkweed, showy tickseed	showy tickseed, oxeye sunflower, blackeyed Susan, New England aster
Plot 4	butterfly milkweed, partridge pea	oxeye sunflower, blackeyed Susan, lanceleaf coreopsis, swamp milkweed, heath aster, narrowleaf mountain mint
Plot 5	blackeyed Susan	blackeyed Susan, wild bergamot, oxeye sunflower
Plot 6	wild senna, blackeyed Susan	blackeyed Susan, lanceleaf coreopsis, browneyed susan
Plot 7	partridge pea	blackeyed Susan, showy tickseed, wild bergamot
Text Color: Blue – 1st year emergent; Orange – 2nd year emergent; Plum – 3rd year emergent, Black – 4th year emergent		

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.

D. Were undesirable species/invasive species present, and what change occurred over previous years?

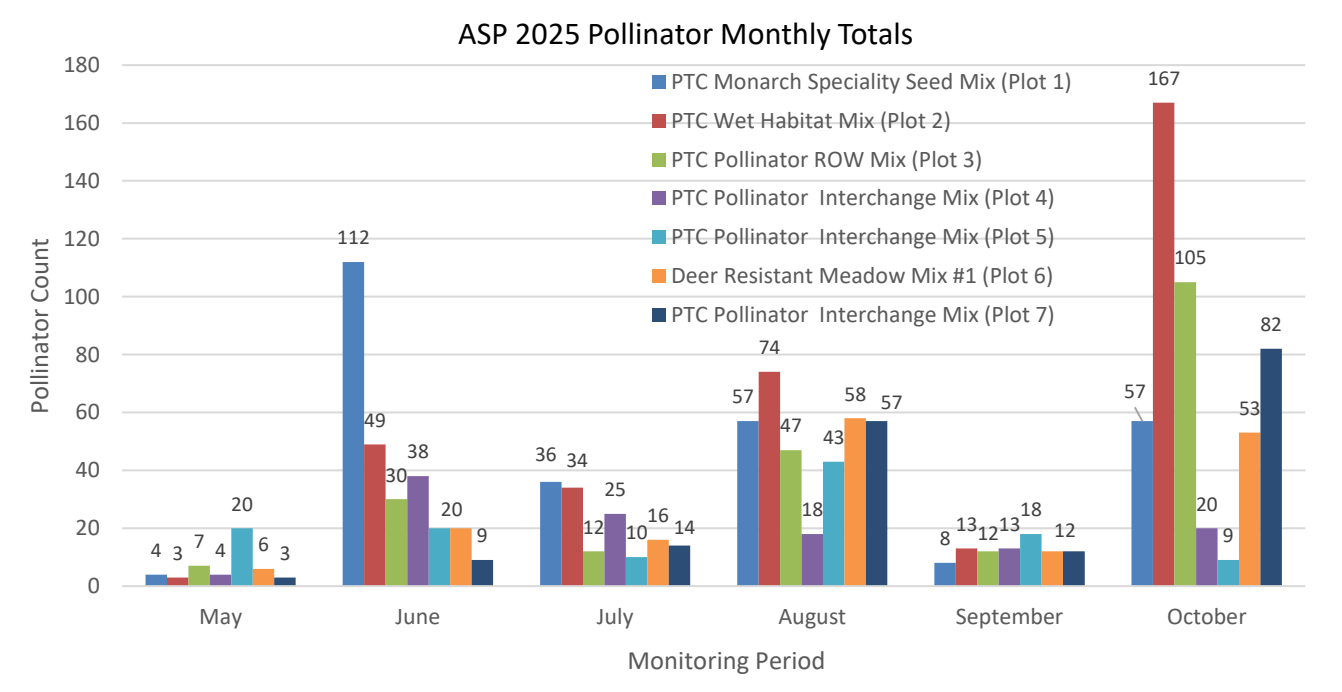
Prevalent undesirable species observed in 2024 included American pokeweed and Canada thistle in all plots except for Plot 2. Plots 4, 5, and 7 had additional grass species, including barnyard grass, foxtail, Japanese bristlegrass, and crabgrass. Plot 6 had a large presence of bindweed. These species were consistently present at varying levels throughout the plots, and were actively managed using herbicides. New to the plots in 2025, staghorn sumac was treated in Plots 1, 2, and 3; and mugwort was treated in Plots 4 and 5. Although staghorn sumac is native and considered a beneficial tree, maintaining herbaceous plots was the design of this habitat, and therefore required removal.

2. Pollinator Monitoring

All of the plots at ASP had a *Medium* pollinator presence throughout the year, except for Plot 2 (*High*) and Plot 4 (*Low*). Pollinator richness varied between plots, but typically ranged between 13 and 17 different species. Individual pollinator counts varied widely between monitoring events and plot locations. The highest counts for each site are as follows: 112 (Plot 1, June), 167 (Plot 2, Oct); 105 (Plot 3, Oct); 38 (Plot 4, June), 43 (Plot 5, Aug), 58 (Plot 6, Aug), and 82 (Plot 7, Oct; Figure 13).

There were 32 different pollinator species observed at ASP in 2025. Common pollinators observed across all plots included various species of bumblebees and honeybees, carpenter bees, hoverflies, cabbage white butterflies, clouded sulfurs, orange sulfurs, skippers, and ladybugs. Occasional or seasonal emergent visitors included false milkweed beetles, large milkweed bugs, lacewings, common blue butterflies, monarch butterflies, black swallowtail butterflies, great spangled fritillaries, spicebush swallowtails, common buckeyes, sachems, pearl crescents, indigo duskywings, and peppered moths.

Figure 13: Number of Individual Pollinators Observed at ASP Plots, Monthly (2025)



3. Implementation Techniques/Management Practices

At the beginning of the growing season, two applications of pre-emergent herbicide were used on all seven plots at Allentown. This is the first time a pre-emergent application has been used in the pollinator pilot program. The granule application was a combined herbicide (.22 Dimension) and 0-0-7 fertilizer, with the primary target to suppress the growth of common grasses, such as crabgrass, foxtails, and barnyard grass prior to germination. Pre-emergents work by creating a chemical barrier within the top layer of the soil

that prevents weed seeds from germinating. At ASP, the common targets for this herbicide were foxtail (*Setaria. verdi* and *S. faberi*), barnyard grass (*Echinochloa. crus-galli*), and chickweed (*Stellaria* sp.). The effectiveness of the pre-emergent granules at suppressing grass growth at ASP is indeterminate. Plots 4, 5, and 7 with a steady growth of foxtails and barnyard grass in 2024 show continued growth of these species in 2025. The additions of mugwort and late thoroughwort to Plots 4 and 5 could suggest some effective grass suppression, as these species are not targeted by the pre-emergent granules. In the beginning of June, two foliar herbicide spot spray applications using Vision (ai: dicambia) and Lontrel (ai: clopyralid) were conducted at all seven plots and targeted the following species: pokeweed, chickweed, thistle, and common broadleaves. These applications were conducted using a backpack sprayer. The degenerative effects of the spot spray herbicide on thistle and pokeweed were observed in July. By fall, the presence of these species was greatly reduced and, if present, was likely overtopped by the robust seed mix growth. Annual fall mowing occurred in November (11/07/2025) across all plots at ASP except Plots 6 and 7. Table 28 provides a review of the yearly trends for seed mix and pollinator data at ASP since the site planting. Prevalent undesirable species present in 2025 are also provided.

Table 28: Allentown Service Plaza (ASP) - Full Monitoring Summary

Seed Mix Plot	Seed Mix Type (# of species)	#Species in Mix	# Species Observed in Mix		Peak Coverage (percent)[1]		2025 Prevalent Undesirable Species[2] Present	Pollinator Species Richness (# of Species)		Pollinator Abundance[3] (# of Individuals)	
			2024	2025	2024	2025		2024	2025	2024	2025
1	PTC Monarch Specialty Mix	17	10	17	63	89	Canada thistle, American pokeweed, staghorn sumac	7	17	Medium	Medium
2	PTC Wet Habitat Mix	23	8	16	81	86	Canada thistle, staghorn sumac	7	13	High	High
3	PTC Pollinator ROW Mix	16	9	16	46	92	Canada thistle, American pokeweed, staghorn sumac	8	15	High	Medium
4	PTC Pollinator Interchange Mix	19	8	18	24	85	Canada thistle, American pokeweed, foxtail, mugwort, bindweed, staghorn sumac	5	17	Low	Low
5	PTC Pollinator Interchange Mix	19	9	17	36	66	Canada thistle, American pokeweed, mugwort, staghorn sumac	4	13	Low	Medium
6	Deer Resistant Meadow Mix #1	27	8	19	59	81	Canada thistle, American pokeweed, bindweed	6	14	Medium	Medium
7	PTC Pollinator Interchange Mix	19	9	17	29	68	Canada thistle, American pokeweed	2	13	Low	Medium

[1]Peak Coverage – highest percent areal cover of the seed mix during the growing season.
[2] The Summary Data Tables in Appendix B provide the scientific names of the species listed in this column.
[3] Pollinator Abundance (average monthly number of individual pollinators observed over growing season in the plot) – High (>50 pollinators observed), Medium (25-49 pollinators observed), Low (<25 pollinators observed).

T-168.4 Salt Shed Westbound (SS)

Originally designed to manage stormwater runoff from the adjacent salt shed lot, the T-168.4 Salt Shed Westbound (SS) site was seeded in 2024 and monitored for the pollinator habitat program in 2025. SS is located north of I-76 within the Sideling Hill mountain range. It is surrounded by wooded mountain land but receives direct sunlight for the majority of the day. The overall site is in the shape of a long triangle, with three bays outlined and separated by rock-lined channels. The largest and westernmost bay is Plot 1, followed by Plot 2 in the middle, and Plot 3 at the far eastern point of the site. Plot 3 is the smallest of the plots, and has the most pressure of undesirable incursion when compared to the other two plots. Perennial ryegrass and switchgrass contributed as the dominant seed mix cover in Year 1 of site development. A few seed mix blooms were available throughout the season, but at very low percentages. Bare areas were noted where mulch piles from compost filter socks were left behind after construction. However, once the fall mowing was completed in October, the mulch was thinned out and scattered to allow for colonization in 2026.

Results of the five Full monthly monitoring events of 2025 (May-October) are provided below, with detailed calculations of the field data tabulated in the summary table in Appendix B. Table 29 provides the list of plots and associated seed mixes at SS.

Table 29: T-168.4 Salt Shed Westbound (SS) Plot Seed Mixes

Site	Seed Mix Plot #	Seed Mix in Plot
T-168.4 Salt Shed Westbound (SS)	1	Short Native Grass Mix
	2	Short Native Grass Mix
	3	Short Native Grass Mix

1. Vegetation Monitoring

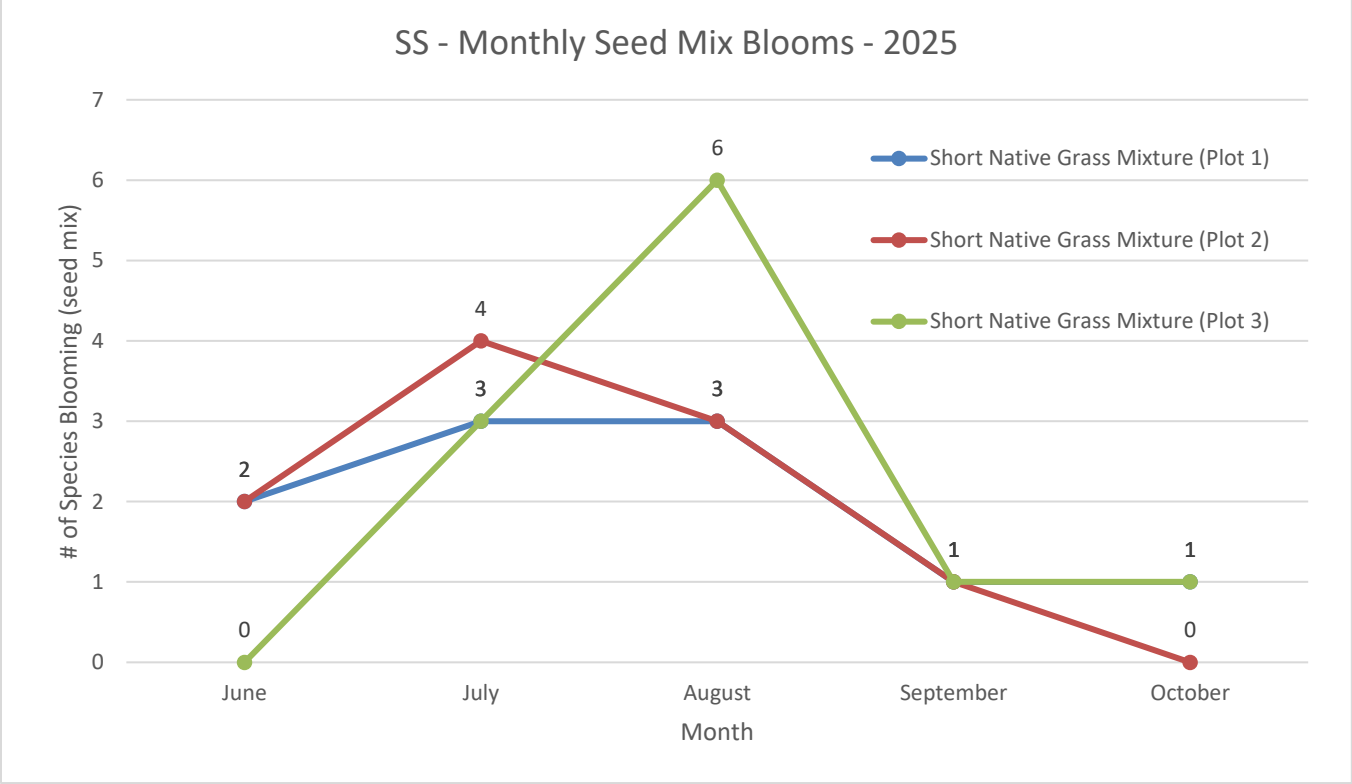
A. Seed mix species germination and average areal cover observed during 2025 monthly events

For the first year of monitoring, the germination rate of seed mix species across all three plots was consistent at 63 percent (five out of eight). Seed mix coverage was calculated to determine the competition between seed mix and non-seed mix coverage. The monthly percent cover of seed mix species was later averaged across the growing season to get an overall estimate of seed mix presence at each plot, which resulted in the following: Plot 1 (57%), Plot 2 (60%), and Plot 3 (19%).

B. When was the highest number of seed mix blooms observed in 2025?

The highest number of seed mix species in bloom occurred in July and August for Plot 1, in July for Plot 2, and in August for Plot 3 (Figure 14).

Figure 14: Monthly Seed Mix Blooming Species at SS, Monthly (2025)



C. What were the dominant blooming species in 2025?

The dominant blooming species by month for each plot at SS in 2025 are provided in Table 30.

Table 30: Dominant Blooming Species* at SS By Month - 2025

2025	Plot 1	Plot 2	Plot 3
June	blackeyed Susan	blackeyed Susan	no blooms
July	purple coneflower	**plains coreopsis**	**plains coreopsis**
Aug.	**purple coneflower**	plains coreopsis	plains coreopsis
Sept.	no blooms	purple coneflower	no blooms
Oct.	no blooms	no blooms	no blooms

*Excludes graminoids. Reference the Pollinator Seed Mix Summaries in Appendix D for scientific names of species listed in this table.
BOLD text denotes the dominant bloom coinciding with the highest pollinator count in each plot in 2025.

D. Were undesirable species/invasive species present?

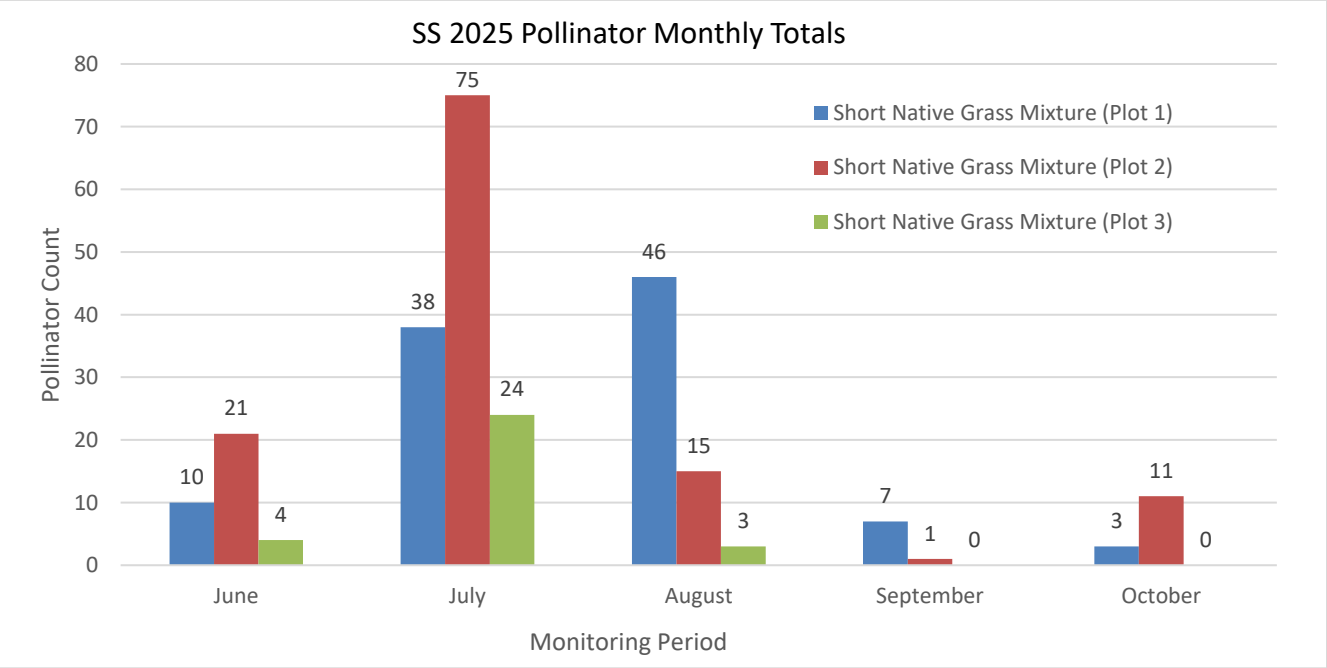
Undesirables were minimally present in Plots 1 and 2, as seed mix species were consistently observed at a higher coverage than non-seed mix species monthly. Conversely, Plot 3 had a higher coverage of non-seed mix species throughout the entire survey season. Canada thistle was the only species identified as problematic and needing corrective action.

2. Pollinator Monitoring

All of the plots at SS had a *Low* pollinator presence throughout the year. Pollinator richness varied between plots, but was relatively similar between Plot 1 (16 species) and Plot 2 (19 species). Plot 3 had the least number of species at a total of 8. Individual pollinator counts varied widely between monitoring events and plot locations. The highest count for each site is as follows: 46 (Plot 1, August), 75 (Plot 2, July); and 24 (Plot 3, July; Figure 15).

There were 25 different pollinator species observed at SS in 2025. Common pollinators observed across all plots included, various species of bumblebees, hoverflies, cabbage white butterflies, clouded sulfurs, and skippers. Occasional or seasonal emergent visitors included: zebra longhorn beetles, margined leather wing beetles, regal fritillary, duskywings, spring azurs, and hornets (bald-faced and European).

Figure 15: Number of Individual Pollinators Observed at SS Plots, Monthly (2025)



3. Implementation Techniques/Management Practices

A single herbicide application using Crossbow (ai: triclopyr and 2, 4-D) was applied in the spring of 2025 to target thistle and common broadleaf weeds at each plot. An incidental mow occurred along the edges of Plots 1, 2, and 3 sometime between June and July. This mow cut most of the thistle growth that was treated, which occurred along the berm between the pollinator site and the adjacent highway. By the end of the season, these mowed areas did not show thistle regrowth, though the basal rosettes of leaves were still present. Table 31 provides a review for seed mix and pollinator data at SS in 2025.

Table 31: T-168.4 Salt Shed Westbound (SS)

Seed Mix Plot	Seed Mix Type/ # of Species	# Species in Mix	# Species Observed in Mix	Peak Coverage (percent)[1]	2025 Prevalent Undesirable Species[2] Present	Pollinator Species Richness (# of Species)	Pollinator Abundance[3] (# of Individuals)
			2025	2025		2025	2025
1	Short Native Grasses Mix	8	5	66	Canada thistle	16	Low
2	Short Native Grasses Mix	8	5	69	Canada thistle	19	Low
3	Short Native Grasses Mix	8	5	31	Canada thistle	8	Low

[1]Peak Coverage – highest percent areal cover of the seed mix during the growing season.
[2] The Summary Data Tables in Appendix B provide the scientific names of the species listed in this column.
[3]Pollinator Abundance (average monthly number of individual pollinators observed over growing season in the plot) – High (>50 pollinators observed), Medium (25-49 pollinators observed), Low (<25 pollinators observed).

Fall Conservation Mowing

Fall conservation mowing is important to the success of pollinator habitat to:

1. Control woody and undesirable vegetation;
2. Reduce harm to insects and larvae by mowing in the fall, when flowers' blooms have decreased;
3. Provide thatch for overwintering pollinator habitat;
4. Leave a portion of hollow stems upright so they are available for spring pollinator nesting; and
5. Improve seed distribution by dispersing seeds onto the ground for increased soil contact and seed bank contribution.

Fall conservation mowing was completed by a PA Turnpike contractor utilizing a Bobcat T595 skid steerer with a brush cutter attachment (Photograph 1) at all sites excluding IRW and SS. The brush cutter was set to a specific height for each site. IRW and SS mowing was completed by a separate PA Turnpike contractor utilizing a Ventrak mower that was modified to increase its mower height capability (Photograph 2). The dates of mowing and the mow height are noted in Table 32 for all plots at seven sites.

Photograph 1: Fall conservation mowing using a skid steerer with a brush cutter attachment in CAB Plot 2 (October 2025).

Photograph 2: Fall conservation mowing using a Ventrak mower with adjusted deck height at IRW (November 2025).

Table 32: 2025 Fall Conservation Mowing

Site	Date of Mowing	Mow Height
Central Administration Building (CAB)	October 27, 2025	10-12 inches
Hickory Run Service Plaza (HRSP)	November 5, 2025	10-12 inches
Irwin Interchange (IRW)	October 27, 2025	8-9 inches
Harrisburg West Interchange (HBGW)	October 29, 2025	10-12 inches
Bensalem Interchange (BEN)	November 12, 2024	Plot #1 = no fall mow Plot #s 2-4 = 10-12 inches
Allentown Service Plaza (ASP)	November 7, 2025	Plot #s 1-5 = 10-12 inches Plot #s 6-7 = no fall mow
T-168.4 Salt Shed Westbound (SS)	October 28, 2025	8-9 inches

Variations of end-of-year mowing heights were implemented at HBGW Plot 1 to evaluate the growth response differences (if any) between 2023 and 2024. In year two (2024) at HBGW, there was no substantial difference between the number of species germinated or the amount of areal coverage between Plot 1A that was not mowed and Plots 1B and 1C of the same seed mix that were mowed annually in the fall. This was consistent with the observations made again in 2025; noting only a nominal difference between plot coverages. At the end of the 2025 season, all plots at HBGW were mowed to the same height as in Plot 1.

Conclusions and Discussion

Please reference the appendices for a summary of Pollinator Habitat Sites (Appendix A: Pollinator Site Summaries), 2025 Results (Appendix B: Summary Table), photographs throughout the monitoring season (Appendix C: Photographs), and Seed Mixes (Appendix D: Pollinator Seed Mix Summaries).

General Notes from the 2025 Monitoring Season

1. **How did rainfall affect the pollinator sites in 2025?**

Statewide, Pennsylvania experienced dry conditions at the onset of spring. Most pollinator sites experienced abnormally dry to moderate drought conditions in April. ASP and IRW were the outliers: ASP experienced severe drought, and IRW experienced normal rainfall. By June, drought conditions broke, and all pollinator sites were under normal conditions throughout the remainder of the summer. By fall (September), drought conditions reappeared for most of the state. While the effects of drought can stunt vegetation growth and limit nectar availability through bloom reduction, the early drought conditions did not appear to noticeably affect the pollinator habitats. None of the site observations noted stressed vegetation or reduced blooms. Moreover, when comparing data from 2024 and 2025, the first blooms observed were consistent at each of the sites.

2. **Was ArcGIS Survey123 an effective monitoring tool for the Full and Health Check survey events?**

Initially adopted in 2024 for this project, ArcGIS Survey123 was employed to standardize the monitoring protocol for tracking vegetative areal cover, as well as pollinator species richness and abundance, at the pollinator sites. It was also selected for its ease of employing survey templates, and had been previously used by PA Turnpike staff for monitoring stormwater facilities.

In 2025, the project team utilized Survey123 to expand monitoring efforts to twice monthly events to be more responsive to disturbances at the pollinator sites. This resulted in the development of a Health Check and a Full monitoring protocol with the application. Starting in May, the monthly monitoring events were conducted at two-week intervals for every site except SS, which commenced in June. The Health Check occurred within the first two weeks of every month, while the Full monitoring events occurred in the last two weeks of the month. This monitoring protocol gave consistency to the timing of data collection project-wide, but also addressed a concern from previous years, allowing for greater flexibility in scheduling site visits for optimal weather conditions to maximize the opportunity for pollinator observations (i.e., sunny days with minimal wind). All site visits were logged into a calendar that was accessible to the project team, which helped prevent conflicts in site use between the monitors and planned herbicide applications.

The Survey123 Health Check monitoring forms were aimed at providing a rapid assessment of the site. This enabled the PA Turnpike to expedite corrective action for any site concerns, such as invasive or undesirable plant incursions, or improperly mowed areas or debris piles within habitat plots. In addition, a cursory review of observed blooms and pollinator species was collected to supplement data collected during the Full monitoring events later in the month.

An efficacy assessment of the Health Check survey on Survey123 determined the mapping feature was the most useful in the application. This feature enabled surveyors to identify problem areas that required herbicide spot treatments to accurately and efficiently control invasive and undesirable vegetation. While the data collected on blooms and pollinator species during the Health Check provided a good snapshot of current conditions, the data were determined to be too general to be incorporated into the Full monitoring results.

The Survey123 Full monitoring forms were consistent with those from 2024, but were modified to include an automatic calculation feature in the percent vegetative cover survey table to notify the surveyor when 100% areal cover has been achieved. This feature helped alleviate concerns that surveyors were overcounting absolute cover totals during their plant cover estimates. For areas that did not have 100 percent areal cover of vegetation, a "bare ground" option was available. This automatic calculation feature standardized data collection and provided a more accurate and consistent assessment of the seed mix coverage.

The data for the 1x1-meter square plots that were collected as part of the Full monitoring protocol was assessed for its effectiveness in capturing pertinent information relating to seed mix success and pollinator presence. The data collected in previous years and in 2025 were not utilized for analysis to the same degree as the overall plot assessments. Given the minimal use of the data from the 1x1-meter square plots, it is recommended these are no longer continued in the Full monitoring protocol.

3. Net Benefit of Pollinator Habitats

While the Pollinator Habitat Program is focused on creating sites with a dominant cover of seed mix species that attract a high degree of pollinator species, it should be noted that additional direct and indirect benefits are realized by the conversion of PA Turnpike ROW turf into meadows that support pollinator communities. For example, the deeper root systems and greater surface roughness associated with meadow ecosystems improve stormwater management through better infiltration and absorption of runoff, while also reducing soil erosion. These habitats also sequester more carbon in the soil and require less mowing (and subsequent CO_2 emissions) in comparison to the previously existing ROW turf. Therefore, even the habitat sites that rate *Low* for seed mix success and pollinator criteria will provide significant benefits for wildlife, water, and air quality, as well as long-term management costs, over the more intensively managed turf environments.

As part of the Pollinator Initiative, the PA Turnpike has been able to test seed mixes and the implementation of meadow habitats at their administrative buildings, interchanges, and service plazas in the outdoor laboratories. The information learned has subsequently had a direct benefit on the PA Turnpike's Integrated Roadside Vegetation Management (IRVM) program, which was formally implemented as trials in the Gibsonia and Newville maintenance sheds in 2025. Management zones were delineated along the ROW based on different management and maintenance requirements. For instance, a low grass zone (Zone 0), requiring frequent mows for roadway clearance, was established next to the roadway edge. The adjacent ROW areas were established as a herbaceous zone (Zone 1) requiring just a seasonal mow. Zone 1 allows for herbaceous growth to reach mature heights, develop nectar-producing flowers, and yield next generation seeds before the fall conservation mow. In addition to these management zones, wildflower areas have been implemented along the Newville maintenance shed corridor as part of a "Beautification Zones" effort. This involves integrating flowering species with minimal site preparation into herbaceous zones.

	
Photograph 3: Blue Mountain Interchange during seeding of wildflowers in IRVM Beautification Zones (November 2025).	**Photograph 4:** Carlisle Interchange Westbound during seeding of wildflowers in IRVM Beautification Zones (November 2025).

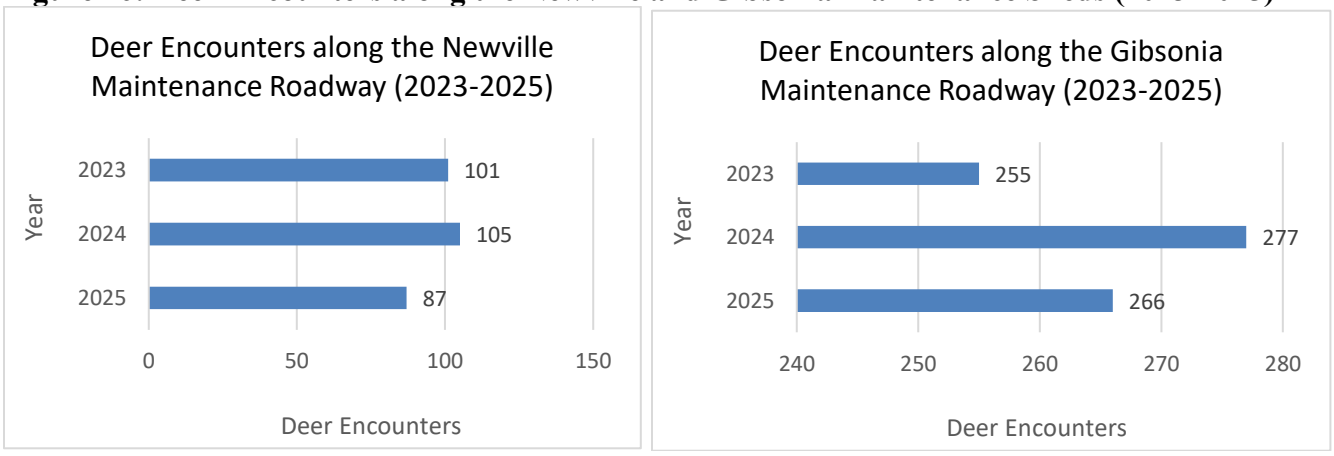
Another potential benefit of the pollinator habitats that extends to the IRVM program is the impact of these meadow habitats on wildlife usage and reduced conflicts with motorists. As noted in the 2024 Annual Report (McCormick Taylor and A.D. Marble 2024), deer are a common safety concern for the PA Turnpike and the traveling public both in Pennsylvania and nationally due to the increased vehicle collision potential resulting from higher deer densities (Bissonette, Kassar, and Cook 2008). Deer-resistant mixes were tested at HRSP and HBGW, and were included at ASP in Plot 6 in 2024. Based on camera trap data collected at HRSP and HBGW in previous years (no cameras were installed at ASP, and trap data was not analyzed in 2025), deer were observed utilizing maintained grass corridors adjacent to seed plots as much (at HRSP) or substantially more frequently (at HBGW) than the plots themselves.

One of the concerns expressed by maintenance staff was whether an IRVM applied along maintenance sheds would bring wildlife closer to the roadway and increase deer encounters. The initial pollinator habitat data suggested that a change in mowing frequency and subsequent increase in herbaceous cover heights within the PA Turnpike ROW would not exacerbate deer encounters along the roadway. A recent application of the IRVM to the Newville and Gibsonia maintenance sheds in 2025 appears to support this conclusion (Figure 16).

Delineators were installed in 2025 to assist mowers with applying the IRVM mowing regimes in the field. The initial IRVM guidelines focused on applying a variety of zones, including Zone 0 (Low Grass Zone), Zone 1 (Herbaceous Zone), Zone 2 (Shrub Zone), and Zone 3 (Tree Zone) maintenance strategies to the ROW within approximately 50 feet of the roadway. However, following coordination with the shed staff, a two-zone strategy (Zones 0 and 1) was determined to be better aligned with current vegetation management procedures. Zone 0 widths were determined by mower reach and were typically established at 16 feet wide. Mowing frequency in this zone was per usual maintenance frequency, averaging 3 to 4 mows in a season. The remaining adjacent ROW areas, excluding stormwater maintenance areas, were established as Zone 1 herbaceous zones, receiving one conservation mow at the end of the growing season (November).

Following the first year of implementation, deer encounters along these 25-mile maintenance sheds has not increased. Deer encounters dropped approximately 21% within the Newville section and 4% along the Gibsonia section since 2024 (Figure 16). While these results are preliminary, they do offer some insight that deer may not be drawn closer to the roadway when mowing frequencies are altered to favor a maturing herbaceous cover. In 2026, deer encounter data will be examined again to determine if this is an existing trend.

Figure 16: Deer Encounters along the Newville and Gibsonia Maintenance Sheds (2023-2025)



Source: PA Turnpike 2025

Pollinator Habitat Site Performance: 2025 and Annual Trends

For this section, please reference the pollinator site summaries in Appendix A for site locations, site characteristics, and performance results.

As in previous years, pollinator sites were assessed for how their individual plots performed during the 2025 monitoring season. Their plot performances were linked to the applied seed mix's germination rate and average monthly areal cover during the monitoring season. In addition, the plot performances were also assessed by the abundance of pollinators they attracted (average monthly) during the monitoring season. Table 33 was developed to highlight how these plots performed overall, and in comparison to each other, in developing a dominant cover of the desired seed mix and attracting a high number of pollinators in 2025.

Table 33: Ranking of Site Based on Seed Mix Performance and Pollinator Presence

Pollinator Presence	Seed Mix Performance (Based on Average Cover and Germination Rate)		
	Excellent (>75%)	**Good (50-75%)**	**Poor (<50%)**
High (>50 indiv.)	HBGW: Plot 1B (PTC Pollinator Interchange Mix) HBGW: Plot 4 (Deer Resistant Meadow Mix #2) ASP: Plot 2 (PTC Wet Habitat Mix)	CAB: Plot 1 (PA Central Lowland Province UPL Meadow Mix) CAB: Plot 2 (Butterfly & Hummingbird Garden Mix) CAB: Plot 3A (2022 PennDOT Pollinator Mix) HBGW: Plot 1A (PTC Pollinator Interchange Mix) HBGW: Plot 2A (PTC Pollinator ROW Mix) HBGW: Plot 3 (Deer Resistant Meadow Mix #1) HBGW: Plot 5 (PTC Monarch Specialty Mix)	
Medium (25-49 indiv.)	HRSP: Plot 3 (Deer Resistance Meadow Mix #1) HBGW: Plot 1C (PTC Pollinator Interchange Mix) ASP: Plot 3 (PTC Pollinator ROW Mix)	CAB: Plot 3B (Modified PennDOT Pollinator Mix) HRSP: Plot 1A (Butterfly & Hummingbird Garden Mix) HRSP: Plot 2B (Modified PennDOT Pollinator Mix) IRW: Plot 3 (PTC Pollinator Interchange Mix) HBGW: Plot 2B (PTC Pollinator ROW Mix) BEN: Plot 2A (2023 PennDOT Pollinator Mix) BEN: Plot 3 (PTC Wet Habitat Mix) BEN: Plot 4 (PTC Pollinator Interchange Mix) ASP: Plot 1 (PTC Monarch Specialty Mix) ASP: Plot 5 (PTC Pollinator Interchange Mix) ASP: Plot 6 (Deer Resistant Meadow Mix #1) ASP: Plot 7 (PTC Pollinator Interchange Mix)	IRW: Plot 2 (PTC Monarch Specialty Mix) IRW: Plot 4 (PA Southern Allegheny Plateau Province Upland Meadow Mix)
Low (<25 indiv.)	BEN: Plot 2B (Modified PennDOT Pollinator Mix)	HRSP: Plot 1B (PA Blue Ridge Province UPL Meadow Mix) IRW: Plot 1 (PTC Pollinator ROW Mix) BEN: Plot 1 (PTC Pollinator ROW Mix) ASP: Plot 4 (PTC Pollinator Interchange Mix) SS: Plot 1 (Short Native Grasses Mix) SS: Plot 2 (Short Native Grasses Mix)	HRSP: Plot 2A (2022 PennDOT Pollinator Mix) SS: Plot 3 (Short Native Grasses Mix)

1. Did new sites perform well in 2025?

In 2025, the only site incorporated into the Pollinator Program was SS. Site monitoring commenced in June and involved a once-monthly Full monitoring event (no Health Checks). Overall, the site plots maintained full vegetative cover except for a few small mulch piles, which were remnants of the compost filter socks used during site construction. Short Native Grasses Mix species, notably perennial ryegrass and switchgrass, composed the dominant season-long cover in the larger Plots 1 and 2, but was not the dominant cover in Plot 3. This plot has the most cover of undesirable species, perhaps due to its small size and limited ability to resist incursions from outside species. Management of undesirables/invasive species at SS was minimal in its first year of development; it only received one herbicide application in the spring, which coincided with the treatment timing of IRW. As seen with the management of the other pollinator sites, suppression of invasive/undesirable species is vital to seed mix development in the first year of growth. With a more passive/low level of management approach to the SS site in the first year, an increase in undesirable species cover in subsequent years is suspected.

A limited number of seed mix blooms were observed over all of the sites throughout the monitoring season due to the high percentage of graminoids in the seed mix. Plots 1 and 2 are marginally meeting the pollinator success criteria, with *Medium* seed mix coverage (50-74%) and a *Low* level of management, despite *Low (<25)* levels of pollinators. Plot 3 is not meeting the success criteria, with both the vegetative and pollinator categories rated as *Low.*

2. Which older sites/plots performed well in 2025?

The best performing sites/plots in 2025 included HBGW (Plots 1B and 4) and ASP (Plot 2). These specific plots contained a high areal cover of seed mix species, attracted an abundance of pollinators, and required minimal maintenance to achieve these results. In addition, HRSP (Plot 3), HBGW (Plot 1C) and ASP (Plot 3) were high performers with high areal cover of seed mix species and slightly less numbers of pollinators than the top performers. These high-performing sites have all done well since planting, requiring only minimal maintenance and herbicide applications to sustain the desired herbaceous cover. Table 34 lists the best performing plots in 2025.

Table 34: Best Performing Plots in 2025

Best Performing Plots in 2025	Average Monthly Areal Cover (percent)	Pollinator Abundance	Level of Maintenance
HBGW Plot 1B	84	High	Low
HBGW Plot 4	86	High	Low
ASP Plot 2	78	High	Low
HBGW Plot 1C	83	Medium	Low
HRSP Plot 3	78	Medium	Low
ASP Plot 3	85	Medium	Medium

3. Which sites underperformed in 2025?

The two lowest-performing sites include HRSP Plot 2A (PennDOT Pollinator Mix) and SS Plot 3 (Short Native Grasses Mix). The seed mix performance for HRSP Plot 2A is *Low*, which has been the ongoing trend since site planting in 2022. This plot has microtopography susceptible to drainage collection from the surrounding uplands, which affects the germination and growth of non-hydrophytic species within the seed mix. Evidence of excess drainage within the plot is the growth of hydrophytes, such as woolgrass (*Scirpus cyperinus*, FACW), New York ironweed (*Vernonia noveboracensis*, FACW), and pathrush (*Juncus tenuis*, FAC) occurring at the downhill/eastern end of the plot. The low performance of SS Plot 3 is related to the small/narrow size of the plot, which incurs the most pressure from undesirables. The higher incursion of non-seed mix species, in combination with small plot size and high abundance of graminoids in the seed mix, very few pollinators were observed throughout the season at SS Plot 3. Table 35 lists the worst performing plots in 2025.

Table 35: Worst Performing Plots in 2025

Worst Performing Plots in 2025	Average Monthly Areal Cover (percent)	Pollinator Abundance	Level of Maintenance
HRSP Plot 2A	42	Low	Low
SS Plot 3	19	Low	Low

Seed Mixes - What Did We Learn in 2025 (Trends)?

For this section, please reference the Pollinator Seed Mix Summaries in Appendix D for a summary of the seed mix species, anticipated bloom times, and performance results. Table 36 was developed to highlight how seed mixes performed overall, and in comparison, to each other, in germination rate and average monthly areal cover during the monitoring season in 2025.

Table 36: Ranking of Seed Mixes Based on Average Percent Areal Cover and Germination Rate

		Seed Mix Performance (Based on Average % Cover for 2025)		
		Excellent (>75%)	**Good (50-75%)**	**Poor (<50%)**
Germination Rate	**Excellent (>75%)**	HRSP: Plot 3 (Deer Resistance Meadow Mix #1) HBGW: Plot 1C (PTC Pollinator Interchange Mix) HBGW: Plot 4 (Deer Resistant Meadow Mix #2) ASP: Plot 3 (PTC Pollinator ROW Mix)	CAB: Plot 1 (PA Central Lowland Province UPL Meadow Mix) CAB: Plot 3A (2022 PennDOT Pollinator Mix) CAB: Plot 3B (Modified PennDOT Pollinator Mix) HRSP: Plot 1A (Butterfly & Hummingbird Garden Mix) HRSP: Plot 2B (Modified PennDOT Pollinator Mix) IRW: Plot 1 (PTC Pollinator ROW Mix) IRW: Plot 3 (PTC Pollinator Interchange Mix) HBGW: Plot 1A (PTC Pollinator Interchange Mix) HBGW: Plot 2A (PTC Pollinator ROW Mix) HBGW: Plot 5 (PTC Monarch Specialty Mix) BEN: Plot 1 (PTC Pollinator ROW Mix) BEN: Plot 2A (2023 PennDOT Pollinator Mix) BEN: Plot 4 (PTC Pollinator Interchange Mix) ASP: Plot 1 (PTC Monarch Specialty Mix) ASP: Plot 4 (PTC Pollinator Interchange Mix) ASP: Plot 5 (PTC Pollinator Interchange Mix) ASP: Plot 7 (PTC Pollinator Interchange Mix)	IRW: Plot 2 (PTC Monarch Specialty Mix) IRW: Plot 4 (PA Southern Allegheny Plateau Province Upland Meadow Mix)
	Good (50-75%)	HBGW: Plot 1B (PTC Pollinator Interchange Mix)* BEN: Plot 2B (Modified PennDOT Pollinator Mix)* ASP: Plot 2 (PTC Wet Habitat Mix)*	CAB: Plot 2 (Butterfly & Hummingbird Garden Mix) HRSP: Plot 1B (PA Blue Ridge Province UPL Meadow Mix) HBGW: Plot 2B (PTC Pollinator ROW Mix) HBGW: Plot 3 (Deer Resistant Meadow Mix #1) B*EN: Plot 3 (PTC Wet Habitat Mix) ASP: Plot 6 (Deer Resistant Meadow Mix #1) SS: Plot 1 (Short Native Grasses Mix) SS: Plot 2 (Short Native Grasses Mix)	HRSP: Plot 2A (2022 PennDOT Pollinator Mix) SS: Plot 3 (Short Native Grasses Mix)
	Poor (<50%)			

***The higher percent areal cover was used over the germination rate for determining Seed Mix Performance as *Excellent* for the Pollinator Seed Mix Summaries.**

1. What were the best performing seed mixes in 2025?

The following seed mixes (Table 37) were rated as having an "Excellent" performance in 2025 with a high germination rate (>75%) and developing a monthly average areal cover over 75%.

Table 37: Best Performing Seed Mixes in 2025

Best Performing Seed Mixes in 2025	Average Monthly Areal Cover (%)	Germination Rate (%)
Deer Resistant Meadow Mix #2 (HBGW, Plot 4)	86	88
PTC Pollinator ROW Mix (ASP, Plot 3)	85	100
PTC Pollinator Interchange Mix (HBGW, Plot 1B)*	84	74
PTC Pollinator Interchange Mix (HBGW, Plot 1C)	83	79
Modified PennDOT Pollinator Mix (BEN, Plot 2B)*	81	63
Deer Resistant Meadow Mix #1 (HRSP, Plot 3)	78	88
PTC Wet Habitat Mix (ASP, Plot 2)*	78	70
PTC Wet Habitat Mix (BEN, Plot 3)**	75	61

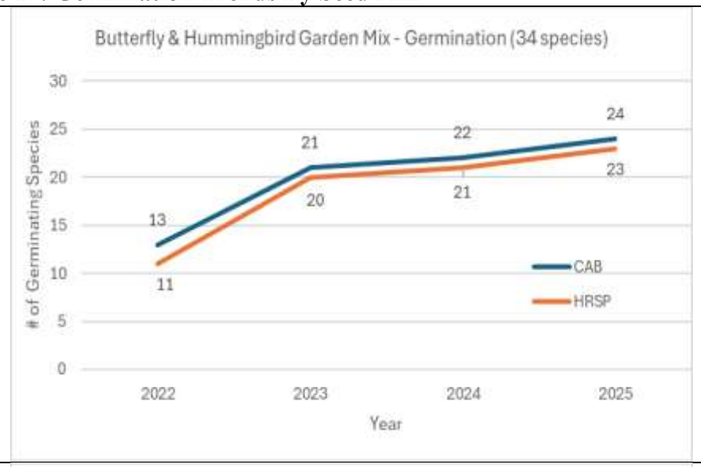
*For the Pollinator Seed Mix Summaries, the higher percent cover was used over the germination rate for determining Seed Mix Performance as "Excellent."
**Despite an areal cover not greater than 75%, this seed mix should be considered in best performing mixes due to its effectiveness in poorly drained areas.

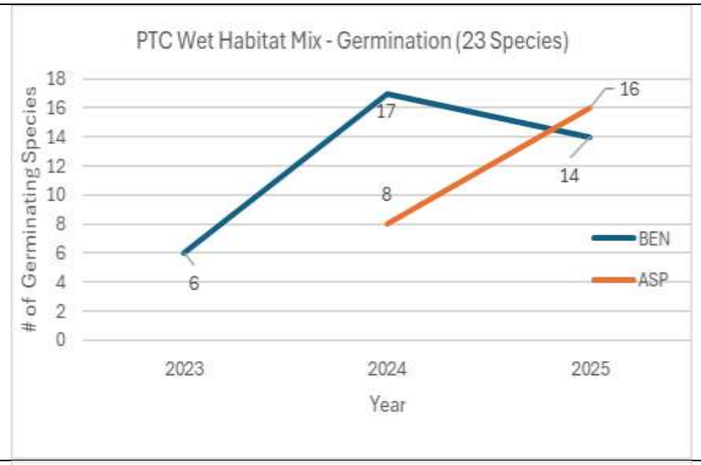
Several seed mixes were included in this group that only had "Good" (50-75%) germination rates but still resulted in "Excellent" areal cover percentages; this is because developing a dominant cover of seed mix species takes precedence, and germination rates can be misleading. Depending on the site conditions, not all species will germinate each year or may be missed by surveyors due to the timing of monitoring events, or simply by the difficulty in locating each species in the dense cover. The only exception on this list is the PTC Wet Habitat Mix at BEN Plot 3, which had a relatively low germination rate (61%) with 75% areal cover. This seed mix resulted in a dense cover of showy tickseed, which is a prolific grower and self-seeding annual that thrives in wet and disturbed soils. Its aggressive spread can quickly overtop the slower growing perennials, reflecting a lower observed germination rate for the seed mix. Seed mix cover is expected to become more diverse and balanced once the perennials become established in Year 2 or Year 3, and are more easily identified.

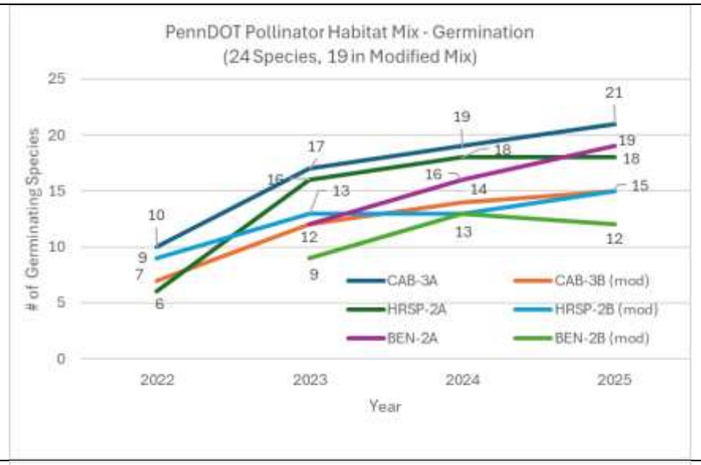
2. Trends for seed mix germination and dominance of seed mix species

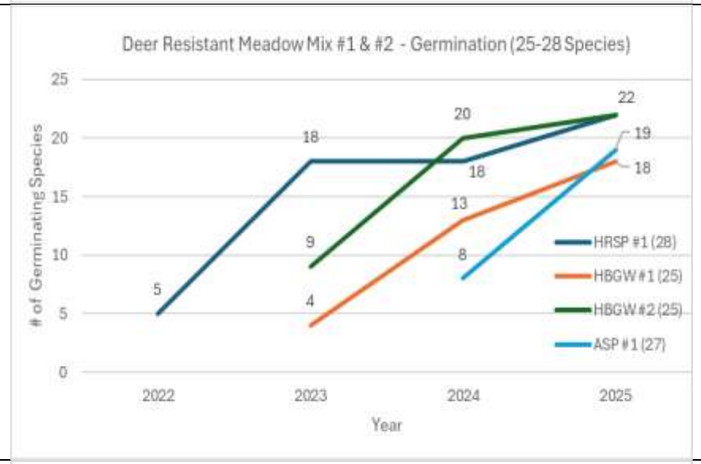
The germination rates for all the seed mixes have increased over the monitoring years, with gains still being observed at sites in their fourth year of development (Figure 17). The PTC Wet Habitat Mix and the PTC Pollinator ROW Mix are the only exceptions in which decreases were noted for the first time in 2025. These decreases were only seen at the BEN plots, where the PTC Wet Habitat Mix saw three (3) fewer species, and the Modified PennDOT Pollinator Habitat Mix saw one (1) less species than in 2024. As discussed in the section above, the decreased germination rate for the

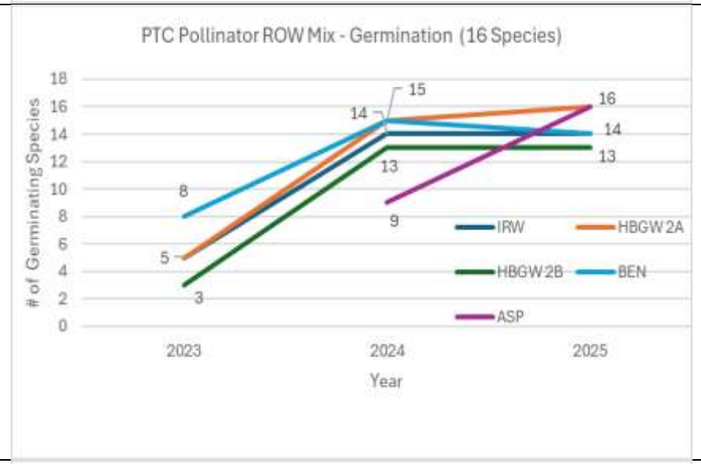
Figure 17: Germination Trends By Seed Mix

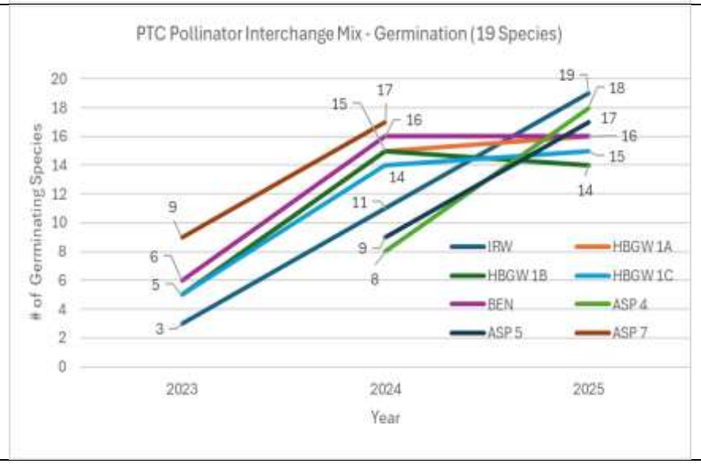


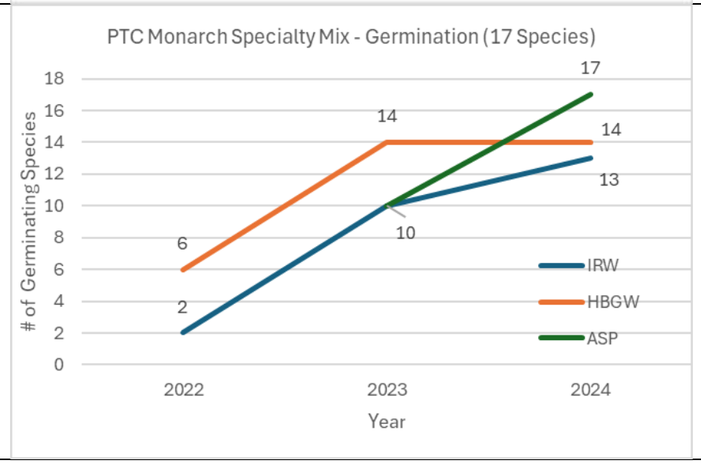


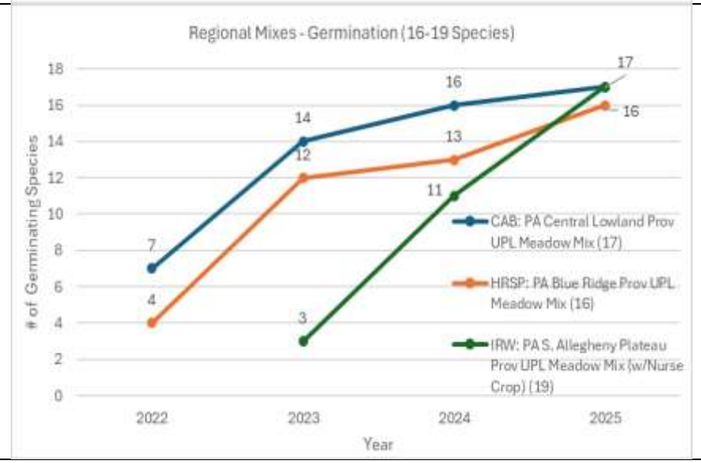












PTC Wet Habitat Mix could be in relation to showy tickseed's vigorous growth. The nominal decrease (-1 species) in the PTC Pollinator ROW Mix's germination rate was due to common milkweed not being observed in 2025.

Areal percent cover of the seed mixes has fluctuated more at the sites and within pollinator plots, unlike germination rates which have consistently increased across most seed mixes and plots (Figure 18; below, page 65). Numerous variables related to individual plot conditions, such as soil moisture, existing seed bank composition, incursion pressure, and maintenance of invasive and undesirable species have a significant effect on the development of seed mix cover at the pollinator sites. Due to the variability in monitoring frequencies from previous years, the discussion regarding trends below focuses on Peak Coverage (formerly termed Optimal Planted Overall Growth), which was tracked in 2025 and previous years.

The **Butterfly & Hummingbird Garden Mix** is in its Year 4 of development at CAB and HRSP. This mix has shown steady progress in establishing a dense cover since 2022, and has nearly maintained an "Excellent" peak cover every year. However, mix species such as blue false indigo, Ohio spiderwort, and white wild indigo have consistently been absent in surveys and would be recommended to be omitted in future applications of this seed mix.

The **PTC Wet Habitat Mix** is in Year 3 of development at BEN and Year 2 at ASP. As discussed in the section above, its germination rate is lower than the others, but consistently develops a high percent areal cover due to the vigorous growth of showy tickseed. By Year 2 at ASP, the perennial swamp milkweed became the dominant cover for a brief window in July and August, while BEN continued to maintain showy tickseed dominance throughout the season in Year 3. This might be explained by the fact that showy tickseed relies on seed dispersal for annual reseeding. For example, ASP Plot 2 was not mowed in the fall of 2024 due to equipment restrictions. This would have inadvertently limited its reseeding opportunities to occur at a natural rate versus a "super spreader" effect produced by fall mowing. The higher coverage of swamp milkweed in 2025 may be reflective of the reduced dispersal of showy tickseed in the fall of 2024, which allowed for better perennial establishment in Year 2 at ASP. In contrast, the consistent fall conservation mowing at BEN, combined with the persistent dominant coverage of showy tickseed through Year 3, may support the importance the fall mow has in seed dispersal for annuals. The plots containing the PTC Wet Habitat Mix at BEN and ASP were mowed in 2025. Monitoring in 2026 will help reveal whether a trend between annual mowing and increased showy tickseed coverage exists, and whether limiting mowing in Year 1 could aid in the establishment of perennials by Year 2.

The **PennDOT Pollinator Habitat Mix** is represented by several variations in composition between the 2022 (CAB Plot 3A/HRSP Plot 2A), the 2023 (BEN Plot 2A), and the Modified (CAB Plot 3B/HRSP Plot 2B/BEN Plot 2B) seed mixes. Designed as a generalist mix to span multiple habitats, the PennDOT Pollinator Habitat Mixes have produced varying degrees of areal cover

over the years. The initial 2022 mix shows the most variations, with peaks and valleys in coverage at CAB and an overall "Poor" performance at HRSP Plot 2A, never reaching 50 percent cover in the four years of monitoring. The poor performance at HRSP Plot 2A appears to be related to high soil moisture levels due to microtopography that directs upland sheet flow through Plot 2A. These wetter conditions hinder both germination and seed mix coverage rates, especially for the non-hydrophytes that are intolerant of wet soils. The 2023 version applied at BEN has shown yearly gains since planting, and reached "Excellent" coverage by Year 3. The Modified version, the last of the PennDOT mixes to be developed, varies greatly from site to site. HRSP and BEN had slow but steady gains in areal cover since planting, while CAB developed "Excellent" coverage by Year 2. The coverage at CAB then subsequently began to decrease in cover in 2024, and continued to decrease in 2025. Overall, with the slow establishment and fluctuations in cover from year to year, the PennDOT Pollinator Habitat Mix is not recommended for continuation in the pollinator program without active management.

The **Deer Resistant Meadow Mixes** applied at HRSP Plot 3, HBGW Plot 3, and ASP Plot 6 (Deer Resistant Meadow Mix #1) and HBGW Plot 4 (Deer Resistant Meadow Mix #2) have shown "Excellent" seed mix coverage at all the sites, starting in Year 2 and continuing through Year 4. In 2025, there was a decrease in the recorded seed mix coverage at HBGW Plot 3. When reviewing the non-seed mix data collected for this plot, beneficials such as greyheaded coneflower, showy tickseed, and narrowleaf sunflower were identified in growing numbers. These particular species are in the Deer Resistant Meadow Mix #2mix of the adjacent HBGW Plot 4, suggesting a crossover between the plots. This particular dip in coverage is an outlier to the overall great performance of the DRMM sites. This mix remains a recommended option for the pollinator program for sites with variable shade or deer pressure.

The first year of monitoring the **PTC Pollinator ROW Mix** produced an outlier in the data collection at HBGW Plot 2B in 2023. The nurse crop comprised entirely of common oats (*Avena sativa*) outcompeted the seed mix in rapid establishment. When the nurse crop was included with the areal cover calculations of the ROW seed mix, the total cover was 100 percent. The remainder of the PTC Pollinator ROW Mix locations show a slow but steady build in coverage over three years, having "Good" to "Excellent" coverage by the end of Year 3. With its high germination rate and history of persistent dominant cover, this mix is recommended for the pollinator program for ROW areas that do not require a showy flowering composition.

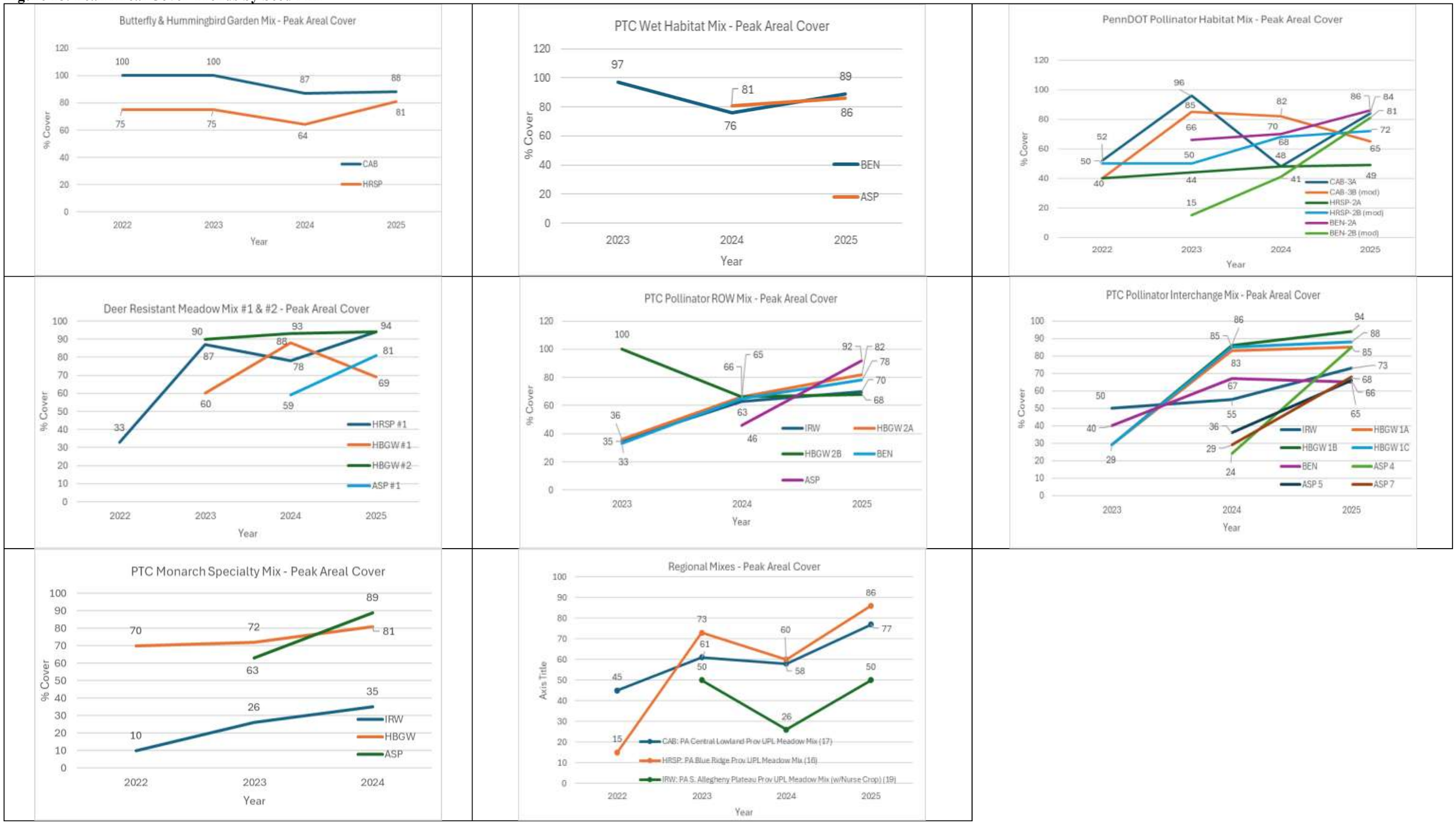
The **PTC Pollinator Interchange Mix** was the most widely used seed mix amongst the pollinator sites, and was applied at HBGW (Plots 1A/1B/1C), BEN (Plot 4), and IRW (Plot 3) in 2023 and ASP (Plot 4/5/7) in 2024. Seed mix coverage over the last three years of monitoring has shown slow growth heading into Year 2 for all the sites except HBGW and ASP Plot 4, which displayed "Excellent" coverage in Year 2. By Year 3, BEN and IRW are still trending with "Good" coverage, while HBGW continues with "Excellent" growth. The overall trend for the PTC Pollinator

Interchange Mix suggests a 50/50 establishment rate between "Good" and "Excellent" coverage over Years 2 and 3. The HBGW plots were planted using double (28 lbs/acre) the recommended rate (14 lbs/acre). For future applications, given the improved performance at HBGW in Years 2 and 3 in comparison to the three other locations, doubling the recommended rate appears to be the most effective strategy for developing a dominant seed mix cover that resists incursions.

The **PTC Monarch Specialty Mix** has done well at the HBGW and ASP sites, averaging "Excellent" coverage by Year 2 (ASP) and Year 3 (HBGW). Performance at IRW has been poor since the initial seeding, and has reached its highest coverage of only 35 percent by the end of Year 3. A review of the planting methods between these three sites identifies a slight difference in the herbicide application timing for site preparation before seeding. HBGW and ASP received two herbicide applications in the spring, prior to site seeding in May. IRW had two fall herbicide applications and one follow-up application in the spring prior to site seeding. The overall lack of progress seen at IRW, especially in Plot 2 where the PTC Monarch Specialty Mix was applied, suggests two spring herbicide applications prior to seeding may be more effective at eliminating existing vegetation, reducing undesirable incursions, and providing better site conditions for seed mix development. The "Excellent" coverage observed at HBGW and ASP, which had the two spring herbicide applications for site preparation, models a great seed mix composition and is recommended for continual use within the pollinator program.

The three regional specific meadow mixes (**Regional Mixes**) used throughout this project include *PA Central Lowland Province UPL Meadow Mix*, *PA Blue Ridge Province UPL Meadow Mix*, and *PA South Allegheny Plateau Province Upland Meadow Mix*. These upland meadow mixes were planted at CAB (Plot 1), HRSP (Plot 1B), and IRW (Plot 4), respectively. All three of these mixes included a higher percentage of grass species and a moderate level of flowering plant species, and were utilized along roadways when a less showy mix would be desirable. Seed mix coverage over the four years of monitoring at CAB and HRSP has shown a slow (CAB) or variable (HRSP) rate of establishment, eventually leading to "Excellent" coverage by Year 4. The reseeding of CAB in 2024 with only flowering species has produced a higher percentage of flowering species versus grasses in 2025. HRSP did not receive this same reseeding treatment, and has thus maintained a higher percent cover of seed mix grasses, primarily of little blue stem. The establishment of the regional mix at IRW has been poor since site establishment, and rates of undesirable incursion remain higher than the desired seed mix. While herbicides and other methods of undesirable species' removal have been utilized to minimize incursions over the years, the data suggest the Southern Allegheny Plateau Province Upland Meadow Mix used at IRW is not competitive enough with non-mix species, and is not recommended for future use in the pollinator program. Similarly, the slow and variable establishment of the PA Central Lowland Province UPL Meadow Mix and PA Blue Ridge Province UPL Meadow Mix remains a limiting factor in withstanding undesirable incursions, and they are also not recommended for future use in the pollinator program. For these reasons, a pollinator seed mix summary was not developed for the Regional Mixes in Appendix D.

Figure 18: Peak Areal Cover Trends by Seed Mix



3. Do seed mixes maintain their dominant cover over the years?

CAB and HRSP are in their fourth year of development. Biennial/short-lived species like blackeyed Susans and bachelor's buttons/cornflower, or annuals like partridge pea, have faded from dominance and are being replaced with hardy/long-lived perennials like purple coneflower, lanceleaf coreopsis, and goldenrods; or graminoid species like switchgrass, little bluestem, and Virginia wildrye. Seed mix germination rates continue to increase through Year 4, as 2025 had the highest germination rate amongst most plots. This suggests that the selected seed mixes are vigorous and self-sustaining without significant management during the growing season outside of judicious spot spraying and a fall conservation mow.

4. Trends for pollinator richness/abundance

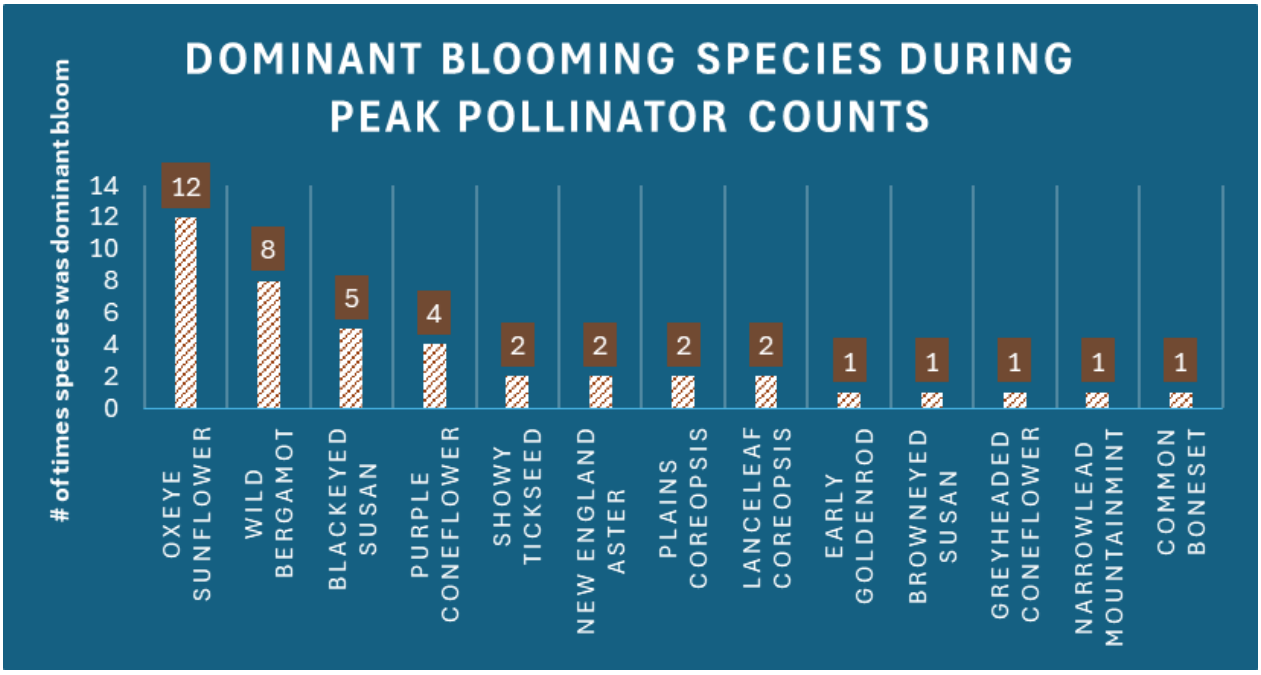
Based on averaged monthly totals during the 2025 monitoring season, all seed mixes generally attracted an abundance of pollinators on the *Medium* (25-49) to *High* (>50) level, except for those with a predominance of graminoids. The Short Native Grass Mix, for example, applied at SS, consistently rated as *Low*, while the PTC Pollinator ROW mix was *Low* for pollinator abundance at both BEN (Plot 1) and IRW (Plot 1). In 2025, pollinator counts were higher than the previous year at all sites except for HRSP, which decreased, and BEN remained approximately the same. This may be due to a concerted effort in 2025 to schedule, or reschedule, field days to more optimal time periods to avoid cloudy or windy days when pollinators are typically less active.

Pollinator species richness ranged from 25 to 35 individual species at all seven sites. The highest levels were observed at the HBGW, ASP, and IRW habitats, with 35, 31, and 32 species observed, respectively (Appendix E: List of Pollinator Species Observed, All Plots - 2025). There does not appear to be a clear reason to explain these results, as the sites range from the largest (ASP) to one of the smallest (IRW), are geographically located across the state, and utilize a full range of the seed mixes.

What may play a more prominent role is the types of flowers blooming at these sites. Figure 19 provides some insights into this by cross-referencing the dominant flowers in bloom when peak pollinator counts were observed as completed in 2025.

This suggests that when oxeye sunflower, wild bergamot, blackeyed Susan, and purple coneflower were in bloom, pollinators were most abundant at the sites. These four species are included in the Deer Resistant Meadow Mixes #1 and #2, PTC Pollinator Interchange Mix, and Butterfly & Hummingbird Garden Mix, while only the Short Native Grass, PTC Wet Habitat, and PTC Pollinator ROW mixes have two species or less. The latter seed mixes generally rated *Medium* to *Low* in attracting pollinator species, but it may be too early to make any conclusion without additional monitoring seasons.

Figure 19: Dominant Blooming Species during Peak Pollinator Counts at All PA Turnpike Pollinator Sites – 2025.



Goals for 2026 (See PA Turnpike Pollinator Pilot Program - Goal Tracking Sheet, page iv)

1. **Utilize monitoring protocol that reflects effort for Candidate Conservation Agreement with Assurances (CCAA) Biological Effectiveness Monitoring Protocol**

Previous monitoring protocols focused on germination rates and ability of selected seed mixes to establish a dominant areal cover while resisting invasive and undesirable incursions. These protocols also involved tracking pollinator usage to determine if a wide variety and abundance of insects and birds were benefiting from the nectar-producing herbaceous cover. In 2024, monitoring protocols were tested that comply with the Nationwide Candidate Conservation Agreement for Monarch Butterfly on Energy and Transportation Lands – An Integrated Candidate Conservation Agreement with Assurance and CCAA (Monarch CCAA). These simulation protocols were noted in Appendix E (McCormick Taylor and A.D. Marble 2024) and indicated that, where tested, the PA Turnpike sites did not have the six or more milkweed stems within at least 90% of sample plots to comply with Monarch CCAA requirements, and forego adaptive management requirements. However, subsequent iterations of the protocol helped to determine that PA Turnpike sites did comply with the requirement that 10% or more areal cover of nectar plants was established in 90% of sample plots to avoid Monarch CCAA adaptive management. With the addition of ASP, and the maturing of the five previous sites, efforts should be made in 2026 to further test these Monarch CCAA monitoring protocols to determine if the thresholds can be met with a standardized method that is replicable by PA Turnpike staff.

2. Applying lessons learned to IRVM Beautification Zone Wildflower Areas

A cost-savings alternative to the pollinator sites was explored and applied to three different locations along the ROW associated with the Newville Maintenance Shed that had been delineated for IRVM. This new approach, called Beautification Zone Wildflower Areas, is a scaled-down approach from the pollinator sites for developing meadow habitat along the ROW. This approach involves drill seeding a showy wildflower mix that only contains forbs (i.e., flowering broadleaf herbaceous species) over existing ROW lawn after the final fall mow. These Beautification Zone Wildflower Areas are distinguished from the pollinator sites, as they involve retrofitting existing vegetated areas without initially denuding them with herbicides to remove competition. Instead, the showy wildflower mix will develop alongside existing ROW grasses to create a meadow-like appearance within designated areas of the IRVM-delineated ROW. By eliminating the need for two herbicide applications for ground stripping, and by using mixes that only contain forbs, site establishment can be accomplished at a significantly reduced cost when compared to the pollinator sites. Further, invasive species management is anticipated to be low due to the competition of already established vegetation.

Table 38: Costs of Pollinator Vegetation Management Approaches

Management Approach	Cost/Acre (seed, equipment, labor)
Pollinator Sites	Range: $4,500/ac (HRSP, 2022) - $8,800/ac (ASP, 2024)
Beautification Zone Wildflower Areas	Range: $1,100/ac (Carlisle Int EB) - $3,000/ac (Blue Mt WB)

Three Beautification Zone Wildflower Areas were planted in the fall of 2025: one within the northern infield ramp of the Blue Mountain Interchange, and the other two at the Carlisle Interchange at the southwestern infield ramp and atop the high slope of the westbound acceleration ramp. Three types of seed mixes were used at the IRVM Beautification Zone Wildflower Areas: PTC Milestone Mix, PTC Stinger Mix, and PTC Overseeding Mix. These mixes were selected for species resistances to specific herbicides (i.e., Milestone and Stinger) often used in roadway vegetation management. Monitoring of these areas will be completed in 2026, with a focus on germination rates of the seed mixes.

3. Tracking reduction in maintenance and carbon emission

The PA Turnpike's stewardship goal embraces sustainable practices that consider their economic, environmental, and social impacts. The IRVM program embodies this goal by evaluating how better management of roadside vegetation can result in a reduction of greenhouse gas emissions and operating costs while creating more aesthetically pleasing and higher functioning landscapes. The Beautification Zone Wildflower Areas approach noted above exemplifies this effort by utilizing cost-effective practices to create nectar-dominant cover within the ROW. In addition, changes in roadside management applied along the Neville maintenance shed as part of the IRVM

implementation is delivering promising results. For example, an IRVM was initially applied to the shed in September 2024, which reduced mowing along low grass (Zone 0) and herbaceous (Zone 1) zones that fall. In 2025, the IRVM was employed for the entire growing season, and resulted in a significant reduction in mowing hours overall (Table 39). By estimating the fuel burn rate and emissions factors associated with mowing equipment (Figure 20), the PA Turnpike was able to extrapolate a reduction of approximately 8.3 metric tons of CO_2 in 2024, and 30.3 metric tons in 2025, respectively.

Table 39: Total Mower Hours and Estimated CO_2 Emissions, Newville Maintenance (2023-2025)

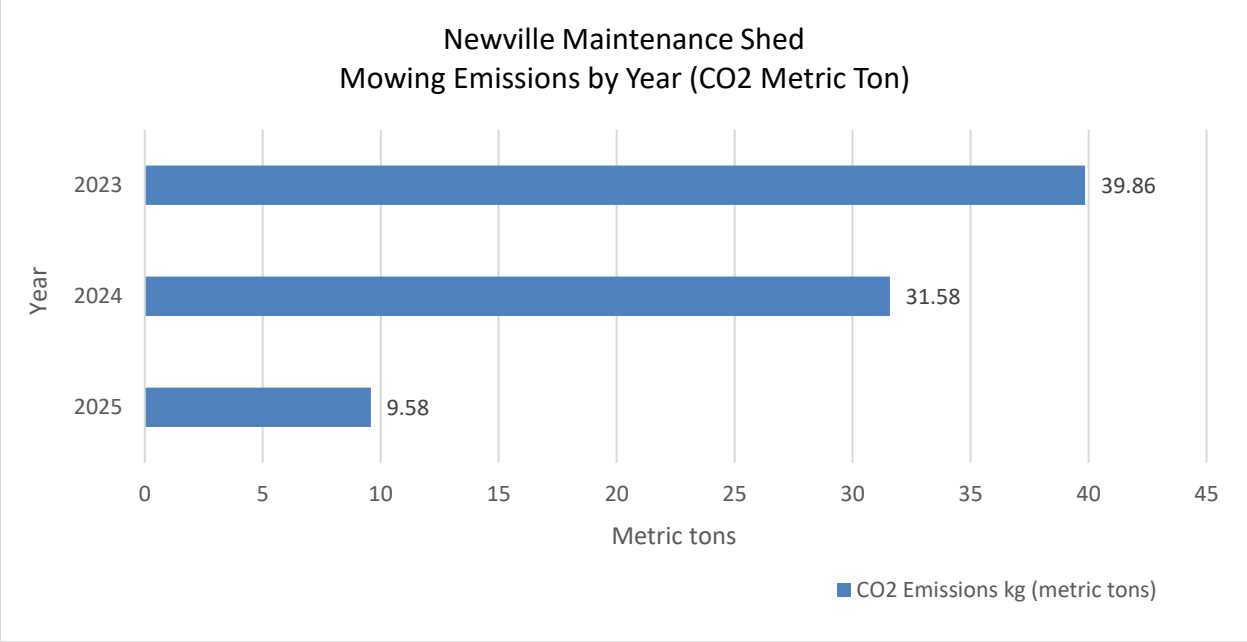
Year	Total Mower Hours	CO_2 Emissions kg (metric tons)
2023	1,859	39,857 (39.86)
2024*	1,473	31,581 (31.58)
2025	447	9,584 (9.58)

*IRVM implemented in September 2024.

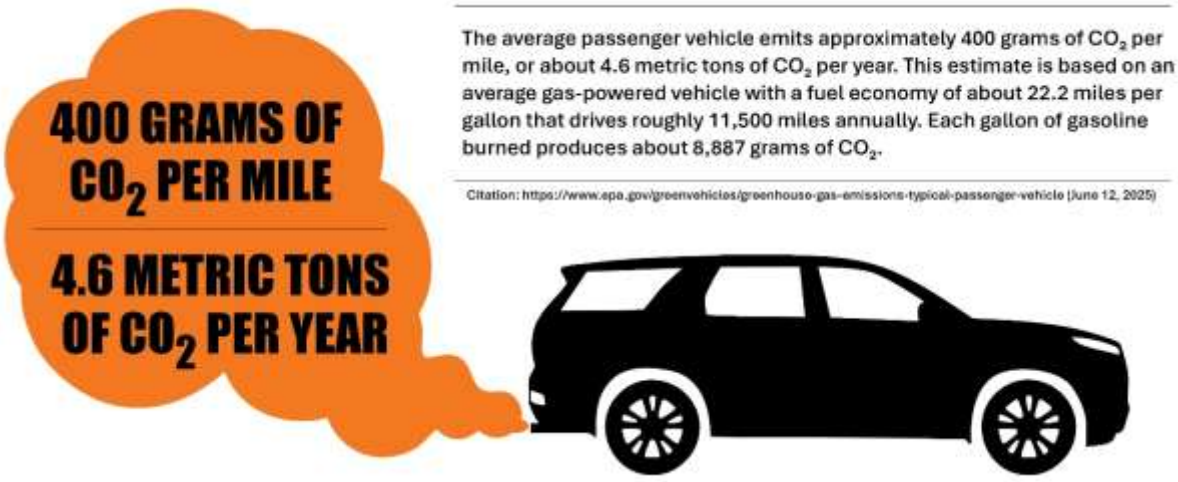
CO_2 Emissions Assumptions:

- Fuel burn rate: **2.1 gal diesel/hour**
- Emission factor: **10.21 kg CO_2/gal**
- CO_2 per mowing hour: **21.44 kg CO_2/hour**

Figure 20: Newville Maintenance Estimated Annual Mowing Emissions (2023-2025)



According to the U.S. Environmental Protection Agency (EPA), a typical passenger vehicle emits approximately 4.6 metric tons of CO_2 per year and emits approximately 400 grams of CO_2 per mile (EPA 2025). Therefore, implementing IRVM along just a 25-mile stretch of roadway is equivalent to eliminating the annual CO_2 emissions of seven (7) passenger cars from the roadway, or the equivalent of eliminating 75,750 miles of driving emissions from passenger cars.



4. Create how-to specification for seed mixes for specific sites/regions

The *Pollinator Initiative* was established to increase the function and value of PA Turnpike land while supporting the ecological benefit of pollinators, provide human benefits associated with the beautification of spaces, provide opportunities for education, and reduce the costs associated with vegetation management on PA Turnpike property. The Pollinator Habitat Pilot Program became the laboratory from which the PA Turnpike was able to test a variety of pollinator-supporting seed mixes across the full spectrum of ecoregions associated with the PA Turnpike's ROW, including the Monongahela Transition Zone, Forested Hills and Mountains, Northern Limestone/Dolomite Valleys, Pocono High Plateau, and Piedmont Uplands Ecoregion. In addition, seed mixes were selected for specific conditions, including hydric and upland soils, for shade tolerance, deer resistance, for sites under greater public scrutiny with a desire for showy flowering species.

After four years, the need exists to consolidate lessons learned into specific planting and management protocols to apply to the PA Turnpike's ROW as part of the IRVM program. In 2026, the project team will develop specifications for seed mixes and site preparation to retrofit ROW along the main roadways, and at interchanges, service plazas, and maintenance and administration campuses.

References

Bissonette, J.A., C.A. Kassar, and L.J. Cook. 2008. Assessment of costs associated with deer-vehicle collisions: human death and injury, vehicle damage and deer loss. Human-Wildlife Conflicts 2(1):17-27.

Borror, Donald J. and Roger Tory Peterson. 1998. *A Peterson Field Guide to Insects.* Houghton Mifflin Co., Boston, Massachusetts.

Brock, Jim P. and Kenn Kaufman. 2006. *Kaufman Field Guide to Butterflies of North America*. Originally published (2003) as *Kaufman Focus Guide to Butterflies of North America*. Houghton Mifflin Co., Boston, Massachusetts.

Evans, Arthur V. 2007. *National Wildlife Federation Field Guide to Insects and Spiders & Related Species of North America*. Sterling Publishing Company, New York, New York.

Eaton, Eric R. and Kenn Kaufman. *Kaufman Field Guide to Insects of North America*. 2007. Houghton Mifflin Co., Boston, Massachusetts.

McCormick Taylor and A.D. Marble. 2024. *Pollinator Pilot 2024 Year-End Report for the Pennsylvania Turnpike Central Administration Building, Allentown Service Plaza, Hickory Run Service Plaza, Irwin Interchange, Harrisburg West Interchange, and Bensalem Interchange.* Prepared for the Pennsylvania Turnpike Commission, Middletown, Pennsylvania.

National Oceanic and Atmospheric Administration (NOAA). 2025. Applied Climate Information System. NOAA Regional Climate Center. https://agacis.rcc-acis.org/, accessed January 27, 2026.

Pennsylvania Turnpike Commission. n.d.a. Pollinator Initiative. https://www.paturnpike.com/responsibility-matters/sustainability/pollinator-overview/pollinator-initiative, accessed December 2025.

Pennsylvania Turnpike Commission (PA TURNPIKE). n.d.b. Sustainability. https://www.paturnpike.com/responsibility-matters/sustainability, accessed January 2026.

Pennsylvania Turnpike Commission (PA TURNPIKE). 2025. *Deer Encounter Data, 2023 - 2025* [unpublished raw data]. PA TURNPIKE Traffic Engineering and Operations.

U.S. Department of Agriculture (USDA). n.d. Pollinators. https://www.climatehubs.usda.gov/topics/pollinators, accessed January 2026.

U.S. Drought Monitor. Maps. National Drought Mitigation Center, University of Nebraska-Lincoln. https://droughtmonitor.unl.edu/Maps.aspx, accessed Nov 11, 2025.

U.S. Environmental Protection Agency (EPA). 2025. Greenhouse Gas Emissions from a Typical Passenger Vehicle. https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle, accessed June 12, 2025.

Glossary of Terms

Dominant Blooming Species – Seed mix species providing the greatest areal coverage in a plot, and in bloom at the time of the monthly monitoring event.

Monarch CCAA – Reference to the Nationwide Candidate Conservation Agreement for Monarch Butterfly on Energy and Transportation Lands – An Integrated Candidate Conservation Agreement with Assurance and Candidate Conservation Agreement (Monarch CCAA). The CCAA provides regulatory certainty for energy companies' and transportation agencies' ongoing activities and supports monarch conservation.

Overall Growth Percentage – The absolute areal cover percentage of vegetation.

Peak Coverage – Highest percent areal cover of the seed mix observed during the growing season. The percentages are derived from the monthly monitoring events.

Pollinator Species Abundance – Total number of individuals observed. When rating sites, the following was used for the pollinators observed: High (>50 pollinators), Medium (25-49 pollinators), Low (<25 pollinators).

Pollinator Species Richness – Total number of species of pollinators observed.

Integrated Roadside Vegetation Management (IRVM) – An ecological-based maintenance approach that includes cost-effective, environmentally safe management alternatives to managing vegetated roadsides.

Appendix A

Pollinator Site Summaries

Central Administration Building (CAB)

Year Planted: 2022 **Total Planted Area:** 1.72 Acres

Cost to Establish: $13,893.99 ($8,077.90 Per Acre)

Plot 1: PA Central Lowland Province UPL Meadow Mix (Mid-July)

Plot 2: Butterfly & Hummingbird Garden Mix (Mid-July)

2025 Seed Mix Performance

★★★ Excellent (75%)
★★ Good (50-74%)
★ Poor (<50%)

(Based on germination rate and percent of areal cover)

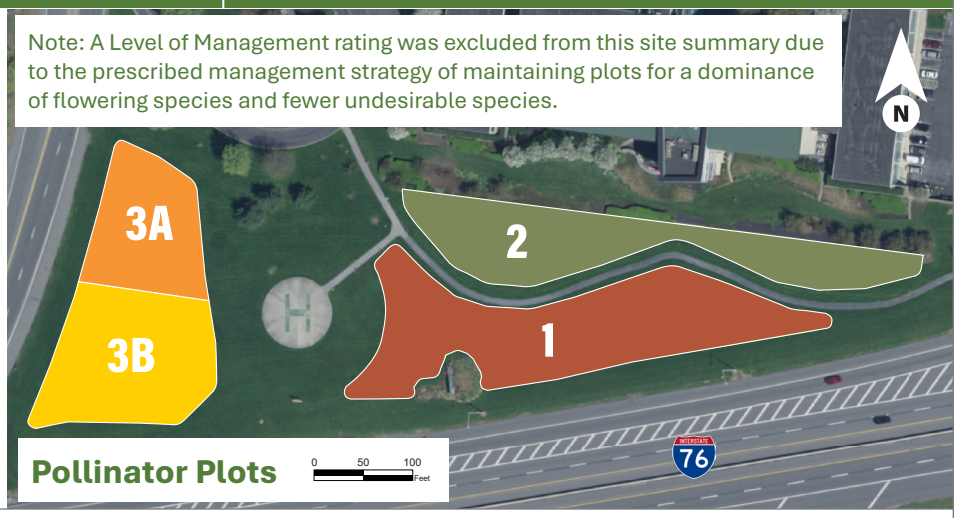
★★ PA Central Lowland Province UPL Meadow Mix

★★ Butterfly & Hummingbird Mix

★★ 2022 PennDOT Pollinator Habitat Mix

★★ Modified PennDOT Pollinator Habitat Mix

Note: A Level of Management rating was excluded from this site summary due to the prescribed management strategy of maintaining plots for a dominance of flowering species and fewer undesirable species.



Pollinator Species Richness and Abundance by Plot

Number indicates species richness.

Abundance indicated by shading:

High >50 Medium 25-49 Low <25

Plot #	1	2	3A	3B
2022	11	15	11	10
2023	22	19	13	19
2024	6	7	7	3
2025	19	14	19	13

Undesirable/Invasive Species by Plot

- 1 3A 3B Creeping thistle*
- All Plots Mugwort*
- 1 Crown vetch*
- 1 Prickly lettuce
- 1 3A 3B Pokeweed
- 1 2 3A Butterfly bush*
- All Plots Tree-of-heaven*
- All Plots Princess tree*
- 1 2 3B *Vitis* spp.
- 2 Staghorn sumac
- 2 Honeysuckle*
- 3A Oriental bittersweet*
- 3B Virginia creeper

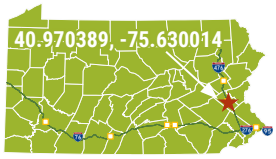
* Invasive species

Highlights:

- Plot 2 includes flowering species that germinate in early spring, outcompeting many undesirable species.
- All plots have established pollinator habitat requiring only annual fall conservation mowing to maintain.

Challenges:

- As the plots are located at PTC's CAB headquarters, additional expense and management were applied to encourage more flowering species and fewer undesirable incursions.



Hickory Run Service Plaza (HRSP)

Year Planted: 2022 **Total Planted Area:** 5.77 Acres

Cost to Establish: $26,202.78 ($4,541.21 Per Acre)

Plot 1A: Butterfly & Hummingbird Garden Mix (Late June)

Plot 3: Deer Resistant Meadow Mix #1 (Late August)

2025 Seed Mix Performance

★★★ Excellent (75%)
★★ Good (50-74%)
★ Poor (<50%)

(Based on germination rate and percent of areal cover)

★★ Butterfly & Hummingbird Mix

★★ PA Blue Ridge Province UPL Meadow Mix

★ 2022 PennDOT Pollinator Habitat Mix

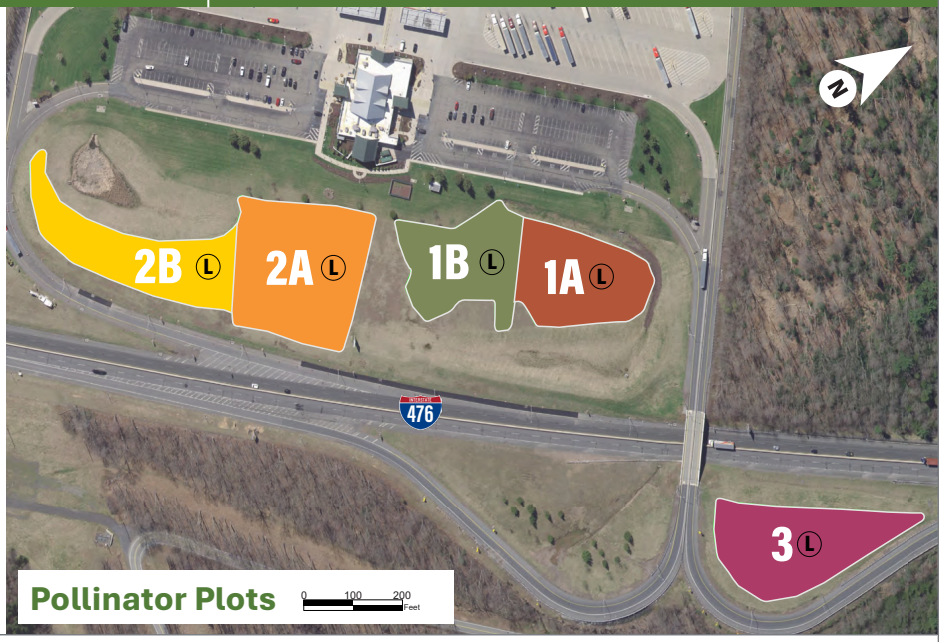
★★ Modified PennDOT Pollinator Habitat Mix

★★★ Deer Resistant Meadow Mix #1

Level of Management

(Spot Spray Applications)

(L) Low (M) Medium (H) High



Pollinator Species Richness and Abundance by Plot

Number indicates species richness.

Abundance indicated by shading:

High >50 Medium 25-49 Low <25

Plot #	1A	1B	2A	2B	3
2022	17	13	12	12	14
2023	39	17	26	29	23
2024	19	18	22	16	24
2025	14	13	15	19	19

Undesirable/Invasive Species by Plot

All plots: trace presence of invasive species. Undesirables are present, but low in quantity and cover. No treatments required.

Highlights:

- Low invasive species pressure.
- No herbicide treatments since planting.
- Highest germination rates noted for all plots in 2025.

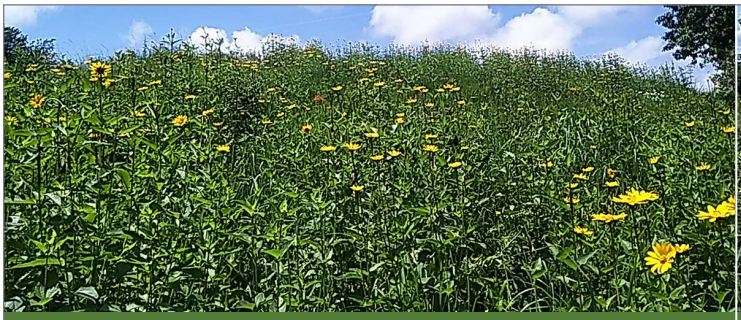
Challenges:

- Medium to low level of pollinators in 2025 after previously high levels in 2023-2024.
- Plot 2A lacks dominant seed mix cover. Poor site drainage impacting germination of seed mix.

Irwin Interchange (IRW)

Year Planted: 2023 **Total Planted Area:** 1.54 Acres

Cost to Establish: $8,498.90 ($5,518.77 Per Acre)



Plot 1: PTC Pollinator ROW Mix (Mid-June)

Plot 3: PTC Pollinator Interchange Mix (Mid-July)

2025 Seed Mix Performance

★★★ Excellent (75%)
★★ Good (50-74%)
★ Poor (<50%)
(Based on germination rate and percent of areal cover)

★★ PTC Pollinator ROW Mix

★ PTC Monarch Specialty Mix

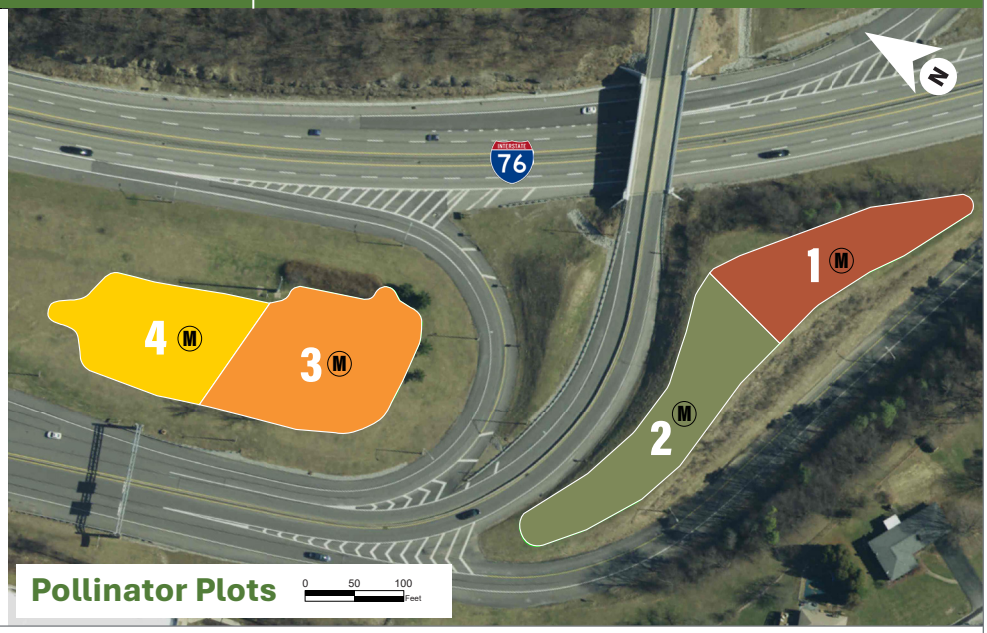
★★ PTC Pollinator Interchange Mix

★ PA Southern Allegheny Plateau Province Upland Meadow Mix with Nurse Crop

Level of Management

(Spot Spray Applications)

(L) Low (M) Medium (H) High



Pollinator Species Richness and Abundance by Plot

Number indicates species richness.

Abundance indicated by shading:

High >50 Medium 25-49 Low <25

Plot #	1	2	3	4
2023	3	6	3	2
2024	10	5	11	11
2025	17	19	12	22

Undesirable/Invasive Species by Plot

1 Canada thistle* and giant foxtail.

2 No singular problematic species; however, non-seed mix species are dominant cover.

3 4 Trace invasive species. Undesirables are present, but low in quantity and cover.

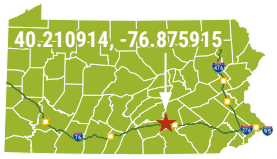
* Invasive species

Highlights:

- 100% germination of seed mix noted for Plots 3-4 in 2025.
- Medium level of pollinators in 2025 after previously low levels in 2023-2024.

Challenges:

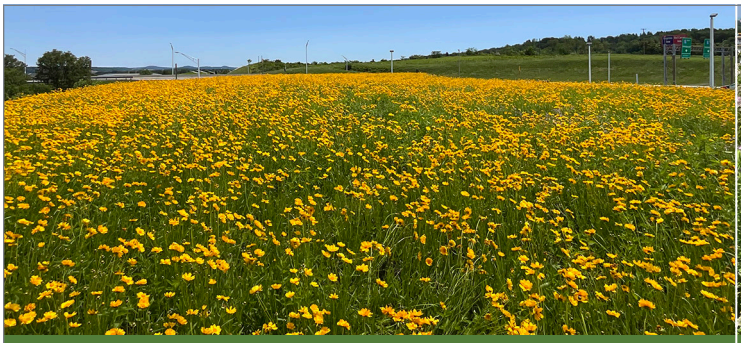
- Consistently low areal cover of seed mix species across all plots.
- Plots 2 and 4 lack dominant cover of seed mix (<50%).
- Medium to low level of pollinators.



Harrisburg West Interchange (HBGW)

Year Planted: 2023 **Total Planted Area:** 4.25 Acres

Cost to Establish: $ 23,830.20 ($5,607.11 Per Acre)



Plot 1C: PTC Pollinator Interchange Mix (Early June)

Plot 5: PTC Monarch Specialty Mix (Mid-July)

2025 Seed Mix Performance

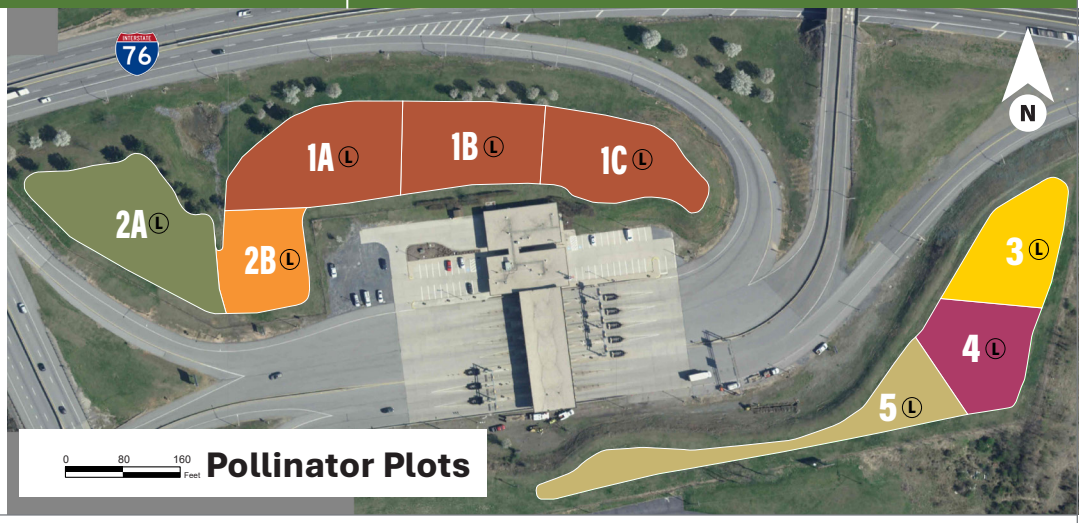
★★★ Excellent (75%)
★★ Good (50-74%)
★ Poor (<50%)
(Based on germination rate and percent of areal cover)

- ★★ PTC Pollinator Interchange Mix (Plot 1A)
- ★★★ PTC Pollinator Interchange Mix (Plots 1B and 1C)
- ★★ PTC Pollinator ROW Mix
- ★★ PTC Pollinator ROW Mix with Nurse Crop
- ★★ Deer Resistant Meadow Mix #1
- ★★★ Deer Resistant Meadow Mix #2
- ★★ PTC Monarch Speciality Mix

Level of Management

(Spot Spray Applications)

(L) Low (M) Medium (H) High



Pollinator Species Richness and Abundance by Plot

Number indicates species richness.

Abundance indicated by shading:

High >50 Medium 25-49 Low <25

Plot #	1A	1B	1C	2A	2B	3	4	5
2023	8	8	8	9	4	13	13	12
2024	7	9	6	13	5	8	9	17
2025	24	15	17	15	15	22	22	21

Undesirable/Invasive Species by Plot

- **All Plots** Crown vetch*
- 1A 2A 4 5 Pokeweed
- 1A 1C 2A Tree-of-heaven*
- 1A 2A 5 Staghorn sumac
- 1A Yellow foxtail
- 1C Trumpet vine
- 2A 2B 3 4 5 Canada thistle*
- 2A Bristle grass
- 2A 4 Black locust
- 2B 3 English plantain
- 5 Butter and eggs

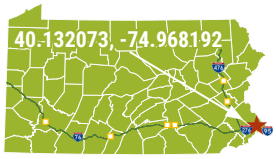
* Invasive species

Highlights:

- Seed mix species continue to maintain dominant areal cover of plots.
- Diversity of blooming species are present throughout entire monitoring season.
- Plots have supported a high pollinator species abundance, including avian species (northern yellow warbler, American goldfinch, mourning dove).

Challenges:

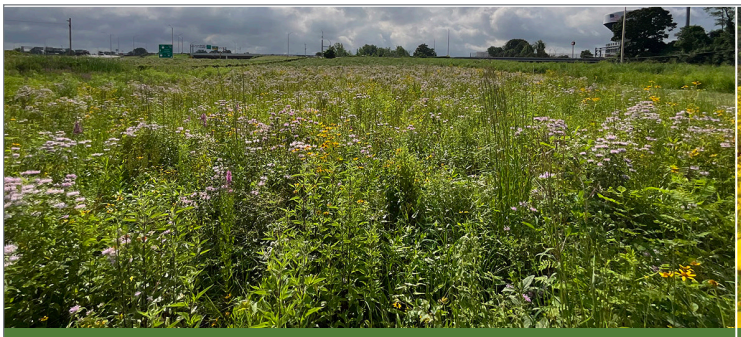
- Non-seed mix species incursions occurring along mowed pathways and plot borders.
- Incursion of crown vetch is present in the lower layer throughout the plots.
- Plots on hilltops and side slopes are susceptible to drought conditions.



Bensalem Interchange (BEN)

Year Planted: 2023 **Total Planted Area:** 2.70 Acres

Cost to Establish: $14,890.44 ($5,514.98 Per Acre)



Plot 2A: 2023 PennDOT Pollinator Habitat Mix (Mid-July)

Plot 3: PTC Wet Habitat Mix (Late September)

2025 Seed Mix Performance

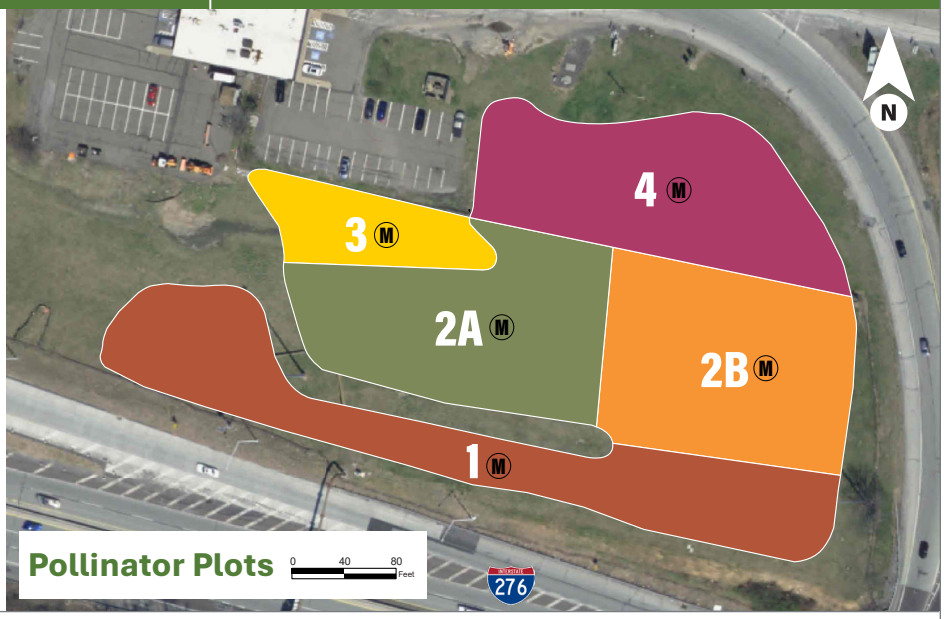
★★★ Excellent (75%)
★★ Good (50-74%)
★ Poor (<50%)
(Based on germination rate and percent of areal cover)

★★ PTC Pollinator Row Mix
★★ 2023 PennDOT Pollinator Habitat Mix
★★★ Modified PennDOT Pollinator Habitat Mix
★★ PTC Wet Habitat Mix
★★ PTC Pollinator Interchange Mix

Level of Management

(Spot Spray Applications)

(L) Low (M) Medium (H) High



Pollinator Species Richness and Abundance by Plot

Number indicates species richness.

Abundance indicated by shading:

High >50 Medium 25-49 Low <25

Plot #	1	2A	2B	3	4
2023	13	16	9	9	8
2024	12	11	13	12	13
2025	14	17	10	15	17

Undesirable/Invasive Species by Plot

1 2B 2A 4 Porcelain berry*
2B Creeping thistle*
3 Purple loosestrife*
1 Crown vetch*
2B 4 Pokeweed

* Invasive species

Highlights:

- Wetland seed mix showing success with consistent blooming species in late summer and fall months.
- Graminoid seed mix species have outcompeted undesirable/invasive species (resisting intrusions).

Challenges:

- Purple loosestrife from adjacent ditch continues to intrude into plots.
- Porcelain berry present prior to plot establishment and remains dominant species requiring active management in all plots (except Plot 3).
- Graminoid seed mix species dominate large portions of all plots (except Plot 3).

Allentown Service Plaza (ASP)

Year Planted: 2024 **Total Planted Area:** 7.5 Acres

Cost to Establish: $65,932.84 ($8,791.05 Per Acre)

Plot 1: PTC Monarch Specialty Mix (Mid-July)

Plot 2: PTC Wet Habitat Mix (Mid-September)

2025 Seed Mix Performance

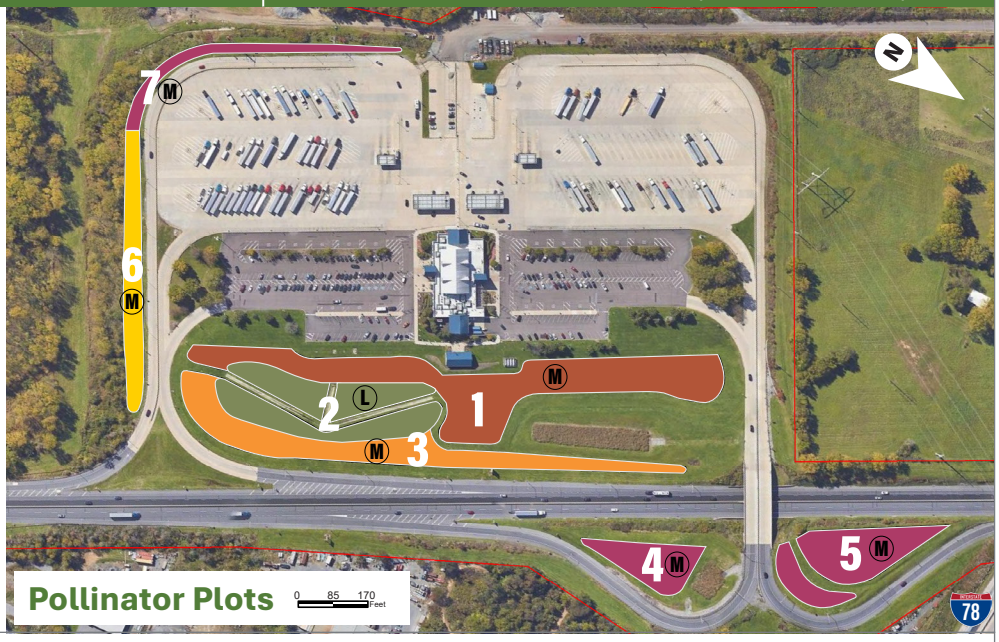
★★★ Excellent (75%)
★★ Good (50-74%)
★ Poor (<50%)
(Based on germination rate and percent of areal cover)

- ★★ PTC Monarch Specialty Mix
- ★★★ PTC Wet Habitat Mix
- ★★★ PTC Pollinator ROW Mix
- ★★ Deer Resistant Meadow Mix #1
- ★★ PTC Pollinator Interchange Mix

Level of Management

(Spot Spray Applications)

(L) Low (M) Medium (H) High



Pollinator Plots 0 85 170 Feet

Pollinator Species Richness and Abundance by Plot

Number indicates species richness.

Abundance indicated by shading:

High >50 Medium 25-49 Low <25

Plot #	1	2	3	4	5	6	7
2024	7	7	8	5	4	6	2
2025	17	13	15	17	13	14	13

Undesirable/Invasive Species by Plot

All Plots Canada thistle*	1 2 3 4 5 Staghorn sumac	5 Giant foxtail
1 3 4 5 6 7 American pokeweed	4 5 Mugwort*	4 6 Bindweed

* Invasive species

Highlights:

- Plots rapidly developed dense and full cover of desired vegetation in 1st year.
- Thick, tall (>5') growth by 2nd year.
- Central plaza (Plots 1-3) are dominated by showy seed mix species.

Challenges:

- Incursion of sumac.
- Access issues for herbicide applications (Plots 4-5).
- Frequent disturbances along parking lot edge (Plot 7).

T-168.4 Salt Shed Westbound (SS)

Year Planted: 2024 **Total Planted Area:** 0.88 Acres

Plot 2: Short Native Grasses Mix (July)

Plot 1: Short Native Grasses Mix (August)

2025 Seed Mix Performance

★★★ Excellent (75%)
★★ Good (50-74%)
★ Poor (<50%)

(Based on germination rate and percent of areal cover)

★★ Short Native Grasses Mix (Plots 1 and 2)

★ Short Native Grasses Mix (Plot 3)

Level of Management

(Spot Spray Applications)

(L) Low (M) Medium (H) High

Pollinator Species Richness and Abundance by Plot

Number indicates species richness.

Abundance indicated by shading:

High >50 Medium 25-49 Low <25

Plot #	1	2	3
2025	16	19	8

Undesirable/Invasive Species by Plot

Canada thistle* noted across all plots.

* Invasive species

Highlights:

- Quick establishment of seed mix.
- Trending as a tall, grassy, roadside meadow with few showy flowers.

Challenges:

- Few showy blooms to attract pollinators.
- Smaller plot sizes incur greater weed pressure (Plot 3).
- Low pollinator numbers.

Appendix B

Monthly Monitoring Summary Tables

Site Name: Central Administration Building (CAB)
Monitoring Year: 2025

Plot	Seed Mix	Number of Species in Applied Seed Mix	**Month of Observation**	Total # of Seed Mix Species Germinated:	Seed Mix Species Not Observed	Number of Seed Mix Species Observed	Total Percent Cover of Seed Mix Species	Dominant Cover: Seed Mix (Highest % cover of a species)	Dominant Cover: Non-Seed mix (Highest % cover of a species)	**Undesirable Plants**	# Blooming Species: Seed Mix	**Dominant Showy Bloomer**	Pollinators Diversity (Species Richness)	**Total Pollinator Species Observed**	Pollinator Abundance (Total # of Individual Pollinators)	Overall Pollinator Presence High: >50 Medium: 25-49 Low: 0-24	Amount of undesirable mitigation required (Total # of Treatments throughout season [Herbicides & mowing])
1	PA Central Lowland Province UPL Meadow Mix	19	May	17	White avens, Zigzag aster	12	48	Virgina Wild Rye (13%)	Creeping thistle (10%)	Creeping thistle, Mugwort, Crown vetch, Prickly lettuce, Pokeweed, Butterfly bush, Tree of Heaven, Princess Tree, Vitis spp.	2	Tall white beardtongue (5%)	2	19	5	High	
			June			16	74	Virgina Wild Rye (20%)	American pokeweed (5%), Daisy fleabane (5%), Perennial ryegrass (5%)		7	Oxeye sunflower (8%)	4		17		Milestone: Pokeweed, thistle & common broadleaf (6/4/25)
			July			11	77	Oxeye sunflower (15%)	Butterfly bush (3%), Common boneset (3%)		8	Oxeye sunflower (15%)	8		150		
			August			15	69	Heath aster (15%)	Canada goldenrod (5%), Common boneset (5%)		11	Calico aster (12%)	3		11		
			September			14	64	Heath aster (12%), Calico aster (12%)	Canada goldenrod (12%)		10	Heath aster, Calico aster (12% each)	6		87		
			October			14	54	Heath aster (16%)	Canada goldenrod (16%)		8	Heath aster (16%)	2		63		Milestone: common broadleaf (10/2/25) Annual Fall Mow (10/27)
Plot			**Month**			Plot Average	64.3										
2	Butterfly & Hummingbird Garden Mix	34	May	24	Aromatic aster, Blue false indigo, Corn poppy, Marsh blazing star, Ohio spiderwort, Perennial blue lupine, Rattlesnake master, Sundrops, White goldenrod, White wild indigo	16	88	Oxeye sunflower (12%), Shasta daisy (12%)	Common mugwort (3%)	Mugwort, Staghorn sumac (beneficial, but not goal of herbaceous plot), Tree of Heaven, Vitis spp., Honey suckle, Princess tree, Butterfly bush	8	Shasta daisy (12%)	6	14	47	High	
			June			18	82	Oxeye sunflower (20%)	Daisy fleabane (5%)		14	Oxeye sunflower (20%)	5		33		Milestone: Pokeweed, thistle & common broadleaf (6/4/25)
			July			16	81	Wild bergamot (12%)	Daisy fleabane (3%), Common boneset (3%)		12	Wild bergamot (12%)	9		231		
			August			15	56	Purple coneflower (8%)	Common boneset (4%), Canada goldenrod (4%), Tall goldenrod (4%)		11	Purple coneflower (8%)	2		20		
			September			13	61	Purple coneflower (10%), Heath aster (10%)	Canada goldenrod (8%)		4	Heath aster (10%)	5		28		
			October			15	65	Grayheaded coneflower (10%), Shasta daisy (10%)	Canada goldenrod (12%)		4	Heath aster (8%)	1		2		Milestone: common broadleaf (10/2/25) Annual Fall Mow (10/27)
Plot			**Month**			Plot Average	72.2										
3A	2022 PennDOT Pollinator Habitat Mix	24	May	21	Marsh blazing star, Partridge pea, White avens	14	77	Oxeye sunflower (12%)	Common mugwort (6%)	Mugwort, Tree of Heaven, Pokeweed, Oriental bittersweet, Princess Tree, Butterfly bush, Creeping thistle	4	Tall white beardtongue (9%)	5	19	43	High	
			June			13	84	Oxeye sunflower (25%)	Daisy fleabane (5%)		9	Oxeye sunflower (25%)	2		19		
			July			15	78	Calico aster (12%)	Daisy fleabane (3%), Common boneset (3%), Switchgrass (3%)		12	Oxeye sunflower, Wild Bergamot (10% each)	8		162		
			August			17	67	Calico aster (12%)	Canada goldenrod (8%)		12	Purple coneflower, Roundhead lespedeza (8% each)	4		8		
			September			14	60	Calico aster (15%)	Canada goldenrod (10%)		3	Calico aster (15%)	7		82		
			October			13	51	Calico aster (14%)	Canada goldenrod (12%)		5	Calico aster (14%)	4		41		Milestone: common broadleaf (10/2/25) Annual Fall Mow (10/27)
Plot			**Month**			Plot Average	69.5										
3B	Modified PennDOT Pollinator Habitat Mix	19	May	15	Aromatic aster, Marsh blazing star, Ohio spiderwort, Soft rush	10	65	Wild bergamot (12%)	Tall fescue (9%)	Mugwort, Creeping thistle, Tree of Heaven, Vitis spp., Princess Tree, Pokeweed, Virginia creeper	4	Tall white beardtongue (10%)	4	13	46	Medium	
			June			11	62	Switchgrass (33%)	Daisy fleabane (10%)		5	Purple coneflower (5%)	3		10		
			July			10	58	Switchgrass (20%)	Heath aster (8%), New England aster (8%)		6	Wild bergamot (12%)	7		104		
			August			10	53	Switchgrass (25%)	Heath aster (8%)		7	Common boneset (8%)	2		6		
			September			13	47	Switchgrass (16%)	Heath aster (10%)		5	Common boneset (8%)	7		86		
			October			9	55	Switchgrass (25%)	Canada goldenrod (10%)		3	Common boneset (13%)	5		41		Milestone: common broadleaf (10/2/25) Annual Fall Mow (10/27)
						Plot Average	56.7										

Site Name: Hickory Run Service Plaza (HRSP)
Monitoring Year: 2025

Plot	Seed Mix	Number of Species in Applied Seed Mix	**Month of Observation**	Total # of Seed Mix Species Germinated:	Seed Mix Species Not Observed	Number of Seed Mix Species Observed	Total Percent Cover of Seed Mix Species	Dominant Cover: Seed Mix (Highest % cover of a species)	Dominant Cover: Non-Seed mix (Highest % cover of a species)	Undesirable/Problematic Plants	# Blooming Species: Seed Mix	Dominant Showy Bloomer	Pollinators Diversity (Species Richness)	Total Pollinator Species Observed	Pollinator Abundance (Total # of Individual Pollinators)	Overall Pollinator Presence (Average) High: >50 Medium: 25-49 Low: 0-24	Amount of undesirable mitigation required (Total # of Treatments throughout season [Herbicides & mowing])
1A	Butterfly & Hummingbird Garden Mix	34	May	23	Aromatic aster, Bachelors buttons, Blue false indigo, California orange poppy, Corn poppy, Heath aster, Ohio spiderwort, Perennial blue lupine, Rattlesnake master, Rocket larkspur, White wild indigo	13	81	Shasta daisy (25%)	Canada goldenrod (6%)	Undesirables present, not requiring control	2	Golden alexanders (2%)	2	14	2	Medium	
			June			14	60	Lanceleaf coreopsis (8%)	Poverty grass (10%)		10	Lanceleaf coreopsis (8%)	5		9		
			July			15	73	Greyheaded coneflower (15%)	Spotted knapweed (7%)		12	Purple coneflower (7%)	9		55		
			August			12	67	Little bluestem, Purple coneflower, Greyheaded coneflower (all 7% each)	Wild carrot (8%)		7	Purple coneflower, Greyheaded coneflower (all 7% each)	7		30		
			September			14	69	Little bluestem (12%)	Common boneset (5%)		9	Blackeyed susan, Purple coneflower, Greyheaded coneflower,New England aster (6% each)	5		51		
			October			12	72	Little bluestem (12%)	Wild carrot (4%)		5	Gray goldenrod (7%)	1		5		Annual Fall Mow (11/5)
Plot			**Month**			Plot Average	70.3										
1B	e Ridge Province UPL Mead	16	May	16	N/A	8	22	New england aster (5%)	Grass sp. (35%)	Undesirables present, not requiring control	0	No Blooms	0	13	0	Low	
			June			6	50	Little bluestem (18%)	Poverty grass (20%)		2	Tall white beardtongue (15%)	0		0		
			July			11	59	Little bluestem (28%)	Birdsfoot trefoil (7%)		6	Early goldenrod (6%)	8		38		
			August			10	71	Little bluestem (30%)	Multiflora rose (5%)		5	Grey goldenrod, early goldenrod (10% each)	8		21		
			September			9	86	Little bluestem (56%)	Indiangrass, Big bluestem (all 3% each)		7	New England aster, Early goldenrod, Gray goldenrod (5% each)	7		22		
			October			8	73	Little bluestem (33%)	Grass leaf goldenrod, Indian grass (5% each)		2	Gray goldenrod, New England aster (8%)	0		0		Annual Fall Mow (11/5)
Plot			**Month**			Plot Average	60.2										
2A	2022 PennDOT Pollinator Habitat Mix	24	May	18	Butterfly weed, Common boneset, Mistflower, Ohio spiderwort, Purple Top, Wild senna	9	33	Lanceleaf coreopsis (8%)	Grass sp. (20%)	Undesirables present, not requiring control	0	No Blooms	1	15	1	Low	
			June			6	33	Lanceleaf coreopsis (15%)	Dark-green bullrush, Poverty grass (all 15% each)		5	Lanceleaf coreopsis (15%)	6		16		
			July			13	49	Wild bergamot (8%)	Birdsfoot trefoil (9%)		10	Wild bergamot (8%)	9		72		
			August			12	49	Little bluestem (10%)	Deer tongue grass (10%)		4	Purple coneflower (8%)	7		21		
			September			11	49	Big bluestem (10%)	White panicle aster (10%)		4	Narrowleaf mountainmint (3%)	5		7		
			October			10	38	Little bluestem, Big bluestem (all 10% each)	Virginia strawberry (10%)		2	Purple coneflower (5%)	2		5		Annual Fall Mow (11/5)
Plot			**Month**			Plot Average	41.8										
2B	Modified PennDOT Pollinator Habitat Mix	19	May	15	Mistflower, Butterfly weed, Common boneset, Foxglove beard tongue, Ohio spiderwort	9	45	Lanceleaf coreopsis (15%)	Birdsfoot trefoil (15%)	Undesirables present, not requiring control	0	No Blooms	1	19	4	Medium	
			June			8	57	Lanceleaf coreopsis (35%)	Oxeye daisy (15%)		6	Lanceleaf coreopsis (35%)	8		44		
			July			14	64	Switchgrass (15%)	Birdsfoot trefoil (6%)		9	Wild bergamot (12%)	11		162		
			August			9	72	Switchgrass (22%)	Spotted knapweed (10%)		6	Lanceleaf coreopsis (15%)	8		50		
			September			4	34	Little bluestem (15%)	Switchgrass (20%)		0	No Blooms	6		12		
			October			8	59	Switchgrass (20%)	Canada goldenrod, crowned vetch, grass leaf goldenrod (8% each)		3	Aromatic aster (2%)	1		10		Annual Fall Mow (11/5)
Plot			**Month**			Plot Average	55.2										
3	Deer Resistant Meadow Mix #1	25	May	22	Blue false indigo, Ohio spiderwort, Zigzag aster	11	60	Little bluestem (10%)	Grass sp. (35%)	Undesirables present, not requiring control	1	Golden alexanders (3%)	4	19	6	Medium	
			June			11	74	Tall white beardtongue, Lanceleaf coreopsis (all 12% each)	Crown vetch (10%)		6	Tall white beardtongue, Lanceleaf coreopsis (all 12% each)	6		47		
			July			16	74	Purple coneflower, Oxeye sunflower (all 12% each)	Birdsfoot trefoil (7%)		12	Purple coneflower, Oxeye sunflower (all 12% each)	9		71		
			August			15	94	Purple coneflower (30%)	Crown vetch, Grass leaf goldenrod, Indiangrass (all 10% each)		10	Purple coneflower (30%)	12		103		
			September			11	91	Purple coneflower (35%)	Crown vetch (5%)		7	Calico aster, Aromatic aster (8%)	5		6		
			October			12	73	Little bluestem (20%)	Poverty grass (8%)		1	Gray goldenrod (5%)	0		0		Annual Fall Mow (11/5)
						Plot Average	77.7										

Site Name: Irwin Interchange (IRW)
Monitoring Year: 2025

Plot	Seed Mix	Number of Species in Applied Seed Mix	**Month of Observation**	Total # of Seed Mix Species Germinated:	Seed Mix Species Not Observed	Number of Seed Mix Species Observed	Total Percent Cover of Seed Mix Species	Dominant Cover: Seed Mix (Highest % cover of a species)	Dominant Cover: Non-Seed mix (Highest % cover of a species)	Undesirable/Problematic Plants	# Blooming Species: Seed Mix	Dominant Showy Bloomer	Pollinators Diversity (Species Richness)	Total Pollinator Species Observed	Pollinator Abundance (Total # of Individual Pollinators)	Overall Pollinator Presence (Average) High: >50 Medium: 25-49 Low: 0-24	Amount of undesirable mitigation required (Total # of Treatments throughout season [Herbicides & mowing])
1	PTC Pollinator ROW Mix	16	May	14	Showy ticktrefoil, Narrow-leaf mountainmint	5	67	Oxeye sunflower (30%)	English plantain (12%)	Thistle, Foxtail	0	No blooms	5	17	9	Low	Crossbow: thistle & common broadleaf (5/28/25)
			June			9	62	Oxeye sunflower (18%)	English plantain (10%)		4	Oxeye sunflower (18%)	5		20		
			July			10	55	Oxeye sunflower (25%)	Common boneset (5%)		8	Oxeye sunflower (25%)	10		30		
			August			7	70	Switchgrass (23%)	Common ragweed (4%)		1	Oxeye sunflower (18%)	2		16		
			September			8	51	Oxeye sunflower (13%)	Canada thistle, Evening primrose, Yellow foxtail, Japanese bristle grass, Common boneset (5% each)		3	Oxeye sunflower (13%)	1		4		
			October			8	46	Switchgrass (20%)	Yellow foxtail (15%)		1	Showy tickseed (3%)	1		1		Annual Fall Mow (10/27)
Plot			**Month**			Plot Average	58.5										
2	PTC Monarch Specialty Mix	17	May	13	Purple coneflower, Rigid goldenrod, Showy milkweed, Spiked blazing star	5	18	Common milkweed (5%)	English plantain (22%)	No singular problematic species, but overall non-seed mix species dominance	0	No blooms	5	19	17	Medium	Crossbow: thistle & common broadleaf (5/28/25)
			June			6	21	Yellow wingstem, Wild bergamot, Early goldenrod (5% each)	English plantain (12%)		5	Yellow wingstem, Wild bergamot (5% each)	2		2		
			July			10	35	Yellow wingstem (8%)	Switchgrass, English plantain (5% each)		8	Blackeyed susan (6%)	4		12		
			August			9	28	Little bluestem (10%)	Burnweed, Evening primrose (9% each)		2	Blackeyed susan (3%)	11		116		
			September			11	23	Blackeyed susan, New england aster (4% each)	Evening primrose, Yellow foxtail, Japanese bristle grass, Common boneset (6% each)		4	Blackeyed susan, New england aster (4% each)	3		15		
			October			7	19	Yellow wingstem, Indian grass, Little bluestem, Wild bergamot (4% each)	Yellow foxtail (18%)		1	Blackeyed susan (1%)	3		5		Annual Fall Mow (10/27)
Plot			**Month**			Plot Average	24.0										
3	PTC Pollinator Interchange Mix	19	May	19	N/A	11	73	Lanceleaf coreopsis, Oxeye sunflower (all 25% each)	English plantain (12%)	Undesirables present, not requiring control	0	Purple coneflower (15%)	3	12	34	Medium	Crossbow: thistle & common broadleaf (5/28/25)
			June			11	50	Lanceleaf coreopsis (15%)	English plantain (14%)		7	Lanceleaf coreopsis (15%)	6		15		
			July			16	55	Purple coneflower (9%)	Common boneset, English plantain (5% each)		12	Purple coneflower (9%)	9		113		
			August			13	68	Oxeye sunflower (25%)	Common boneset (12%)		4	Oxeye sunflower (25%)	3		8		
			September			13	46	Purple coneflower, Oxeye sunflower (9% each)	Yellow foxtail (9%)		4	Purple coneflower, Oxeye sunflower (9% each)	4		53		
			October			10	70	Lanceleaf coreopsis (24%)	Yellow foxtail (9%)		2	Purple coneflower (9%)	0		0		Annual Fall Mow (10/27)
Plot			**Month**			Plot Average	60.3										
4	PA Southern Allegheny Plateau Province Upland Meadow Mix (with Nurse Crop)	17	May	17	N/A	10	27	Virginia wild rye (10%)	Wood sorrel (20%)	No singular problematic species, but overall non-seed mix species dominance	0	No blooms	5	22	7	Medium	Crossbow: thistle & common broadleaf (5/28/25)
			June			13	50	Virginia wild rye (16%)	English plantain (16%)		9	Browneyed susan (6%)	5		12		
			July			10	47	Oxeye sunflower (13%)	English plantain (7%)		9	Oxeye sunflower (13%)	12		52		
			August			10	40	Browneyed susan, Oxeye sunflower, Virginia wild rye, Gray goldenrod (7% each)	Timothy grass (11%)		6	Browneyed susan, Oxeye sunflower, Gray goldenrod (7% each)	7		60		
			September			11	47	Browneyed susan (10%)	Common boneset (10%)		6	Browneyed susan (10%)	5		116		
			October			12	46	Gray goldenrod (13%)	Yellow foxtail (20%)		6	Grey goldenrod (13%)	1		1		Annual Fall Mow (10/27)
						Plot Average	42.8										

Site Name: Harrisburg West interchange (HBGW)
Monitoring Year: 2025

Plot	Seed Mix	Number of Species in Applied Seed Mix	**Month of Observation**	Total # of Seed Mix Species Germinated:	Seed Mix Species Not Observed	Number of Seed Mix Species Observed	Total Percent Cover of Seed Mix Species	Dominant Cover: Seed Mix (Highest % cover of a species)	Dominant Cover: Non-Seed mix (Highest % cover of a species)	Undesirable/ Problematic Plants	# Blooming Species: Seed Mix	Dominant Showy Bloomer	Pollinators Diversity (Species Richness)	Total Pollinator Species Observed	Pollinator Abundance (Total # of Individual Pollinators)	Overall Pollinator Presence High: >50 Medium: 25-49 Low: 0-24	Amount of undesirable mitigation required (Total # of Treatments throughout season [Herbicides & mowing])
1A	PTC Pollinator Interchange Mix	19	May	16	Blue false indigo, Common milkweed, Rigid goldenrod	10	80	Oxeye sunflower (26%)	Crown vetch (6%)	Crown vetch, Pokeweed, Tree of Heaven, Staghorn sumac (beneficial, but not goal of herbaceous plot), Yellow foxtail	3	Oxeye sunflower (26%)	2	24	9	High	
			June			12	85	Oxeye sunflower (24%)	Crown vetch (8%)		8	Oxeye sunflower (24%)	14		171		
			July			11	70	Switchgrass (16%)	English plantain (8%)		11	Oxeye sunflower (14%)	10		101		Milestone: crown vetch, yellow toad flax,tree of heaven/sumac, pokeweed (7/22/25)
			August			14	79	Oxeye sunflower (15%)	Common boneset (3%), Crown vetch (3%)		8	Oxeye sunflower (15%)	7		23		
			September			7	60	Oxeye sunflower (20%)	English plantain (8%)		2	No blooms	4		19		
			October			10	56	Switchgrass (14%)	English plantain (8%), Crown vetch (8%)		3	Heath aster (4%)	2		7		Annual Fall Mow (10/29)
Plot			**Month**			Plot Average	71.7										
1B	PTC Pollinator Interchange Mix	19	May	14	Blue false indigo, Common milkweed, Early goldenrod, Purple top, Rigid goldenrod	9	88	Oxeye sunflower (54%)	Crown vetch (5%)	Crown vetch	2	Oxeye sunflower (54%)	5	15	22	High	
			June			12	94	Oxeye sunflower (52%)	Crown vetch (3%)		9	Oxeye sunflower (52%)	10		244		
			July			12	88	Oxeye sunflower (41%)	Crown vetch (2%), English plantain (2%)		10	Oxeye sunflower (41%)	8		95		Milestone: crown vetch, yellow toad flax,tree of heaven/sumac, pokeweed (7/22/25)
			August			9	84	Oxeye sunflower (32%)	Crown vetch (4%)		4	Oxeye sunflower (32%)	1		4		
			September			9	80	Oxeye sunflower (25%)	Canada goldenrod (4%), Black locust (4%)		3	Heath aster (5%)	3		9		
			October			6	67	Oxeye sunflower (40%)	English plantain (10%), Crown vetch (10%)		1	Heath aster (8%)	1		7		Annual Fall Mow (10/29)
Plot			**Month**			Plot Average	83.5										
1C	PTC Pollinator Interchange Mix	19	May	15	Blue false indigo, Common milkweed, Purple top, Rigid goldenrod	7	88	Lanceleaf coreopsis (47%)	Crown vetch (3%)	Crown vetch, Tree of Heaven, Trumpet vine	2	Lanceleaf coreopsis (47%)	6	17	78	Medium	
			June			10	83	Lanceleaf coreopsis (36%)	Crown vetch (7%)		6	Lanceleaf coreopsis (36%)	8		75		
			July			12	88	Switchgrass (32%)	Crown vetch (3%), English plantain (3%)		11	Lanceleaf coreopsis (16%)	6		49		Milestone: crown vetch, yellow toad flax,tree of heaven/sumac, pokeweed (7/22/25)
			August			13	80	Lanceleaf coreopsis (18%)	Crown vetch (6%)		6	Oxeye sunflower (8%)	4		8		
			September			11	80	Switchgrass (25%)	Crown vetch (5%), Silver cinquefoil (5%)		4	Heath aster (3%)	2		3		
			October			10	77	Switchgrass (25%)	English plantain (5%), Crown vetch (5%)		3	Heath aster (8%)	2		6		Annual Fall Mow (10/29)
Plot			**Month**			Plot Average	82.7										
2A	PTC Pollinator ROW Mix	16	May	16	N/A	13	82	Switchgrass (25%)	Wood sorrel (5%)	Crown vetch, Canada thistle, Staghorn sumac (beneficial, but not goal of herbaceous plot), Pokeweed, Bristle grass, Tree of Heaven, Black locust	0	No blooms	3	15	10	High	
			June			11	69	Oxeye sunflower (16%)	Crown vetch (5%), English plantain (5%)		5	Oxeye sunflower (16%)	10		217		
			July			11	67	Switchgrass (28%)	Daisy fleabane (3%), Crown vetch (3%), Japanese bristle grass (3%), Staghorn sumac (3%)		7	Oxeye sunflower (10%)	7		60		Milestone: crown vetch, yellow toad flax,tree of heaven/sumac, pokeweed (7/22/25)
			August			12	77	Switchgrass (25%)	Staghorn sumac (4%)		9	Oxeye sunflower (7%)	4		10		
			September			12	74	Switchgrass (20%)	Common boneset (8%)		7	Showy tickseed (11%)	4		33		
			October			10	64	Switchgrass (35%)	Common boneset (6%)		5	Showy tickseed (4%)	3		8		Annual Fall Mow (10/29)
Plot			**Month**			Plot Average	72.2										
2B	PTC Pollinator ROW Mix w Nurse Crop	18	May	13	Common milkweed, Early goldenrod, Narrowleaf mountainmint	9	50	Oxeye sunflower (16%)	English plantain (13%)	Crown vetch, English plantain, Canada thistle	0	No blooms	3	15	13	Medium	
			June			6	68	Oxeye sunflower (20%)	English plantain (10%)		4	Oxeye sunflower (20%)	8		159		
			July			8	66	Oxeye sunflower (18%)	English plantain (9%)		5	Oxeye sunflower (18%)	8		42		Milestone: crown vetch, yellow toad flax,tree of heaven/sumac, pokeweed (7/22/25)
			August			11	67	Switchgrass (18%)	English plantain (5%) Browneyed Susan (5%)		8	Oxeye sunflower (15%)	6		17		
			September			8	54	Switchgrass (20%)	English plantain (10%)		5	New England aster, showy tickseed (3% each)	3		9		
			October			10	51	Switchgrass (15%)	English plantain (8%), Crown vetch (8%)		6	Showy tickseed (4% each)	1		1		Annual Fall Mow (10/29)
Plot			**Month**			Plot Average	59.3										
3	Deer Resistant Meadow Mix #1	28	May	18	Aromatic aster, blue false indigo, Golden alexanders, Hairy beardtongue, Marsh blazing star, Ohio spiderwort, Tall white beardtongue, White goldenrod, Wild senna, Zigzag aster	10	69	Virginia wild rye (16%)	Greyheaded coneflower (12%)	Crown vetch, English plantain, Canada thistle	1	Lanceleaf coreopsis (6%)	4	22	11	High	
			June			9	57	Oxeye sunflower (17%)	Greyheaded coneflower (10%)		8	Oxeye sunflower (17%)	10		303		
			July			15	67	Side oats grama (10%), Oxeye sunflower (10%), Virginia wild rye (10%)	Greyheaded coneflower (13%)		13	Oxeye sunflower (10%)	9		170		
			August			10	56	Purple coneflower (10%), Little bluestem (10%)	Greyheaded coneflower (9%)		9	Purple coneflower (10%)	8		19		
			September			10	59	Little bluestem (14%)	Showy tickseed (9%)		6	Narrowleaf mountainmint (4%)	4		31		
			October			10	57	Little bluestem (15%)	Crown vetch (8%), Narrowleaf sunflower (8%)		2	Heath aster (5%)	5		28		Annual Fall Mow (10/29)
Plot			**Month**			Plot Average	60.8										

Plot	Seed Mix	Number of Species in Applied Seed Mix	**Month of Observation**	Total # of Seed Mix Species Germinated:	Seed Mix Species Not Observed	Number of Seed Mix Species Observed	Total Percent Cover of Seed Mix Species	Dominant Cover: Seed Mix (Highest % cover of a species)	Dominant Cover: Non-Seed mix (Highest % cover of a species)	Undesirable/ Problematic Plants	# Blooming Species: Seed Mix	Dominant Showy Bloomer	Pollinators Diversity (Species Richness)	Total Pollinator Species Observed	Pollinator Abundance (Total # of Individual Pollinators)	Overall Pollinator Presence High: >50 Medium: 25-49 Low: 0-24	Amount of undesirable mitigation required (Total # of Treatments throughout season [Herbicides & mowing])
4	Deer Resistant Meadow Mix #2	25	May	22	Blue false indigo, Purple top, Rigid goldenrod	14	84	Greyheaded coneflower (20%)	Crown vetch (3%)	Crown vetch, Canada thistle, Pokeweed, Black locust	1	Lanceleaf coreopsis (5%)	3	22	8	High	
			June			15	85	Greyheaded coneflower (15%), Oxeye sunflower (15%)	Crown vetch (6%)		10	Greyheaded coneflower, Oxeye sunflower (15% each)	10		247		
			July			19	94	Greyheaded coneflower (25%)	Crown vetch (1%), English plantain (1%), Black locust (1%), Common boneset (1%), Wood sorrel (1%)		15	Greyheaded coneflower (25%)	11		55		
			August			18	88	Greyheaded coneflower (17%)	Crown vetch (3%)		12	Greyheaded coneflower (17%)	6		23		
			September			16	83	Little bluestem (20%)	Crown vetch (4%)		6	Hairy mountainmint, showy tickseed (5% each)	7		34		
			October			14	79	Greyheaded coneflower (18%)	Crown vetch (5%)		4	Narrow-leaved sunflower (6%)	5		28		Annual Fall Mow (10/29)
Plot			**Month**			Plot Average	85.5										
5	PTC Monarch Specialty Seed Mix	17	May	14	Rigid goldenrod, Showy milkweed, Spiked blazing star	11	70	Wild bergamot (20%)	English plantain (7%)	Crown vetch, Pokeweed, Canada thistle, Butter and eggs, Staghorn sumac (beneficial, but not goal of herbaceous plot)	0	No blooms	2	21	5	High	
			June			12	72	Wild bergamot (15%)	Creeping thistle (5%), Crown vetch (5%)		7	Wild bergamot (15%)	10		162		
			July			12	81	Side oats grama (15^%)	Crown vetch (4%)		8	Wild bergamot (14%)	12		236		Milestone: crown vetch, yellow toad flax,tree of heaven/sumac, pokeweed (7/22/25)
			August			14	67	Wild bergamot (14%)	Crown vetch (6%)		10	Purple coneflower (6%)	7		24		
			September			11	73	Wild bergamot (20%)	Common boneset (8%)		5	Yellow wingstem (12%)	9		114		
			October			10	59	Little bluestem (14%)	Crown vetch (6%), Common boneset (6%)		4	Yellow wingstem (10%)	4		14		Annual Fall Mow (10/29)
						Plot Average	70.3										

Site Name: Bensalem Interchange (BEN)
Monitoring Year:2025

Plot	Seed Mix	Number of Species in Applied Seed Mix	**Month of Observation**	Total # of Seed Mix Species Germinated:	Seed Mix Species Not Observed	Number of Seed Mix Species Observed	Total Percent Cover of Seed Mix Species	Dominant Cover: Seed Mix (Highest % cover of a species)	Dominant Cover: Non-Seed mix (Highest % cover of a species)	Undesirable/ Problematic Plants	# Blooming Species: Seed Mix	Dominant Showy Bloomer	Pollinators Diversity (Species Richness)	Total Pollinator Species Observed	Pollinator Abundance (Total # of Individual Pollinators)	Overall Pollinator Presence High: >50 Medium: 25-49 Low: 0-24	Amount of undesirable mitigation required (Total # of Treatments throughout season [Herbicides & mowing])
1	PTC Pollinator ROW Mix	16	May	14	Common milkweed, Fall panicum grass	10	69	Showy tickseed (16%)	Porcelain berry (8%)	Porcelain berry, Crown vetch	2	Oxeye sunflower (8%)	4	14	11	Low	Vision (dicamba): pokeweed, porcelain berry, chickweed, broadleaf (5/15/25)
			June			7	60	Blackeyed Susan (15%), Showy tickseed (15%)	English plantain (10%)		5	Blackeyed Susan (15%)	7		23		
			July			13	63	Indian grass (10%)	Purple top (10%)		9	Oxeye sunflower, partridge pea (5% each)	2		8		Pushade: selective grass spray (plot 1 only) - 7/15/25 Roundup QuikPRO: loosestrife/porcelain berry/thistle/pokeweed - 7/23/25
			August			13	78	Indian grass (20%)	American pokeweed (5%), Japanese bristle grass (5%), Porcelain berry (5%), English plantain (5%)		11	Partridge pea (5%)	5		24		
			September			10	64	Switchgrass (20%)	Porcelain berry (8%)		7	Showy tickseed, New England aster, Blackeyed Susan, Narrowleaf mountainmint (2% each)	6		50		
			October			8	67	Little bluestem (18%)	Common boneset (15%)		5	No Blooms	0		0		Milestone: Common broadleaf/porcelain berry (10/1/25)
Plot			**Month**			Plot Average	66.8										
2A	2023 PennDOT Pollinator Habitat Mix	24	May	19	Marsh blazing star, Mistflower, Ohio spiderwort, Round seeded panic grass, Sundrops	16	86	Wild bergamot (25%)	Deer tongue grass (5%), Porcelain berry (5%)	Porcelain berry	4	Tall white beardtongue (20%)	5	17	45	Medium	Vision (dicamba): pokeweed, porcelain berry, chickweed, broadleaf (5/15/25)
			June			11	46	Blackeyed Susan (7%), Wild bergamot (7%)	English plantain (10%)		6	Blackeyed Susan (7%)	3		20		
			July			14	67	Wild bergamot (15%), Oxeye sunflower (15%)	Horseweed (7%), Deer tongue grass (7%), Common beggarticks (7%)		12	Wild bergamot, Oxeye sunflower (15% each)	8		96		Roundup QuikPRO: loosestrife/porcelain berry/thistle/pokeweed - 7/23/25
			August			12	52	Oxeye sunflower (15%)	Porcelain berry (10%)		10	Oxeye sunflower (15%)	8		28		
			September			8	48	Little bluestem (28%)	Common beggarticks (12%)		4	Common boneset (5%)	6		37		
			October			9	66	Little bluestem (30%)	Porcelain berry (12%)		4	Common boneset (15%)	1		7		Milestone: Common broadleaf/porcelain berry (10/1/25)
Plot			**Month**			Plot Average	60.8										
2B	Modified PennDOT Pollinator Habitat Mix	19	May	12	Aromatic aster, Anise hyssop, Golden alexander, Marsh blazing star, Ohio spiderwort, Partridge pea, Soft rush	6	27	Wild bergamot (10%)	Japanese bristle grass (30%)	Creeping thistle, Porcelain berry, Pokeweed	3	Tall white beardtongue (3%)	3	10	6	Low	Vision (dicamba): pokeweed, porcelain berry, chickweed, broadleaf (5/15/25)
			June			8	46	Switchgrass (25%)	Creeping thistle (20%)		5	Blackeyed Susan (5%)	5		13		
			July			8	50	Switchgrass (20%)	Burnweed (16%)		7	Wild bergamot (10%)	2		11		Roundup quickpro: loosestrife/porcelain berry/thistle/pokeweed - 7/23/25
			August			9	53	Switchgrass (27%)	Porcelain berry (15%)		5	Blackeyed Susan, purple coneflower (1% each)	2		7		
			September			5	64	Switchgrass (30%)	Porcelain berry (10%)		4	Common boneset (10%)	2		9		
			October			6	81	Switchgrass (40%)	Porcelain berry (10%)		4	Common boneset (15%)	1		1		Milestone: Common broadleaf/porcelain berry (10/1/25)
Plot			**Month**			Plot Average	53.5										
3	PTC Wet Habitat Mix	23	May	14	Button bush, Fowl manna grass, Frank's sedge, Green bullrush, Path rush, Shallow sedge, Soft rush, Squarrose sedge, Wool grass	7	89	Showy tickseed (50%)	Shasta daisy (4%)	Purple loosestrife	0	No blooms	2	15	6	Medium	Vision (dicamba): pokeweed, porcelain berry, chickweed, broadleaf (5/15/25)
			June			6	60	Showy tickseed (33%)	Deer tongue grass (8%), Common reed (8%)		3	Swamp milkweed (5%)	5		24		
			July			10	71	Showy tickseed (42%)	Creeping thistle (3%), English plantain (3%), Blackeyed Susan (3%), Purple loosestrife (3%), Yellow nutsedge (3%)		4	Swamp milkweed (5%)	8		52		Roundup QuikPRO: loosestrife/porcelain berry/thistle/pokeweed - 7/23/25
			August			8	69	Showy tickseed (35%)	English plantain (5%), Japanese bristle grass (5%), Porcelain berry (5%), Seaside goldenrod (5%)		6	Showy tickseed (35%)	9		33		
			September			6	74	Showy tickseed (35%)	Seaside goldenrod (10%)		6	Showy tickseed (35%)	8		100		
			October			5	86	Sawtooth sunflower (30%), Showy tickseed (30%)	Seaside goldenrod (5%)		5	Sawtooth sunflower, Showy tickseed (30% each)	4		25		Milestone: Common broadleaf/porcelain berry (10/1/25) Annual Fall Mow (11/6/2026)
Plot			**Month**			Plot Average	74.8										
4	PTC Pollinator Interchange Mix	19	May	16	Blue false indigo, Rigid goldenrod, Virginia wild rye	10	57	Lanceleaf coreopsis (21%)	Canada thistle (8%), English plantain (8%)	Porcelain berry, Pokeweed	1	Lanceleaf coreopsis (21%)	6	17	34	Medium	Vision (dicamba): pokeweed, porcelain berry, chickweed, broadleaf (5/15/25)
			June			11	60	Switchgrass (10%)	English plantain (10%), white clover (10%)		8	Wild bergamot (8%)	5		34		
			July			13	60	Little bluestem (10%), Lanceleaf coreopsis (10%), Switchgrass (10%)	English plantain (5%), Horseweed (5%), Porcelain berry (5%)		12	Lanceleaf coreopsis (10%)	8		45		Roundup QuikPRO: loosestrife/porcelain berry/thistle/pokeweed - 7/23/25
			August			9	57	Switchgrass (15%)	English plantain (10%)		7	Lanceleaf coreopsis (8%)	7		19		
			September			10	60	Little bluestem (25%)	Porcelain berry (10%)		6	Lanceleaf coreopsis (10%)	6		21		
			October			7	65	Little bluestem (20%)	Common boneset (7%)		5	Lanceleaf coreopsis (15%)	3		9		Milestone: Common broadleaf/porcelain berry (10/1/25)
						Plot Average	59.8										

Site Name: Allentown Service Plaza (ASP)

Monitoring Year: 2025

Plot	Seed Mix	Number of Species in Applied Seed Mix	**Month of Observation**	Total # of Seed Mix Species Germinated:	Seed Mix Species Not Observed	Number of Seed Mix Species Observed	Total Percent Cover of Seed Mix Species	Dominant Cover: Seed Mix (Highest % cover of a species)	Dominant Cover: Non-Seed mix (Highest % cover of a species)	Undesirable/ Problematic Plants	# Blooming Species: Seed Mix	Dominant Showy Bloomer	Pollinators Diversity (Species Richness)	Total Pollinator Species Observed	Pollinator Abundance (Total # of Individual Pollinators)	Overall Pollinator Presence (Average) High: >50 Medium: 25-49 Low: 0-24	Amount of undesirable mitigation required (Total # of Treatments throughout season [Herbicides & mowing])
1	PTC Monarch Speciality Seed Mix	17	May	17	N/A	9	54	Wild bergamot (18%)	Canada thistle (12%)	Canada thistle, American pokeweed, Staghorn sumac (beneficial, but not goal of herbaceous plot)	0	No blooms	2	17	4	Medium	Pre-emergent: 0-0-7 w/ .22 Dimension 2 Applications: 3/31/25, 5/13/25
			June			11	89	Blackeyed Susan (30%)	Canada thistle (3%)		6	Blackeyed Susan (30%)	11		112		Lontrel: thistle & common broadleaf (6/2/25) Vision (Dicambia): pokeweed, chickweed, common broadleaf (6/4/25)
			July			8	74	Blackeyed susan (17%)	Tall fescue (5%)		7	Blackeyed Susan (17%)	6		36		
			August			12	51	Purple coneflower, Side oats gamma, Wild bergamot (9% each)	Horseweed, Common ragweed (9% each)		2	Narrowleaf mountainmint (3%)	8		57		
			September			13	78	Indian grass (27%)	Ragweed (5%)		6	Yellow wingstem, swamp milkweed (12 % each)	2		8		
			October			13	52	Wild bergamot (8%)	Canada thistle (5%)		1	Early goldenrod (3%)	4		57		Annual Fall Mow (11/7)
Plot			**Month**			Plot Average	66.3										
2	PTC Wet Habitat Mix	23	May	16	Button bush, Fowl Manna Grass, Frank's Sedge, Green Bulrush, Shallow sedge, Squarrose Sedge, Woolgrass	10	68	Showy tickseed (31%)	Canada thistle (20%)	Canada thistle, Staghorn sumac (beneficial, but not goal of herbaceous plot)	0	No blooms	2	13	3	High	Pre-emergent: 0-0-7 w/ .22 Dimension 2 Applications: 3/31/25, 5/13/25
			June			10	89	Showy tickseed (35%)	Canada thistle (5%)		3	Swamp milkweed (20%)	8		49		Lontrel: thistle & common broadleaf (6/2/25) Vision (Dicambia): pokeweed, chickweed, common broadleaf (6/4/25)
			July			8	63	Swamp milkweed (30%)	Common ragweed (10%)		4	Swamp milkweed (30%)	7		34		
			August			13	86	Swamp milkweed (12%)	Common ragweed (5%)		4	New England aster (10%)	6		74		
			September			9	75	Showy tickseed (30%)	Daisy fleabane, Dogbane, English plantain, Grass leaf goldenrod, Tall goldenrod (5% each)		6	Showy tickseed (30%)	4		13		
			October			8	85	Swamp milkweed, Common boneset, Showy tickseed (19% each)	Common ragweed, Burnweed (2% each)		2	Common boneset (19%)	3		167		Annual Fall Mow (11/7)
Plot			**Month**			Plot Average	77.7										
3	PTC Pollinator ROW Mix	16	May	16	N/A	8	83	Showy tickseed (60%)	Canada thistle (20%)	Canada thistle, American pokeweed, Staghorn sumac (beneficial, but not goal of herbaceous plot)	0	No blooms	4	15	7	Medium	Pre-emergent: 0-0-7 w/ .22 Dimension 2 Applications: 3/31/25, 5/13/25
			June			10	87	Switchgrass (30%)	Canada thistle (8%)		4	Oxeye sunflower (25%)	6		30		Lontrel: thistle & common broadleaf (6/2/25) Vision (Dicambia): pokeweed, chickweed, common broadleaf (6/4/25)
			July			9	80	Switchgrass (25%)	Common ragweed (5%)		7	Blackeyed susan (15%)	5		12		
			August			8	83	Switchgrass (45%)	Horseweed, Common chicory (9% each)		3	Oxeye sunflower (12%)	9		47		
			September			11	85	Switchgrass (30%)	Wild bergamot, Common boneset (5% each)		7	Showy tickseed (15%)	4		12		
			October			11	92	Switchgrass (20%)	Staghorn sumac (2%)		4	New England aster (1%)	5		105		Annual Fall Mow (11/7)
Plot			**Month**			Plot Average	85.0										
4	PTC Pollinator Interchange Mix	19	May	18	Showy tick trefoil	10	64	Lanceleaf coreopsis (11%)	Canada thistle (15%)	Canada thistle, American pokeweed, Foxtail, Mugwort, Bindweed, Staghorn sumac (beneficial, but not goal of herbaceous plot)	0	No blooms	3	17	4	Low	Pre-emergent: 0-0-7 w/ .22 Dimension 2 Applications: 3/31/25, 5/13/25
			June			8	85	Switchgrass (25%)	Burnweed, Canada thistle (3% each)		7	Oxeye sunflower (20%)	6		38		Lontrel: thistle & common broadleaf (6/2/25) Vision (Dicambia): pokeweed, chickweed, common broadleaf (6/4/25)
			July			10	77	Blackeyed susan, Switchgrass, Oxeye sunflower (15% each)	Barnyard grass (7%)		9	Oxeye sunflower, Blackeyed susan (15% each)	8		25		
			August			8	65	Switchgrass (35%)	Foxtail (10%)		5	Lanceleaf coreopsis, swamp milkweed (5% each)	6		18		
			September			10	38	Switchgrass (10%)	Mugwort (10%)		5	Blackeyed susan (4%)	3		13		
			October			10	59	Switchgrass (27%)	Mugwort (6%)		4	Heath aster, narrowleaf mountainmint (1% each)	6		20		Annual Fall Mow (11/7)
Plot			**Month**			Plot Average	64.7										
5	PTC Pollinator Interchange Mix	19	May	17	Purpletop, Rigid goldenrod	5	32	Swamp milkweed (9%)	Canada thistle (16%)	Canada thistle, American pokeweed, Mugwort, Staghorn sumac (beneficial, but not goal of herbaceous plot)	0	No blooms	5	13	20	Medium	Pre-emergent: 0-0-7 w/ .22 Dimension 2 Applications: 3/31/25, 5/13/25
			June			11	66	Blackeyed susan, switchgrass (20% each)	Canada thistle, Late thoroughwort (7% each)		10	Blackeyed Susan (20%)	5		20		Lontrel: thistle & common broadleaf (6/2/25) Vision (Dicambia): pokeweed, chickweed, common broadleaf (6/4/25)
			July			9	61	Wild bergamot (13%)	Canada thistle (6%)		7	Wild bergamot (13%)	6		10		
			August			12	40	Switchgrass (18%)	Late thoroughwort (8%)		4	Oxeye sunflower (2%)	10		43		
			September			10	62	Switchgrass (15%)	Late thoroughwort (7%)		4	Blackeyed susan (12%)	4		18		
			October			11	58	Switchgrass, Early goldenrod (10% each)	Pokeweed, Daisey fleabane, mugwort (5% each)		2	Blackeyed susan (8%)	2		9		Annual Fall Mow (11/7)
Plot			**Month**			Plot Average	53.2										

Plot	Seed Mix	Number of Species in Applied Seed Mix	**Month of Observation**	Total # of Seed Mix Species Germinated:	Seed Mix Species Not Observed	Number of Seed Mix Species Observed	Total Percent Cover of Seed Mix Species	Dominant Cover: Seed Mix (Highest % cover of a species)	Dominant Cover: Non-Seed mix (Highest % cover of a species)	Undesirable/ Problematic Plants	# Blooming Species: Seed Mix	Dominant Showy Bloomer	Pollinators Diversity (Species Richness)	Total Pollinator Species Observed	Pollinator Abundance (Total # of Individual Pollinators)	Overall Pollinator Presence (Average) High: >50 Medium: 25-49 Low: 0-24	Amount of undesirable mitigation required (Total # of Treatments throughout season [Herbicides & mowing])
6	Deer Resistant Meadow Mix #1	27	May	19	Blue false indigo, Early goldenrod, Golden alexanders, Marsh blazing star, Ohio spiderwort, Purple lovegrass, Roundheaded lespedeza, Zigzag aster	9	62	Virginia wild rye (15%)	Bindweed (7%)	Canada thistle, American pokeweed, Bindweed	2	Lanceleaf coreopsis (10%)	4	14	6	Medium	Pre-emergent: 0-0-7 w/ .22 Dimension 2 Applications: 3/31/25, 5/13/25
			June			10	77	Blackeyed susan, Wild bergamot, and Side oats gamma (15% each)	Bindweed, Burnweed (5% each)		5	Blackeyed Susan (15%)	4		20		Lontrel: thistle & common broadleaf (6/2/25) Vision (Dicambia): pokeweed, chickweed, common broadleaf (6/4/25)
			July			7	65	Blackeyed susan (28%)	Crown vetch (8%)		7	Blackeyed susan (28%)	4		16		
			August			11	53	Browneyed susan (13%)	Barnyard grass (12%)		5	Browneyed susan (13%)	8		58		
			September			12	81	Browneyed Susan (25%)	Common beggar ticks (5%)		6	Browneyed susan (25%)	4		12		
			October			13	67	Browneyed Susan (24%)	Burnweed (7%)		6	Browneyed susan (24%)	5		53		
Plot			**Month**			Plot Average	67.5										
7	PTC Pollinator Interchange Mix	19	May	17	Blue false indigo, showy tick trefoil	7	58	Wild bergamot, Blackeyed susan (all 11% each)	English plantain, Creeping thistle (6% each)	Canada thistle, American pokeweed	0	No Blooms	2	13	3	Medium	Pre-emergent: 0-0-7 w/ .22 Dimension 2 Applications: 3/31/25, 5/13/25
			June			10	61	Blackeyed susan (30%)	Canada thistle (8%)		5	Blackeyed Susan (30%)	3		9		Lontrel: thistle & common broadleaf (6/2/25) Vision (Dicambia): pokeweed, chickweed, common broadleaf (6/4/25)
			July			10	68	Blackeyed susan (25%)	Barnyard grass (6%)		9	Blackeyed Susan (25%)	5		14		
			August			15	65	Switchgrass (12%)	Barnyard grass, Foxtail (5% each)		7	Blackeyed Susan (5%)	7		57		
			September			13	60	Switchgrass (20%)	Evening primrose (8%)		6	Showy tick trefoil (6%)	5		12		
			October			10	49	Switchgrass (23%)	Common ragweed (20%)		6	Wild bergamot (10%)	5		82		
						Plot Average	60.2										

Site Name: T-168.4 Salt Shed Westbound
Monitoring Year:2025

Plot	Seed Mix	Number of Species in Applied Seed Mix	**Month of Observation**	Total # of Seed Mix Species Germinated:	Seed Mix Species Not Observed	Number of Seed Mix Species Observed	Total Percent Cover of Seed Mix Species	Dominant Cover: Seed Mix (Highest % cover of a species)	Dominant Cover: Non-Seed mix (Highest % cover of a species)	Undesirable/Problematic Plants	# Blooming Species: Seed Mix	Dominant Showy Bloomer	Pollinators Diversity (Species Richness)	Total Pollinator Species Observed	Pollinator Abundance (Total # of Individual Pollinators)	Overall Pollinator Presence (Average) High: >50 Medium: 25-49 Low: 0-24	Amount of undesirable mitigation required (Total # of Treatments throughout season [Herbicides & mowing])
1	Short Native Grass Mixture (Pl 1)	8	June	5	Little bluestem, Sideoats grama, and Annual ryegrass	3	66	Perennial ryegrass (30%)	Curly dock (30%)	Canada thistle (treated)	2	Blackeyed susan (2%)	7	16	10	Low	Crossbow: thistle & common broadleaf (5/28/25) Mowed thistle patches
			July			3	47	Perennial ryegrass (35%)	Curly dock (25%)		3	Purple coneflower (8%)	7		38		
			August			3	54	Switchgrass (30%)	Crowned vetch (15%)		3	Purple coneflower (15%)	8		46		
			September			3	58	Switchgrass (50%)	Curly dock (15%)		1	No blooms	5		7		
			October			3	62	Switchgrass (54%)	Curly dock (15%)		1	No blooms	3		3		Annual Fall Mow (10/28)
Plot			**Month**			Plot Average	57.4										
2	Short Native Grass Mixture (Pl 2)	8	June	5	Little bluestem, Sideoats grama, Annual ryegrass	4	53	Perennial ryegrass, Plain coreopsis (all 25% each)	Birdsfoot trefoil, Tall fescue (8% each)	Canada thistle (treated)	2	Blackeyed susan (2%)	7	19	21	Low	Crossbow: thistle & common broadleaf (5/28/25) Mowed thistle patches
			July			5	69	Perennial ryegrass, Plain coreopsis (all 30% each)	Red clover, Curly dock (5% each)		4	Plains coreopsis (30%)	9		75		
			August			5	47	Switchgrass (25%)	Canada thistle (8%)		3	Plains coreopsis (3%)	4		15		
			September			4	63	Perennial ryegrass, Switchgrass (all 25% each)	Aster pilose (6%)		1	Purple coneflower (1%)	1		1		
			October			5	66	Perennial ryegrass (28%)	Aster pilose (7%)		0	No blooms	6		11		Annual Fall Mow (10/28)
Plot			**Month**			Plot Average	59.2										
3	Short Native Grass Mixture (Pl 3)	8	June	5	Little bluestem, Annual ryegrass, Switchgrass	2	12	Perennial ryegrass (10%)	Birdsfoot trefoil (20%)	Canada thistle (treated)	0	No blooms	3	8	4	Low	Crossbow: thistle & common broadleaf (5/28/25) Mowed thistle patches
			July			3	19	Perennial ryegrass (12%)	Birdsfoot trefoil (25%)		3	Plains coreopsis (5%)	5		24		
			August			6	13	Perennial ryegrass (7%)	Common ragweed (20%)		6	Plains coreopsis (3%)	3		3		
			September			3	21	Perennial ryegrass (15%)	Common ragweed, birdsfoot trefoil (15% each)		1	No blooms	0		0		
			October			5	31	Perennial ryegrass (15%)	Common ragweed, birdsfoot trefoil (15% each)		1	No blooms	0		0		Annual Fall Mow (10/28)

Appendix C

Photographs

Central Administration Building (CAB) - 2025


Plot 1 (June)


Plot 2 (July)


Plot 3A (July)


Plot 3B (July)


Plot 1 (September)


Plot 2 (September)


Plot 3A (September)


Plot 3B (September)

Irwin Interchange (IRW) – 2025


Plot 1 (June)

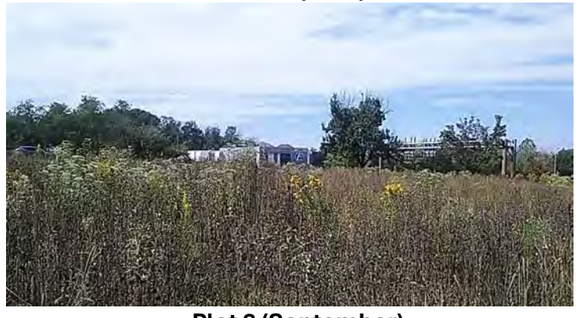

Plot 2 (June)


Plot 3 (June)


Plot 4 (July)


Plot 1 (September)


Plot 2 (September)


Plot 3 (September)


Plot 4 (September)

Hickory Run Service Plaza (HRSP) - 2025

Plot 1A (July)

Plot 1B (June)

Plot 1A (September)

Plot 1B (October)

Plot 2A (July)

Plot 2B (June)

Plot 3 (July)

Plot 2A (October)

Plot 2B (August)

Plot 3 (August)

Harrisburg West Interchange (HBGW) - 2025

Plot 1A (June)

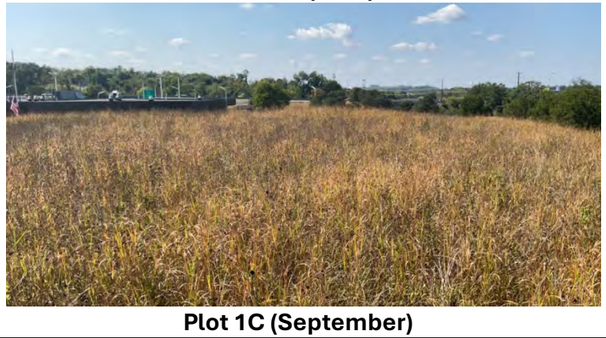
Plot 1B (July)

Plot 1C (June)

Plot 2A (June)

Plot 1A (September)

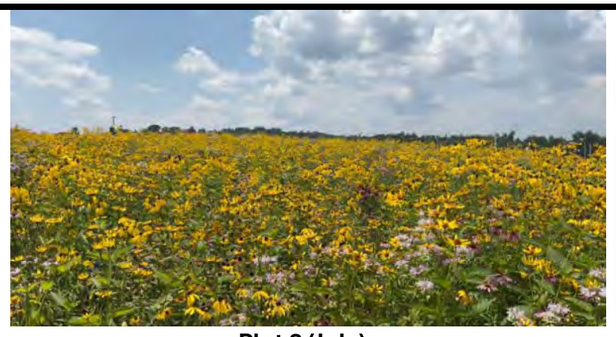
Plot 1B (September)



Plot 1C (September)

Plot 2A (September)

Plot 2B (June)



Plot 3 (July)

Plot 4 (July)

Plot 5 (July)

Plot 2B (September)

Plot 3 (September)

Plot 4 (September)

Plot 5 (September)

T-168.4 Salt Shed Westbound (SS) - 2025

Plot 1 (July)

Plot 1 (July)

Plot 2 (July)

Plot 1 (September)

Plot 2 (September)

Plot 3 (September)

Bensalem Interchange (BEN) - 2025

Plot 1 (July)

Plot 1 (September)

Bensalem Interchange (BEN) - 2025

Plot 2A (July)

Plot 2B (July)

Plot 3 (July)

Plot 4 (July)

Plot 2A (September)

Plot 2B (September)

Plot 3 (October)

Plot 4 (October)

Allentown Service Plaza (ASP)
2025

Plot 1 (June)

Plot 2 (June)

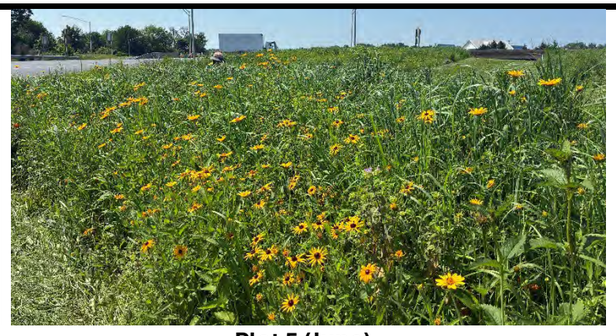
Plot 3 (June)

Plot 1 (September)

Plot 2 (September)

Plot 3 (October)

Plot 4 (June)



Plot 5 (June)

Plot 6 (June)

Plot 7 (June)

Plot 4 (September)

Plot 5 (September)

Plot 6 (October)

Plot 7 (October)

Appendix D

Pollinator Seed Mix Summaries

PTC Monarch Specialty Mix

Location	Rate Applied
Allentown Service Plaza (ASP)	18 lbs./ac.
Harrisburg West Interchange (HBGW)	12 lbs./ac.
Irwin Interchange (IRW)	12 lbs./ac.

Species Bloom Times

Common Name	Scientific Name	Growing Season Bloom Time								
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
black-eyed Susan	*Rudbeckia hirta*									
butterfly milkweed	*Asclepias tuberosa*									
common milkweed	*Asclepias syriaca*									
early goldenrod	*Solidago juncea*									
Indian grass*	*Sorghastrum nutans*									
little bluestem*	*Schizachyrium scoparium*									
narrowleaf mountainmint	*Pycnanthemum tenuifolium*									
New England aster	*Symphyotrichum novae-angliae*									
partridge pea	*Cassia fasciculata*									
purple coneflower	*Echinacea purpurea*									
rigid goldenrod	*Solidago rigida*									
showy milkweed (U.S. native, PA absent)	*Asclepias speciosa*									
side-oats grama*	*Bouteloua curtipendula*									
spiked blazing star	*Liatris spicata*									
swamp milkweed	*Asclepias incarnata*									
wild bergamot	*Monarda fistulosa*									
yellow wingstem	*Verbesina alternifolia*									

*Denotes graminoid species

Dominant Species (by Month) in 2025

Month	Dominant Cover (by Site)		
	HBGW - Plot 5	ASP - Plot 1	IRW - Plot 2
May	wild bergamot (20%)	wild bergamot (18%)	common milkweed (5%)
June	wild bergamot (15%)	black-eyed Susan (30%)	yellow wingstem, wild bergamot, early goldenrod (5% each)
July	side-oats grama (15^%)	black-eyed susan (17%)	yellow wingstem (8%)
August	wild bergamot (14%)	purple coneflower, side-oats grama, wild bergamot (9% each)	little bluestem (10%)
September	wild bergamot (20%)	Indian grass (27%)	black-eyed Susan, New England aster (4% each)
October	little bluestem (14%)	wild bergamot (8%)	yellow wingstem, Indian grass, little bluestem, wild bergamot (4% each)

Performance at Sites in 2025

Site	% Germination	Average Monthly % Cover of Seed Mix	Overall Pollinator Presence*
ASP (Plot 1)	100	66	Medium
HBGW (Plot 5)	82	70	High
IRW (Plot 2)	76	24	Medium

* Pollinator count monthly average: Low: 0-24; Medium: 25-49; High: >50

Trends: Germination Rate and Average Peak % Cover in Plots

	Year 1 (ASP/HBGW/IRW)	**Year 2** (ASP/HBGW/IRW)	**Year 3** (HBGW/IRW)
Germination Rate (%)	35	80	79
Peak % Cover of Seed Mix (Average for All Plots)	48	62	58

Butterfly & Hummingbird Garden Mix

Location	Rate Applied
Central Administration Building (CAB)	20 lbs./ac.
Hickory Run Service Plaza (HRSP)	10 lbs./ac.

Species Bloom Times

Common Name	Scientific Name	Growing Season Bloom Time								
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
aromatic aster	*Symphyotrichum oblongifolium*									
bachelor's button tall mixed/cornflower (U.S. non-native)	*Centaurea cyanus*									
black-eyed Susan	*Rudbeckia hirta*									
blue false indigo	*Baptisia australis*									
butterfly milkweed	*Asclepias tuberosa*									
California orange poppy (U.S. native, PA adventive)	*Eschscholzia californica*									
corn poppy (U.S. non-native)	*Papaver rhoeas*									
golden alexander	*Zizia aurea*									
gray goldenrod	*Solidago nemoralis*									
grey-headed coneflower	*Ratibida pinnata*									
heath aster	*Symphyotrichum (Aster) pilosus*									
lanceleaf coreopsis	*Coreopsis lanceolata*									
licorice-scented goldenrod	*Solidago odora*									
little bluestem*	*Schizachyrium scoparium*									
marsh blazing star	*Liatris spicata*									
narrowleaf mountainmint	*Pycnanthemum tenuifolium*									
New England aster	*Symphyotrichum novae-angliae*									
Ohio spiderwort	*Tradescantia ohiensis*									
oxeye sunflower	*Heliopsis helianthoides*									
perennial blue lupine	*Lupinus perennis*									
plains coreopsis	*Coreopsis tinctoria*									
purple coneflower	*Echinacea purpurea*									
rattlesnake master (U.S. native, PA absent)	*Eryngium yuccifolium*									
rocket larkspur (U.S. non-native)	*Delphinium ajacis (Consolida ajacis)*									
Shasta daisy (U.S. non-native)	*Leucanthemum × superbum*									
smooth blue aster	*Symphyotrichum laeve*									
sundrops	*Oenothera fruticosa var. fruticosa*									
swamp milkweed	*Asclepias incarnata*									
sweet William (U.S. non-native)	*Dianthus barbatus*									
tall white beardtongue	*Penstemon digitalis*									
Virginia wild rye*	*Elymus virginicus*									
white goldenrod	*Solidago bicolor*									
white wild indigo (U.S. native, PA absent)	*Baptisia alba*									
wild bergamot	*Monarda fistulosa*									

*Denotes graminoid species

Dominant Species (by Month) in 2025

Month	Dominant Cover (by Site)	
	CAB - Plot 2	HRSP - Plot 1A
May	oxeye sunflower (12%), Shasta daisy (12%)	Shasta daisy (25%)
June	oxeye sunflower (20%)	lanceleaf coreopsis (8%)
July	wild bergamot (12%)	grey-headed coneflower (15%)
August	purple coneflower (8%)	little bluestem, purple coneflower, grey-headed coneflower (all 7% each)
September	purple coneflower (10%), heath aster (10%)	little bluestem (12%)
October	gray-headed coneflower (10%), Shasta daisy (10%)	little bluestem (12%)

Performance at Sites in 2025

Site	% Germination	Average Monthly % Cover of Seed Mix	Overall Pollinator Presence*
CAB (Plot 2)	71	72	High
HRSP (Plot 1A)	68	70	Medium

* Pollinator count monthly average: Low: 0-24; Medium: 25-49; High: >50

Trends: Germination Rate and Average Peak % Cover in Plots

	Year 1 (CAB/HRSP)	Year 2 (CAB/HRSP)	Year 3 (CAB/HRSP)	Year 4 (CAB/HRSP)
Germination Rate (%)	35	60	63	69
Peak % Cover of Seed Mix (Average for All Plots)	88	88	76	85

PTC Wet Habitat Mix

Location	Rate Applied
Allentown Service Plaza (ASP)	15 lbs./ac.
Bensalem Interchange (BEN)	15 lbs./ac.

Species Bloom Times

Common Name	Scientific Name	Growing Season Bloom Time								
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
blue vervain	*Verbena hastata*									
button bush	*Cephalanthus occidentalis*									
common boneset	*Eupatorium perfoliatum*									
fowl manna grass*	*Glyceria striata*									
fox sedge	*Carex vulpinoidea*									
Frank's sedge	*Carex frankii*									
great blue lobelia	*Lobelia siphilitica*									
green bulrush*	*Scirpus atrovirens*									
New England aster	*Symphyotrichum novae-angliae*									
path rush	*Juncus tenuis*									
rice cutgrass*	*Leersia oryzoides*									
rosemallow (swamp)	*Hibiscus moscheutos*									
sawtooth sunflower	*Helianthus grosseserratus*									
shallow sedge	*Carex lurida*									
showy tickseed	*Bidens aristosa*									
sneezeweed	*Helenium autumnale*									
soft rush	*Juncus effusus*									
squarrose sedge	*Carex squarrosa*									
swamp milkweed	*Asclepias incarnata*									
sweet Joe-Pye weed	*Eupatorium purpureum*									
Virginia wild rye*	*Elymus virginicus*									
woolgrass*	*Scirpus cyperinus*									
yellow wingstem	*Verbesina alternifolia*									

*Denotes graminoid species

Dominant Species (by Month) in 2025

Month	Dominant Cover (by Site)	
	BEN - Plot 3	ASP - Plot 2
May	showy tickseed (50%)	showy tickseed (31%)
June	showy tickseed (33%)	showy tickseed (35%)
July	showy tickseed (42%)	swamp milkweed (30%)
August	showy tickseed (35%)	swamp milkweed (12%)
September	showy tickseed (35%)	showy tickseed (30%)
October	sawtooth sunflower (30%), showy tickseed (30%)	swamp milkweed, common boneset, showy tickseed (19% each)

Performance at Sites in 2025

Site	% Germination	Average Monthly % Cover of Seed Mix	Overall Pollinator Presence*
ASP (Plot 2)	70	78	High
BEN (Plot 3)	61	75	Medium

* Pollinator count monthly average: Low: 0-24; Medium: 25-49; High: >50

Trends: Germination Rate and Average Peak % Cover in Plots

	Year 1 (ASP/BEN)	Year 2 (ASP/BEN)	Year 3 (BEN)
Germination Rate (%)	30	72	61
Peak % Cover of Seed Mix (Average for All Plots)	89	81	89

PTC Pollinator ROW Mix

Location	Rate Applied
Allentown Service Plaza (ASP)	16 lbs./ac.
Bensalem Interchange (BEN)	16 lbs./ac.
Harrisburg West Interchange (HBGW)	24 lbs./ac. (w/nurse crop)
Irwin Interchange (IRW)	32 lbs./ac.

Species Bloom Times

Common Name	Scientific Name	Growing Season Bloom Time								
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
big bluestem*	*Andropogon gerardii*									
black-eyed Susan	*Rudbeckia hirta*									
butterfly milkweed	*Asclepias tuberosa*									
common milkweed	*Asclepias syriaca*									
deer tongue grass*	*Panicum clandestinum*									
early goldenrod	*Solidago juncea*									
fall panicum*	*Panicum anceps*									
Indian grass*	*Sorghastrum nutans*									
little bluestem*	*Schizachyrium scoparium*									
narrowleaf mountainmint	*Pycnanthemum tenuifolium*									
New England aster	*Symphyotrichum novae-angliae*									
oxeye sunflower	*Heliopsis helianthoides*									
partridge pea	*Cassia fasciculata*									
showy tickseed	*Bidens aristosa*									
showy tick trefoil	*Desmodium canadense*									
switchgrass*	*Panicum virgatum*									

*Denotes graminoid species

Dominant Species (by Month) in 2025

Month	Dominant Cover (by Site)		
	HBGW - Plot 2A	BEN - Plot 1	ASP - Plot 3
May	switchgrass (25%)	showy tickseed (16%)	showy tickseed (60%)
June	oxeye sunflower (16%)	black-eyed Susan (15%), showy tickseed (15%)	switchgrass (30%)
July	switchgrass (28%)	Indian grass (10%)	switchgrass (25%)
August	switchgrass (25%)	Indian grass (20%)	switchgrass (45%)
September	switchgrass (20%)	switchgrass (20%)	switchgrass (30%)
October	switchgrass (35%)	little bluestem (18%)	switchgrass (20%)

	HBGW - Plot 2B	IRW - Plot 1
May	oxeye sunflower (16%)	oxeye sunflower (30%)
June	oxeye sunflower (20%)	oxeye sunflower (18%)
July	oxeye sunflower (18%)	oxeye sunflower (25%)
August	switchgrass (18%)	switchgrass (23%)
September	switchgrass (20%)	oxeye sunflower (13%)
October	switchgrass (15%)	switchgrass (20%)

Performance at Sites in 2025

Site	% Germination	Average Monthly % Cover of Seed Mix	Overall Pollinator Presence*
ASP (Plot 3)	100	85	Medium
BEN (Plot 1)	88	67	Low
HBGW (Plots 2A and 2B)	100, 72	70, 59	High, Medium
IRW (Plot 1)	88	59	Low

* Pollinator count monthly average: Low: 0-24; Medium: 25-49; High: >50

Trends: Germination Rate and Average Peak % Cover in Plots

	Year 1 (ASP/BEN/HBGW/IRW)	Year 2 (ASP/BEN/HBGW/IRW)	Year 3 (BEN/HBGW/IRW)
Germination Rate (%)	38	91	89
Peak % Cover of Seed Mix (Average for All Plots)	50	70	75

PTC Pollinator Interchange Mix

Location	Rate Applied
Allentown Service Plaza (ASP)	14 lbs./ac.
Bensalem Interchange (BEN)	14 lbs./ac.
Harrisburg West Interchange (HGBW)	28 lbs./ac.
Irwin Interchange (IRW)	14 lbs./ac.

Species Bloom Times

Common Name	Scientific Name	Growing Season Bloom Time								
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
black-eyed Susan	*Rudbeckia hirta*									
blue false indigo	*Baptisia australis*									
butterfly milkweed	*Asclepias tuberosa*									
common milkweed	*Asclepias syriaca*									
early goldenrod	*Solidago juncea*									
heath aster	*Symphyotrichum (Aster) pilosus*									
lanceleaf coreopsis	*Coreopsis lanceolata*									
little bluestem*	*Schizachyrium scoparium*									
narrowleaf mountainmint	*Pycnanthemum tenuifolium*									
oxeye sunflower	*Heliopsis helianthoides*									
partridge pea	*Cassia fasciculata*									
purple coneflower	*Echinacea purpurea*									
purple top*	*Tridens flavus*									
rigid goldenrod	*Solidago rigida*									
showy tick trefoil	*Desmodium canadense*									
swamp milkweed	*Asclepias incarnata*									
switchgrass*	*Panicum virgatum*									
Virginia wild rye*	*Elymus virginicus*									
wild bergamot	*Monarda fistulosa*									

*Denotes graminoid species

Dominant Species (by Month) in 2025

Month	Dominant Cover (by Site)		
	ASP - Plot 4	**HBGW - Plot 1A**	**BEN - Plot 4**
May	lanceleaf coreopsis (11%)	oxeye sunflower (26%)	lanceleaf coreopsis (21%)
June	switchgrass (25%)	oxeye sunflower (24%)	switchgrass (10%)
July	black-eyed Susan, switchgrass, oxeye sunflower (15% each)	switchgrass (16%)	little bluestem (10%), lanceleaf coreopsis (10%), switchgrass (10%)
August	switchgrass (35%)	oxeye sunflower (15%)	switchgrass (15%)
September	switchgrass (10%)	oxeye sunflower (20%)	little bluestem (25%)
October	switchgrass (27%)	switchgrass (14%)	little bluestem (20%)

	ASP - Plot 5	**HBGW - Plot 1B**	**IRW - Plot 3**
May	swamp milkweed (9%)	oxeye sunflower (54%)	lanceleaf coreopsis, oxeye sunflower (all 25% each)
June	black-eyed Susan, switchgrass (20% each)	oxeye sunflower (52%)	lanceleaf coreopsis (15%)
July	wild bergamot (13%)	oxeye sunflower (41%)	purple coneflower (9%)
August	switchgrass (18%)	oxeye sunflower (32%)	oxeye sunflower (25%)
September	switchgrass (15%)	oxeye sunflower (25%)	purple coneflower, oxeye sunflower (9% each)
October	switchgrass, early goldenrod (10% each)	oxeye sunflower (40%)	lanceleaf coreopsis (24%)

	ASP - Plot 7	**HBGW - Plot 1C**
May	wild bergamot, black-eyed Susan (all 11% each)	lanceleaf coreopsis (47%)
June	black-eyed Susan (30%)	lanceleaf coreopsis (36%)
July	black-eyed Susan (25%)	switchgrass (32%)
August	switchgrass (12%)	lanceleaf coreopsis (18%)
September	switchgrass (20%)	switchgrass (25%)
October	switchgrass (23%)	switchgrass (25%)

Performance at Sites in 2025

Site	% Germination	Average Monthly % Cover of Seed Mix	Overall Pollinator Presence*
ASP (Plots 4, 5, and 7)	95, 89, 89	67, 53, 60	Low, Medium, Medium
BEN (Plot 4)	84	60	Medium
HBGW (Plots 1A, 1B, and 1C)	84, 74, 79	72, 84, 83	High, High, Medium
IRW (Plot 3)	100	60	Medium

* Pollinator count monthly average: Low: 0-24 Medium: 25-49 High: >50

Trends: Germination Rate and Average Peak % Cover in Plots

	Year 1 (ASP/BEN/HBGW/IRW)	**Year 2** (ASP/BEN/HBGW/IRW)	**Year 3** (BEN/HBGW/IRW)
Germination Rate (%)	33	81	84
Peak % Cover of Seed Mix (Average for All Plots)	33	74	81

PennDOT Pollinator Mix 2022/2023 and Modified Mix

Location	Rate Applied
Bensalem Interchange (BEN), Plots 2A and 2B	10 lbs./ac., 7 lbs./ac.
Central Administration Building (CAB), Plots 3A and 3B	7 lbs./ac. (all)
Hickory Run Service Plaza (HRSP), Plots 2A and 2B	7 lbs./ac. (all)

Species Bloom Times

Common Name	Scientific Name	Growing Season Bloom Time								
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
anise hyssop (1, 2)	*Agastache foeniculum*									
aromatic aster (3)	*Symphyotrichum oblongifolium*									
big bluestem* (2)	*Andropogon gerardii*									
black-eyed Susan (2, 3)	*Rudbeckia hirta*									
blue vervain (1)	*Verbena hastata*									
butterfly milkweed (2, 3)	*Asclepias tuberosa*									
calico aster (1)	*Aster lateriflorus*									
common boneset (2, 3)	*Eupatorium perfoliatum*									
common milkweed (1, 2, 3)	*Asclepias syriaca*									
early goldenrod (1)	*Solidago juncea*									
fox sedge (3)	*Carex vulpinoidea*									
golden alexander (1, 2, 3)	*Zizia aurea*									
gray goldenrod (1)	*Solidago nemoralis*									
Joe-Pye weed (1)	*Eutrochium fistulosum*									
lanceleaf coreopsis (1, 2, 3)	*Coreopsis lanceolata*									
little bluestem* (1, 2, 3)	*Schizachyrium scoparium*									
marsh blazing star (1, 2, 3)	*Liatris spicata*									
mistflower (2)	*Conoclinium coelestinum*									
narrowleaf mountainmint (1, 2)	*Pycnanthemum tenuifolium*									
New York ironweed (1)	*Vernonia noveboracensis*									
Ohio spiderwort (2, 3)	*Tradescantia ohiensis*									
oxeye sunflower (1, 2)	*Heliopsis helianthoides*									
partridge pea (1, 2, 3)	*Cassia fasciculata*									
path rush* (3)	*Juncus tenuis*									
purple top* (2)	*Tridens flavus*									
purple coneflower (1, 2, 3)	*Echinacea purpurea*									
roundhead lespedeza (1, 2)	*Lespedeza capitata*									
round-seeded panicgrass* (2)	*Dichanthelium polyanthes*									
showy tick trefoil (2)	*Desmodium canadense*									
smooth blue aster (1)	*Symphyotrichum laeve*									
soft rush* (3)	*Juncus effusus*									
sundrops (1, 2)	*Oenothera fruticosa var. fruticosa*									
swamp milkweed (1, 2, 3)	*Asclepias incarnata*									
switchgrass* (3)	*Panicum virgatum*									
tall white beardtongue (1, 2, 3)	*Penstemon digitalis*									
Virginia wild rye* (1)	*Elymus virginicus*									
white avens, PA ecotype (1)	*Geum canadense*									
wild bergamot (1, 2, 3)	*Monarda fistulosa*									
wild senna (2)	*Senna hebecarpa*									

*Denotes graminoid species (1) 2022 PennDOT Pollinator Habitat Mix; (2) 2023 PennDOT Pollinator Habitat Mix; (3) Modified PennDOT Pollinator Habitat Mix

Dominant Species (by Month) in 2025

Month	Dominant Cover (by Site)					
	CAB - Plot 3A (2022)	HRSP - Plot 2A (2022)	BEN - 2A (2023)	CAB - Plot 3B (Mod)	BEN - Plot 2B (Mod)	HRSP - Plot 2B (Mod)
May	oxeye sunflower (12%)	lanceleaf coreopsis (8%)	wild bergamot (25%)	wild bergamot (12%)	wild bergamot (10%)	lanceleaf coreopsis (15%)
June	oxeye sunflower (25%)	lanceleaf coreopsis (15%)	black-eyed Susan, wild bergamot (7% each)	switchgrass (33%)	switchgrass (25%)	lanceleaf coreopsis (35%)
July	calico aster (12%)	wild bergamot (8%)	wild bergamot, oxeye sunflower (15% each)	switchgrass (20%)	switchgrass (20%)	switchgrass (15%)
August	calico aster (12%)	little bluestem (10%)	oxeye sunflower (15%)	switchgrass (25%)	switchgrass (27%)	switchgrass (22%)
September	calico aster (15%)	big bluestem (10%)	little bluestem (28%)	switchgrass (16%)	switchgrass (30%)	little bluestem (15%)
October	calico aster (14%)	little bluestem, big bluestem (10% each)	little bluestem (30%)	switchgrass (25%)	switchgrass (40%)	switchgrass (20%)

Performance at Sites in 2025

Site	% Germination	Average Monthly % Cover of Seed Mix	Overall Pollinator Presence*
BEN (Plots 2A and 2B)	79, 63	55, 61	Medium (all)
CAB (Plots 3A and 3B)	88, 79	70, 57	High, Medium
HRSP (Plots 2A and 2B)	75, 79	42, 55	Low, Medium

* Pollinator count monthly average: Low: 0-24; Medium: 25-49; High: >50

Trends: Germination Rate and Average Peak % Cover in Plots

	Year 1 (BEN/CAB/HRSP)	Year 2 (BEN/CAB/HRSP)	Year 3 (BEN/CAB/HRSP)	Year 4 (CAB/HRSP)
Germination Rate (%)	41	67	73	80
Peak % Cover of Seed Mix (Average for All Plots)	44	64	69	68

Deer Resistant Meadow Mixes #1 and #2

Location	Rate Applied
Allentown Service Plaza (ASP), Plot 6	20 lbs./ac.
Harrisburg West Interchange (HBGW), Plots 3 and 4	20 lbs./ac., 16.5 lbs/ac.
Hickory Run Service Plaza (HRSP), Plot 3	20 lbs./ac.

Species Bloom Times

Common Name	Scientific Name	Growing Season Bloom Time								
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
aromatic aster (1)	*Symphyotrichum oblongifolium*									
black-eyed Susan (1, 2)	*Rudbeckia hirta*									
blue false indigo (1, 2)	*Baptisia australis*									
brown-eyed Susan (1)	*Rudbeckia triloba*									
butterfly milkweed (1, 2)	*Asclepias tuberosa*									
calico aster (1)	*Aster lateriflorus*									
common milkweed (2)	*Asclepias syriaca*									
early goldenrod (1, 2)	*Solidago juncea*									
golden alexander (1)	*Zizia aurea*									
gray goldenrod (1)	*Solidago nemoralis*									
grey-headed coneflower (2)	*Ratibida pinnata*									
hairy beardtongue (1)	*Penstemon hirsutus*									
hairy mountain mint (2)	*Pycnanthemum pilosum*									
heath aster (1, 2)	*Symphyotrichum (Aster) pilosus*									
ironweed (2)	*Vernonia altissima*									
lanceleaf coreopsis (1, 2)	*Coreopsis lanceolata*									
little bluestem* (1, 2)	*Schizachyrium scoparium*									
marsh blazing star (1)	*Liatris spicata*									
narrowleaf mountainmint (1, 2)	*Pycnanthemum tenuifolium*									
narrow-leaved sunflower (2)	*Helianthus angustifolius*									
New England aster (2)	*Symphyotrichum novae-angliae*									
Ohio spiderwort (1)	*Tradescantia ohiensis*									
oxeye sunflower (1, 2)	*Heliopsis helianthoides*									
partridge pea (1, 2)	*Cassia fasciculata*									
purple coneflower (1, 2)	*Echinacea purpurea*									
purple lovegrass* (1)	*Eragrostis spectabilis*									
purple top* (2)	*Tridens flavus*									
rigid goldenrod (2)	*Solidago rigida*									
roundhead lespedeza (1)	*Lespedeza capitata*									
showy tickseed (2)	*Bidens aristosa*									
side-oats grama* (1, 2)	*Bouteloua curtipendula*									
sundrops (1)	*Oenothera fruticosa var. fruticosa*									
swamp milkweed (2)	*Asclepias incarnata*									
tall white beardtongue (1)	*Penstemon digitalis*									
Virginia mountain mint (2)	*Pycnanthemum virginianum*									
Virginia wild rye* (1, 2)	*Elymus virginicus*									
white goldenrod (1)	*Solidago bicolor*									
wild bergamot (1, 2)	*Monarda fistulosa*									
wild senna (1)	*Senna hebecarpa*									
zigzag aster (1)	*Symphyotrichum prenanthoides*									

*Denotes graminoid species (1) Deer Resistant Meadow Mix #1; (2) Deer Resistant Meadow Mix #2

Dominant Species (by Month) in 2025

	Dominant Cover (by Site)			
	ASP - Plot 6 (DRMM 1)	HRSP - Plot 3 (DRMM 1)	HBGW - Plot 3 (DRMM 1)	HBGW - Plot 4 (DRMM 2)
May	Virginia wild rye (15%)	little bluestem (10%)	Virginia wild rye (16%)	grey-headed coneflower (20%)
June	black-eyed Susan, wild bergamot, and side-oats grama (15% each)	tall white beardtongue, lanceleaf coreopsis (12% each)	oxeye sunflower (17%)	grey-headed coneflower, oxeye sunflower (15% each)
July	black-eyed Susan (28%)	purple coneflower, oxeye sunflower (12% each)	side-oats grama, oxeye sunflower, Virginia wild rye (10% each)	grey-headed coneflower (25%)
August	brown-eyed Susan (13%)	purple coneflower (30%)	purple coneflower (10%), little bluestem (10%)	grey-headed coneflower (17%)
September	brown-eyed Susan (25%)	purple coneflower (35%)	little bluestem (14%)	little bluestem (20%)
October	brown-eyed Susan (24%)	little bluestem (20%)	little bluestem (15%)	grey-headed coneflower (18%)

Performance at Sites in 2025

Site	% Germination	Average Monthly % Cover of Seed Mix	Overall Pollinator Presence*
ASP (Plot 6)	70	68	Medium
HBGW (Plots 3 and 4)	64, 88	61, 86	High (all)
HRSP (Plot 3)	88	78	Medium

* Pollinator count monthly average: Low: 0-24; Medium: 25-49; High: >50

Trends: Germination Rate and Average Peak % Cover in Plots

	Year 1 (ASP/HGBW/HRSP)	Year 2 (ASP/HGBW/HRSP)	Year 3 (HGBW/HRSP)	Year 4 (HRSP)
Germination Rate (%)	25	67	75	88
Peak % Cover of Seed Mix (Average for All Plots)	61	87	80	94

Appendix E

List of Pollinator Species Observed, All Plots - 2025

PTC Pollinator Habitat Program (Annual Monitoring)

List of Pollinator Species Observed, All Plots - 2025

CAB	HBGW	BEN	ASP	HRSP	IRW	SS
Blue-winged wasp	Black swallowtail	Asian lady beetle	*Bombus spp.* (bumblebee spp.)	Black swallowtail	Black blister beetle	Bald faced hornet
Bombus spp. (bumblebee spp.)	*Bombus spp.* (bumblebee spp.)	*Bombus spp.* (bumblebee spp.)	Cabbage white	*Bombus spp.* (bumblebee spp.)	*Bombus spp.* (bumblebee spp.)	*Bombus spp.* (bumblebee spp.)
Cabbage white (*Pieris rapae*)	Brown belted bumblebee	Cabbage white	Carpenter bees	Cabbage white	Brown paper wasp	Cabbage white
Carpenter bee	Brown skipper spp.	*Cantharidae spp* . (soldier beetle)	*Celastrina sp.* (small carpenter bee)	Carpenter bee	Cabbage white	Carpenter bee
Clouded sulphur	Cabbage white	Clouded sulphur	Clouded sulphur	*Celastrina sp.* (small carpenter bee)	Carpenter bee	Clouded sulfur
Cloudless sulphur	Carpenter bee	Cloudless sulphur	Cloudless sulphur	Clouded sulfur	Clouded sulphur	Clouded sulphur
Common eastern bumblebee	Clouded sulphur	Common buckeye	Common blue	Common blue	Cloudless sulphur	Common buckeye
Eastern tailed blue	Cloudless sulphur	Eastern tailed blue	Common buckeye	Common ringlet	Common sulphur	Duskywing
European honeybee (*Apis mellifera*)	Comma	Eastern tiger swallowtail	Common skipper	Eastern tailed blue	Duskywing skipper	European hornet
False milkweed beetle	Common eastern bumblebee	European honeybee	Eastern tailed blue	Firefly	Eastern carpenter bee	Hesperiidae spp. (skipper)
Hesperiidae spp. (Skipper)	Eastern tailed blue	Field skipper	False milkweed beetle	Golden soldier beetle	Eastern pine elfin	Honeybee
Housefly	Eastern tiger swallowtail	Golden soldier beetle	Great black wasp	Grass moth	Eastern tailed blue	Hoverfly spp. (Syrphidae)
Hoverfly spp. (Syrphidae)	Eastern yellowjacket	Grass skipper	Great spangled fritillary	Great spangled frittilary	Golden soldier beetle	Ladybug
Hummingbird moth	European honeybee	Hesperiidae spp. (skipper)	Hesperiidae spp. (skipper)	Hesperiidae spp. (skipper)	Great golden digger wasp	Least skipper
Margined leatherwinged beetle	Golden northern bumblebee	Indigo duskywing	Honeybee	Honeybee	Great spangled fritillary	Margined leatherwing beetle
Monarch	Halictidae spp. (sweat bees)	Lampyridae spp. (firefly)	Hoverfly spp. (Syrphidae)	Hoverfly spp. (Syrphidae)	Hesperiidae spp. (skipper)	Mason bee
Mud dauber	Hesperiidae spp. (skipper)	Monarch	Indigo duskywing	Leafcutter bee	Honeybee	Milkweed beetle
Painted lady	Hoverfly spp. (Syrphidae)	Orange sulphur	Lacewing	Least skipper	Hoverfly spp. (Syrphidae)	Monarch
Pieridae spp. (whites, sulphurs, yellows)	Lepidoptera spp.	Red milkweed beetle	Lady beetle	Margined leatherwing beetle	Huron sachem	Orange sulphur
Sachem skipper	Margined leatherwinged beetle	Silver spotted skipper	Ladybug	Monarch	Least skipper	Pearl crescent
Silver spotted skipper	Monarch	Sootywing butterfly	Large milkweed bugs	Orange sulphur	Ligated furrow bee	Regal frittillary
Southern yellowjacket	Mud dauber	Spotted skipper	Lightning bug	Pearl crescent	Meadow fritillary	Spring azure
Tiger swallowtail	Orange sulphur	Swamp milkweed leaf beetle	Monarch	Soldier beetle	Milkweed beetle	Vespidae spp. (wasps)
Vespidae spp. (wasps)	Painted lady	Hoverfly spp. (Syrphidae)	Orange sulphur	Spicebush swallowtail	Monarch	Winter firefly
Wild indigo duskywing	*Pelopidas spp.* (Hesperiidae family)	Yellow sulphur	Pearl crescent	Spring azure	Orange sulfur	Zebra longhorn beetle
Yellowjacket	Pieridae spp. (whites, sulphurs, yellows)	**25**	Pecks skipper	Summer azure	Pearl crescent	**25**
26	*Polygonia* spp. (comma or question mark)		Peppered moth	Sweat bee	Peck's skipper	
	Red spotted purple		Silver spotted skipper	Tiger swallowtail	Sachem sp.	
	Ruby-throated hummingbird		Spicebush swallowtail	Yellow sulfur	Silver spotted skipper	
	Scollid wasp (Scoliidae spp.)		Swallowtail	**29**	Smooth faced miner bee	
	Silver spotted skipper		Yellowjacket		Traverse banded flower fly	
	Spicebush swallowtail		**31**		Yellow collard scape moth	
	Tiger swallowtail				**32**	
	Vespidae spp. (wasps)					
	Wild indigo duskywing					
	35					