



## Museums for America

Sample Application MA-255957-OMS-24  
Project Category: Collections Stewardship and Access

### University of Texas at Austin, Lady Bird Johnson Wildflower Center

Amount awarded by IMLS:	\$115,214
Amount of cost share:	\$135,271

The Lady Bird Johnson Wildflower Center at the University of Texas at Austin will address the need to test and assess viability of their collection of over 800 seed accessions, many of which are rare and over 20 years old. Project activities will include acquiring germination chambers and lab materials; researching and testing germination protocols for a subset of priority collections; and conducting germination trials and developing protocols for systematically testing viability of new and existing seed collections. Staff will also document procedures for continued testing and create a plan for future management of the seed bank. The final products will benefit the users of the seed bank, including professionals in the Center for Plant Conservation network, researchers, government agencies, and other conservation partners.

Attached are the following components excerpted from the original application.

- Narrative
- Schedule of Completion
- Performance Measurement Plan

When preparing an application for the next deadline, be sure to follow the instructions in the most recent Notice of Funding Opportunity for the grant program to which you are applying.

## **Title:** Improving Seed Bank Collections Management through Germination and Viability Testing

### **Summary**

The Lady Bird Johnson Wildflower Center, the Texas state botanical garden and a field station of the University of Texas at Austin, maintains a conservation seed bank representing 575 taxa native to Texas. With over 800 total accessions, this collection supports a variety of research and conservation activities and ensures the survival of rare and declining species in the face of ongoing habitat loss. However, the viability of many of these collections remains unknown, necessitating germination testing to determine whether the seed bank is effectively supporting plant conservation. We request two years of funding for staffing, equipment, materials, and travel to implement germination and viability testing of our collections, and to disseminate the results. The data we gain from our collections will guide future management of the seed bank, help us better serve its users, and be broadly shared with the plant conservation community and public in Texas and beyond.

### **I. Project Justification**

*IMLS program goals and objectives*— Our project fits within Goal 3 of Museums for America, Collections Stewardship and Access: Advance the management and care of collections and their associated documentation. Specifically, as the Texas state botanical garden and a living museum, our proposed project focuses on improving the management of one of our most valuable collections, our conservation seed bank of native Texas plants. By establishing the lab infrastructure and protocols for germination and viability testing of our existing seed collections, we will improve our long-term management and gain valuable information about the status of our seed bank that we can use to prioritize and plan new collections. Thus, our project fits within Objective 3.1: Support cataloging, inventorying, and registration; collections information management; and collections planning.

*Background*— The mission of the Lady Bird Johnson Wildflower Center is “inspiring the conservation of native plants.” The Wildflower Center fulfills this mission in part by safeguarding rare and threatened plant species within its conservation seed bank, as a participating institution of the Center for Plant Conservation (CPC). Long-term storage of wild-collected seeds in seed banks, which serve as a back-up for wild populations in the event of drastic declines, is a cost-effective method for supporting the recovery of threatened plant species (Guerrant & al., 2004). Since 2000, the Wildflower Center has built one of the largest seed banks of Texas-native plants to preserve the biodiversity of Texas’s 12 ecoregions and provide material to researchers and conservationists. With ongoing, rapid environmental degradation and over 400 plant species of greatest conservation need (SGCNs) in Texas at risk of severe population losses (TPWD, 2023), there is a clear need for expanded seed banking efforts in Texas.

In order to be useful for research or conservation, collections within seed banks must be viable so that they can be germinated to produce new, reproductive plants that can be studied or reintroduced to the wild. Conventional seed banking seeks to prolong the lifespan of seeds by drying and freezing them; however, only certain species can tolerate this treatment, and the behavior and lifespan of tolerant seeds under storage conditions differs by habitat, taxonomy, and history of the collections (Walters, 2015; Wyse & Dickie, 2016). Given this potential variability in seed health and survival, collections must be assessed before and after long-term storage to determine their viability and to develop management plans for banked seeds. Current guidelines recommend performing initial viability tests on fresh seeds and at least every 10 years after banking (MSBP, 2022). Such testing allows detection of declines in viability, indicating a need for recollection or propagation of stored seed (CPC, 2019). To date, the Wildflower Center does not conduct regular viability testing on banked seeds. With over 800 accessions of native Texas plants and plans to significantly expand our collections of rare and declining

species in the near future, it is crucial that our Science and Conservation team develops robust testing protocols to assess the viability of our existing accessions and plan for future collection management.

Not only are germination tests an essential tool for assessing the status of a given seed collection, but they can also provide a greater understanding of plant natural history, conservation need, and management more broadly. Because there is limited information available on the biology of rare and endangered plants, seed banks play an important role in gathering data on how to manage these species (Clemente & al., 2017). Data from germination tests are also used to evaluate how well current processing, storage, and other collections management practices act to protect the viability of seeds, which can be used to develop new methods and storage protocols (Godefroid & al., 2010). Germination tests can also be used to determine growth requirements, as seeds may exhibit dormancy that must be broken through exposure to specific temperature and moisture regimes or other pre-treatments (Baskin & Baskin, 2014). Thus, germination tests can be used to generate invaluable knowledge for conservation practitioners and horticulturists both within and outside our institution.

*Assessment of need*— The need for a viability and germination testing program at the Wildflower Center was identified through an inventorying process completed earlier this year. The Wildflower Center’s seed bank holds approximately 800 accessions representing 575 different taxa, including 28 SGCNs (Table 1). The majority of accessions, including 70 accessions of 22 SGCNs, consist of the minimum recommended number of 250 seeds needed to perform a germination test (MSBP, 2022). Through this process, we also found a lack of information on post-storage seed quality. At least 70% of accessions in the Wildflower Center’s seed bank are over 10 years old. Of these, 310 accessions (58 SGCN accessions) meet the minimum number of seeds recommended for performing a germination test, but routine testing has never been done. Viability testing is therefore necessary in order to determine the status of our older seed collections and to determine future actions for our seed banking program, such as new seed collection or modified storage procedures.

**Table 1.** Summary of data from the Lady Bird Johnson Wildflower Center seed bank inventory.

# Seeds in accession	Total taxa	Total accessions	SGCN taxa	SGCN accessions
> 0	575	801	28	257
> 250	348	448	22	70

*Project scope and purpose*— In response to the need we identified through our seed bank inventory, we propose to establish a viability and germination testing program. Our primary purpose is to develop the lab infrastructure, procedures, and capacity to manage our seed bank according to recognized, professional standards (FAO, 2013; MSBP, 2015; CPC, 2019). We plan to share relevant results, including data, experiences, and plants, with the plant conservation community as well as the public. By completing this project, we will (1) gain insight into the health of our collection, (2) ensure that our existing storage and seed handling protocols provide satisfactory conditions for ex-situ conservation, (3) establish a regular program of germination testing to monitor the value of our existing and incoming collections, and (4) contribute to plant conservation on local and national scales by providing data on viability over time and successful germination protocols.

*Target groups*— Our project targets individuals and organizations across the United States that directly use our seed bank as a resource for research, horticultural display, and species recovery projects (Table 2). Currently, our seed bank is used by a diverse group of researchers and conservationists, who generally either request seed of hard-to-obtain plant species for projects, or use our seed bank to store materials and provide back-up storage of collections. Our team also maintains an extensive network of collaborators of plant conservation professionals in Texas and nationwide, with whom we actively share knowledge and expertise. All target groups will immediately benefit from the project, whether we share data on germination requirements and viability, seeds, or storage space with them. Each target group also qualifies as a long-term beneficiary, because the project

supports long-term storage and use of seeds. Target groups, as potential collaborators on rare species conservation efforts, also have an interest in how this project will shape the development of our future conservation strategy and will therefore participate in project planning. In developing this proposal, we have relied upon the scientific guidelines published by the CPC (2019) and the practical advice of CPC Partners. We intend to draw upon the expertise of other researchers and local conservation professionals during the project period to determine how to handle seeds of particular species. In addition, input from target groups through requests for material or direct contact will be sought to identify which accessions should be prioritized for testing. See Letters of Support from three of our collaborators: Dr. Katie Heineman, Vice President of Science and Conservation of the Center for Plant Conservation, Anna Strong, Rare Species Botanist in the Texas Parks and Wildlife Department, and Dr. Brooke Best, Director of Texas Plant Conservation of the Botanical Research Institute of Texas.

**Table 2.** Summary of target groups.

Group	Seed bank usage	Benefit of project	Involvement in planning
CPC Partners (74 institutions) <sup>1</sup>	Back-up storage of collections and seed source for use in species recovery.	Better management of stored seed, sharing of technical information and best practices, and reliable seed supply for conservation.	CPC guidelines used for project design. Provide advice on testing procedures and equipment.
Plant conservation professionals in Texas (29 organizations) <sup>2</sup>	Storage of collections and seed source for use in species recovery.	Better management of stored seed, sharing of technical information, and more reliable seed supply for conservation work.	Participate in identifying testing priorities. Provide information on seed storage and germination.
Researchers	Storage of collections and seed source for experimental use.	Better management of stored seed, sharing of technical information, and more reliable seed supply for research projects.	Participate in identifying testing priorities. Provide information on seed storage and germination.
U.S. botanic gardens (1,037) <sup>3</sup>	Seed source for gardens and lands.	More reliable seed supply for increasing diversity of collections.	Participate in identifying testing priorities.

<sup>1</sup>Number of CPC Institutional Conservation Partners. <sup>2</sup>Number of respondents to an online survey announced at the Texas Plant Conservation Conference held at Fort Worth Botanic Garden in July 2023. <sup>3</sup>Number of U.S. botanic gardens listed on the BGCI GardenSearch website.

*Other beneficiaries*—Aside from the ongoing benefits to target groups, this project will also benefit members of the public that do not directly use our seed bank (Table 3). The proposed work would allow us to better fulfill our mission by providing new opportunities to display and interpret our collections to guests of the Wildflower Center and to online visitors to our Native Plants of North America (NPONA) website, a widely used online plant information database (<https://www.wildflower.org/plants-main>) with ~9.5 million visitors per year.

**Table 3.** Summary of non-target beneficiaries.

Group (Size estimate)	Benefit
General public (>9,500,000/year) <sup>1</sup>	Online access to information on native plant seeds and propagation through NPONA.
Guests of the Lady Bird Johnson Wildflower Center (250,000/year) <sup>2</sup>	Enhanced displays of conservation species for public education.

<sup>1</sup>Number of unique users of NPONA website from 1 September 2022 to 1 September 2023. <sup>2</sup>Approximate number of guests from most recent fiscal year.

*Relevance to our organization's Strategic Plan*—Improving seed bank management advances the Wildflower Center's strategic plan by expanding the scope and reach of our conservation program, and better equipping us to excel in our displays of regional plant diversity (see Strategic Plan Summary). The project helps us meet Transformative Goal I of closer integration with the University of Texas (UT) by increasing the quality and usability of our seed collections, a resource which is used by UT researchers for studies ranging from phylogenetics to landscape ecology and restoration. Our proposed project will also foster collaborations with UT researchers through seed testing and involving students in project activities (see below). Our project also relates to Transformative Goal II, to be a leading botanic garden displaying native plants, by improving our stewardship of our living collections and providing increased plant material for use in garden displays. Transformative Goal III, which aims to connect people to native plants and landscapes, is addressed by proposed updates to our online plant database (NPONA) as well as educational displays. Finally, our project contributes to Transformative Goal IV, to maximize our human, financial, and infrastructure resources, by investing in equipment and developing staff expertise on collections management to help advance the Wildflower Center's core mission.

## **II. Project Work Plan**

*Overview of Activities*—Grant funding will be used by the Science and Conservation Team for equipment and support staff to establish a new germination and viability testing program for our seed bank. The data we gain from initial tests will be summarized for our plant records database (IrisBG) and disseminated to interested groups. Seedlings resulting from the tests we perform will be grown out and distributed to our gardens and target groups as appropriate. We will also develop a plan for future management of the seed bank that includes a schedule for viability monitoring and needed actions to adequately conserve the species represented in the seed bank. Project activities will take place over the course of two years using a combination of resources provided by grant funding and the Wildflower Center (see below).

The proposed work will be structured into three phases to maximize efficiency. See the Schedule of Completion for a timeline of specific tasks. Following is an outline of each phase:

- *Phase 1: Set-up and prioritization.* The first phase will include ordering and setting up lab equipment as well as developing procedures for performing tests. Specific accessions to prioritize for testing will be identified in consultation with target groups, and germination protocols will be researched.
- *Phase 2: Seed testing.* We will execute germination and viability tests and record results in the second phase, working with target groups to grow out seedlings for seed increases, garden use, or distribution as appropriate. We will also verify the relative humidity of all storage containers of seeds that we test and repackage seeds as necessary to prolong their lifespan. Volunteers and undergraduate students will be recruited and trained to build our capacity for continued seed testing.
- *Phase 3: Summary and planning.* In the final phase, data will be summarized and distributed to conservation partners through multiple forums, and the results will be shared with the public. A seed bank management plan and procedures document will be produced to facilitate future work.

In accordance with our main purpose, the focus of our work will be on developing the procedures and capacity for seed testing through phases 1 and 3. We anticipate that phase 2 will be the most challenging part of the project because of the need for experimentation to determine optimum germination conditions. Natural variation in germination times and the possible requirement for lengthy dormancy-breaking treatments (Baskin & Baskin, 2003; Elias & al., 2012) further complicate planning of the testing phase. It is therefore critical that we carefully prioritize which accessions to test. Our top priorities will be the 70 SGCN accessions with at least 250 seeds and any incoming collections for gathering baseline viability data (MSBP, 2015; CPC, 2019). The next priority will be existing accessions of Texas-native species with over 10 years in storage and known germination protocols. We will collaborate with our target groups to refine our list of priorities based on their needs for plant

material. For species that the Wildflower Center does not have experience growing, germination protocols will be researched through literature searches, consulting standard references (Deno, 1993; Cullina, 2000; Baskin & Baskin, 2014; NPN, 2023; SER & al., 2023), and contacting knowledgeable individuals in the CPC network.

*Staff roles*— Project planning, implementation, and assessment will be carried out by four members of our Science and Conservation team at the Wildflower Center: the Director of Science and Conservation (Sean Griffin), the Conservation Collections Manager (Jonathan Flickinger), the Seed Bank Coordinator (Jessi White), and a yet-unhired Seed Bank Technician. Specifically, the Director will contribute ~8% time (1 month per year 2024/2025 and 2025/2026) to project activities including managing finances, managing personnel, project design, project assessment, and outreach/communication of results. The Conservation Collections Manager will contribute ~30% time (4 months per year) to activities including managing personnel, project design, project assessment, and outreach/communication. The Seed Bank Coordinator will contribute 50% time (6 months per year) to overseeing the specifics of this project, including project design, literature review, methods development, ordering of materials, project implementation, and seed bank management. Finally, our new Seed Bank Technician will contribute 50% time (6 months per year) to project implementation activities including literature review, methods development, volunteer training, and general labwork. We will also recruit and train volunteers and undergraduate student interns to assist with routine seed testing activities. For this project, we are requesting funds to support the new Seed Bank Technician; all other staff time will be provided as cost-share.

*Required resources*—The main needed equipment is a germination chamber that will provide a temperature- and humidity-controlled environment for seed tests, which will also require installation of a water purification system. In addition, funding for consumable supplies (e.g., Petri dishes, agar, filter papers, razor blades), chemicals (tetrazolium chloride, bleach, Tween 20, ethanol), seed storage equipment (hygrometer, refrigerator), and glassware for use in germination and viability tests is requested. Other standard lab equipment such as microscopes, freezers, fume hood, and forceps will be provided by the Wildflower Center.

Space requirements include lab space for setting up and running germination trials and grow space for seed increases. We will use existing facilities in the Research Building at the Wildflower Center to house the germination chamber, provide work space for the Seed Bank Technician, and store required material. Grow space in the nursery and greenhouse areas, located adjacent to the Research Building, will be shared with the Horticulture Team. We will use a partial bench within one greenhouse (ca. 6 ft. × 6 ft.) for raising young seedlings or growing plants outside of the normal growing period and an equivalent area under shade cloth in the adjacent nursery area and tree yard for larger plants.

*Progress tracking*—Members of the project team will share responsibility for tracking progress towards achieving the intended results in an efficient and timely manner (see Performance Measurement Plan). Project team members will meet monthly to discuss progress towards achieving objectives, and every six months report their progress to the Director of Science and Conservation, who will evaluate the work accomplished against the Schedule of Completion. Every six months, the Seed Bank Technician will also reevaluate testing priorities based on the results to date. Quarterly accounting of hours spent on project activities and expenditures will ensure that resources are being used efficiently. As germination tests are completed, the methods and results of each test will be recorded by the Seed Bank Technician in a separate spreadsheet file that calculates statistics (germination and viability percentages with error) and graphs seed germination over time. These files will be archived in an existing shared online storage location. Key information on the experimental conditions and results of germination tests will be input into the plant records database for tracking and future reference. Use of the database will also allow us to track distributions of plant material and new seed bank accessions resulting from project activities. We will track dissemination of information on germination protocols and seed viability data to conservation partners and the public through updates made to NPONA, the Texas Plant Conservation Alliance website (TXPCA; in development by our team to be released end of 2023), and CPC forums. We will also keep a

running list of instances in which we supply seed bank users or correspondents with information on the viability of our collections or germination protocols. All website updates, distributions of plants, and correspondence on project-related findings will be reported on an annual basis by the appropriate project team member for compilation into a comprehensive end-of-project-year report on completed activities and results by the Director of Science and Conservation. The seed bank management plan we produce (see below) will itself also act as a primary means of tracking the progress we have made on improving our management practices over the course of the project.

*Risks and mitigation*—We have identified two major risks associated with this project. The first risk is that we will be unable to locate information on how to germinate seeds of our highest testing priorities. To mitigate this risk, we will reach out to our network of growers and conservation professionals for unpublished information and insights before testing seeds without existing germination protocols. In addition, before testing seeds of rare species without germination protocols, we will perform tests on more common relatives to avoid unnecessary destructive use of higher-value collections. Another major risk is that we will be unable to determine whether seeds that do not germinate are nonviable or merely dormant. To address this risk, we will incorporate dissections of ungerminated seeds into our testing procedure (MSBP, 2022). If lack of germination is prevalent within our collections, we will partner with researchers at UT to develop species-specific protocols for assessing viability with tetrazolium chloride stain (AOSA, 2010) or x-ray image seeds at the Botanical Research Institute of Texas, a CPC institution in Texas with which we closely collaborate (see Letter of Support from Brooke Best).

### **III. Project Results**

*Intended results and impacts*—The principal anticipated outcome of the project is an operational system and expanded capacity for seed testing, which we will use to generate data and a collection management plan for improving management of the Wildflower Center’s seed bank (Table 4). First, we will obtain viability percentages for tested accessions, which will allow us to determine whether recollection or regeneration of seeds is needed. Second, we will write new protocols for germinating seeds that will facilitate growing plants for reintroductions or ex situ collections in botanic gardens. Third, we will summarize what we have learned in a seed bank management plan that provides (1) instructions for how to process, store, and test seeds that can be used to train volunteers and student workers; (2) specific actions to take for managing rare species such as collections from more populations, use of alternate storage methods if necessary, or further research on how to improve germination percentages; and (3) a schedule for continued, regular germination testing to monitor the viability of stored seeds. Other intended results include plants grown from germinated seedlings for use by the Wildflower Center gardens or target groups (Table 2) and presentations on our project to educate general audiences on plant conservation and to encourage other institutions to implement seed testing programs.

The results of our work will be disseminated to target groups and other beneficiaries (Tables 2, 3) by various means. Data and other technical information, including successful seed germination protocols, will be uploaded to a shared database hosted on the TXPCA website and posted to forums on the CPC website for the rare species in their National Collection. We will also provide this information directly to users when we fulfill requests for seeds. The “Propagation” and “Wildflower Center Seed Bank” sections of the NPONA website will be updated with information on germination protocols and current seed bank accessions, respectively. Another way we will reach the public is through recording step-by-step YouTube videos on seed germination ([www.youtube.com/@WildflowerCenterAustin](http://www.youtube.com/@WildflowerCenterAustin)). We will actively seek out botanic gardens with which to share new plant material through the TXPCA or CPC networks. Placing more native plants on display at these institutions will extend the reach of our project by providing additional opportunities to interpret plant diversity and conservation to the public. To reach more specialized audiences, we will present our work at conferences such as Native Plant Society of Texas (NPSOT) Symposia, the 2025 Texas Plant Conservation Conference

(TPCC), and the annual meetings of the CPC and American Public Gardens Association (APGA). We will also plan to lead a seed bank management workshop at the next TPCC covering best practices for planning, building, and maintaining a conservation collection of seeds.

The intended results of our project will change the way our target groups (Table 2) interact with the seed bank. Requesters of seeds from our bank will have improved confidence in the ability of the seeds we supply to meet their needs without having to use scarce resources for conducting their own germination tests. Conversely, those who contribute seeds will gain confidence that the collections are appropriately stewarded. Conservation partners will also be able to work more efficiently knowing which species are adequately represented in ex-situ collections and which need further attention. Overall, we expect that obtaining and sharing our results will increase the use of our seed bank and catalyze further seed banking efforts at local and national levels.

**Table 4.** Project results and how they address needs of our organization and broader conservation community.

<b>Product</b>	<b>Knowledge Gained</b>	<b>Benefit to Society</b>	<b>Dissemination</b>
Viability data	Longevity of stored seeds and value of seed bank for ex-situ conservation.	Greater confidence in the efficacy of current conservation measures and identification of gaps.	Data contributed to a shared database of seed accessions hosted by TXPCA. Healthy seed collections listed on NPONA for users to request.
Germination protocols	How to use banked seeds for conservation and restoration projects.	Increased availability of information on how to grow native plant species.	Protocols posted to CPC forums, NPONA, LBJWC YouTube channel, and TXPCA website.
Seed bank management plan	Actions needed for rare species conservation and collections care.	Improved strategies for plant conservation and management of seed bank facilities.	Plant sent to relevant collaborators in TXPCA and CPC and presented during a workshop on seed bank management at the 2025 TPCC.
Plant material	Growth requirements and propagation methods for native species.	More opportunities for educating the public on plant conservation and plants for research and conservation.	CPC gardens contacted to receive plant material. Plants shared with other target groups upon request. Inventory on NPONA will be updated based on viability and health of material.
Presentations	Summary of the knowledge gained from other research products.	Heightened awareness of conservation work and best practices for seed bank management.	Presentations at UT and meetings of Texas/national organizations such as NPSOT, TPCC, CPC, and APGA.

*Continuing benefits*—The Wildflower Center and those we serve will continue to realize benefits from this project after its scheduled completion. By prioritizing which collections we test, we will maximize the benefit of the funding to guide future conservation activities. Phase 3 of the project work plan will also position the Science and Conservation Team to continue germination and viability testing as part of routine collections care. Viability data and information on the tests we performed for each accession will be stored in our plant records database, for permanent reference, which will also allow us to generate reports for sharing test results with partner organizations in the future. Germination protocols made available to the public over the internet (Table 4) will also remain accessible. We furthermore expect this project to permanently enhance the Wildflower Center’s horticultural display for the education and enjoyment of the public as new species are propagated and trialed in the gardens. Finally, we anticipate that this project will stimulate the implementation of seed banking best practices in Texas and across the CPC network as we share our accumulated knowledge and experience.



# Improving Seed Bank Collections Management through Germination and Viability Testing

## Schedule of Completion

*Project Year 1: September 2024–August 2025*

	Task	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
<b>P h a s e 1</b>	Purchase and set up equipment.	██████████											
	Develop system for data management.		██████████										
	Research germination protocols for species.				██████████								
	Create prioritized list of accessions for testing.				██████████								
	Update existing seed bank records as needed.	████████████████████											
<b>P h a s e 2</b>	Test relative humidity of storage containers and repackage seeds as needed.							████████████████████					
	Design and set up germination/viability tests.							████████████████████					
	Monitor tests and record data.							████████████████████					
	Create plan for new seedlings/seeds.							████████████████████					
	Summarize results and enter into plant records database.								██████████████████				
	Write germination protocols.								██████████████████				
	Post updates to CPC, NPONA, and TXPCA websites.								██████████████████				
	Develop garden displays.												
<b>O n g o i n g</b>	Recruit and train volunteers and students.							████████████████████					
	Follow up with researchers.							████████████████████					
	Grow out and distribute seedlings.							██████████████████					
	Report results of project activities.												████

Abbreviations: CPC = Center for Plant Conservation, NPONA = Native Plants of North America, TXPCA = Texas Plant Conservation Alliance.



PERFORMANCE MEASUREMENT PLAN

**Applicant Name:** Lady Bird Johnson Wildflower Center

**Project Title:** Improving Seed Bank Collections Management through Germination and Viability Testing

<p><b>Performance Measure</b></p>	<p><b>Data We Will Collect</b> (e.g., counts, costs, weights, volumes, temperatures, percentages, hours, observations, opinions, feelings)</p>	<p><b>Source of Our Data</b> (e.g., members of the target group, project staff, stakeholders, internal/external documents, recording devices, databases)</p>	<p><b>Method We Will Use</b> (e.g., survey, questionnaire, interview, focus group, informal discussion, observation, assessment, document analysis)</p>	<p><b>Schedule</b> (e.g., daily, weekly, monthly, quarterly, annually, beginning/end)</p>
<p><b>Effectiveness:</b> The extent to which activities contribute to achieving the intended results</p>	<p>The main outcomes of our project are a functioning system for performing germination and viability tests, information on seed viability and germination requirements to be shared with target groups as well as the public, and a seed bank management plan:</p> <ul style="list-style-type: none"> <li>● Every six months beginning in Phase 2, the Seed Bank Technician will compare the tested accessions to the list of highest priorities for testing, revising priorities as necessary.</li> <li>● At the end of each project year, the Seed Bank Technician will report the number of seed accessions that were repackaged and the number of new germination protocols written.</li> <li>● At the end of each project year, the Seed Bank Coordinator will report the number of project-related posts to the TXPCA and NPONA websites, and the number of times germination protocols and viability data were provided to seed bank users.</li> <li>● At the end of each project year, the Conservation Collections Manager will report the number of project-related updates posted to the CPC website and use the plant records database to generate reports on the number of seed bank accessions tested, the number of new accessions resulting from project activities, and the number of accessions distributed to seed bank users.</li> <li>● At the end of each project year, the Director of Science and Conservation (Project Director), will compile and summarize all performance measures.</li> <li>● Within a month after completion of the seed bank management plan, the Conservation Collections Manager and Director of Science and Conservation will evaluate the management needs of the seed bank against institutional and team-level priorities.</li> <li>● During Phase 3, the project team will present to Wildflower Center staff a list of new plants added to the garden from project activities.</li> </ul>			

<p><b>Efficiency:</b> How well resources (e.g., funds, expertise, time) are used and costs are minimized while generating maximum value for the target group</p>	<p>We will track our use of the resources for which we requested funding, including equipment, supplies, and staffing:</p> <ul style="list-style-type: none"> <li>● Each quarter, the Conservation Collections Manager will report our total and cumulative expenditures on equipment and supplies to the Director of Science and Conservation.</li> <li>● At the end of Phase 2, the Seed Bank Technician will calculate the average cost in materials and length of time needed to perform a germination test on a seed accession.</li> <li>● Weekly, project personnel will record the amount of time spent working on project activities. Student workers will report their hours weekly to the Conservation Collections Manager.</li> <li>● Each quarter, beginning in Phase 2, the Conservation Collections Manager will request data on the number of hours logged by our volunteers from the volunteer office.</li> <li>● Each quarter, project personnel will report their hours, including those of volunteers and student workers, to the Director of Science and Conservation.</li> </ul>
<p><b>Quality:</b> How well the activities meet the requirements and expectations of the target group</p>	<p>We will assess how well our project activities serve each target group of seed bank users:</p> <ul style="list-style-type: none"> <li>● Within six months of sending seed to a researcher, we will contact them with a short questionnaire to ascertain how useful the material was for their work.</li> <li>● Annually at meetings of the TXPCA, we will survey members on seed banking needs and how the data provided through the organization’s website are being used.</li> <li>● At the end of each project year, we will contact botanic gardens (CPC and non-CPC institutions) with which we have shared plant material to find out whether the material is still in their collection and how it has been used (research, long-term storage, display, nursery stock, conservation actions, etc.).</li> <li>● Immediately after the seed bank management workshop, we will administer workshop evaluations to participants to obtain feedback on what was learned and what training or other resources participants still need relative to their seed banking efforts.</li> </ul>
<p><b>Timeliness:</b> The extent to which each task/activity is completed within the proposed timeframe</p>	<p>The timeliness of our completion of activities will be regularly assessed during each project phase:</p> <ul style="list-style-type: none"> <li>● Every month, the Seed Bank Technician and Seed Bank Coordinator will meet with the Conservation Collections Manager to discuss the status of their work on project activities.</li> <li>● Every six months (end Phase 1, mid Phase 2, end Phase 2, end Phase 3), project personnel will write a report on their progress toward achieving each relevant activity from the Schedule of Completion to the Director of Science and Conservation, who will assess how well the project is following the schedule.</li> </ul>

Abbreviations: CPC = Center for Plant Conservation, NPONA = Native Plants of North America, TXPCA = Texas Plant Conservation Alliance.