SWANA STUDENT DESIGN COMPETITION (SDC)

Addressing waste and resource management challenges

PROBLEM STATEMENT AND PROTOCOL

January - April 2026

1. Introduction

The SWANA Student Design Competition (SDC) is a team project focused on solving a "real world" problem faced by waste and resource management professionals. The competition provides

professional experience to students pursuing an education and/or career in waste, resource management and related environmental fields. The goals of the SDC are to:

- Provide students with real world experience in solving complex waste, resource management and environmental issues in a supportive and fun environment.
- Provide students with an opportunity to display their problem-solving, professional writing and communication skills.
- Encourage student involvement in SWANA.

This document outlines the problem statement and guidelines for the competition. **Participants are advised to read the entire document as guidelines detailed in this document must be followed.**

2. Problem Statement & Competition Format

The problem statement is provided under **Attachment 1**. In general, the SDC is organized as explained below:

- Students will review the Problem Statement and existing information. Interested teams will submit a completed Team Commitment Form.
- SWANA will host a virtual kick-off meeting to explain the Problem Statement and associated data.
- Students will be guided by the SWANA SDC committee and, upon request, be paired with a mentor to assist their team with the project.
- Student teams will present their solutions through a report, infographic, and virtual presentation by the deadlines summarized in Section 4.

The solution to the Problem Statement must be detailed in a design report, infographic, and presentation. Guidelines for each of the three components are provided in Sections 5 through 7.

3. Eligibility to Participate

Participating teams must comply with the following criteria:

- Each participating student must be a member of SWANA. You are encouraged to activate your free membership in advance. SWANA Student Membership.
- Each participating team can have a minimum of two (2) and a maximum of eight (8) team members. The recommended team size is four (4) members.
- Each participant must be enrolled as a full-time or a part-time student during competition enrollment. We understand that some students may graduate or be near graduation at the time of the presentation. However, to ensure participation, **we require at least one student in the team to anticipate graduation after the scheduled date for presentations**.

Preferably all team members should be from the same school/university; however, exceptions can be made. An exception request must be made using the *Team Commitment Form* providedas **Attachment 2**, and the participants should reach out to the contacts provided for further discussion.

- The *Team Commitment Form* must be signed by a school faculty member as the team's

sponsor.

4. Deadlines

The deadlines for the competition are detailed below. Submissions must be made electronically (unless specified otherwise) to the contact person identified in Section 11.

- **Team Commitment Form**: Teams must submit the Team Commitment Form (**Attachment 2**) to participate in the competition. SWANA recommends to interested teams submit the Team Commitment Form as soon as possible. Applications are **due by February 6, 2026**. Acceptance of the Team Commitment Form to confirm participation in the SDC will be provided upon submission of the form.
- A kickoff meeting will be held February 10, 2026, to provide the teams with an overview of the competition, review the SDC problem statement, requirements, and answer general questions. An additional follow-up meeting will be scheduled for March 2, 2026. Further information will be provided for the selected teams.
- **Design Report**: The final design report must be submitted by April 1, 2026. The guidelines presented in Section 5 must be followed for the design report.
- **Infographic**: Infographic must be submitted by April 1, 2026. The guidelines presented in Section 6 must be followed for the infographic.
- **Presentation**: The student design teams will present their solutions virtually April 14, 2026. The specific date and time for each presentation will be communicated to teams in March. The guidelines listed in Section 7 must be followed for the presentation. All presentations will be recorded and become the property of SWANA.

5. Design Report Guidelines

The Design Report must follow the structure listed below:

- Report must be submitted in pdf format.
- Font must be a 12-point standard business font (e.g., Calibri, Arial, Times New Roman) and double-spaced text.
- Recommended format for Citations/References: Chicago Style.
- The maximum report length is limited to 30 pages (not including a cover sheet and references).
- The report must clearly outline any assumptions used by the team in their decision-making and provide a clear recommendation.
- Tables and figures can be provided as attachments in addition to the 30-page limit. There is no page limit on the attachments (tables and figures), but attachments should not be narrative in form (i.e., attachments cannot be used to extend the length of the core report narrative).

Refer to the judging sheet provided as **Attachment 3** to gauge the expectations of the judges.

6. Infographic Guidelines

The following guidelines must be followed.

- Infographics should be geared toward the general public and should condense the key points of your report and presentation into an engaging and informative summary.
- All infographics must be created in a desktop page layout software (e.g., PowerPoint, Adobe InDesign, QuarkXPress) or an online infographic design site that can produce high-res images.
- All art must be formatted as CMYK, hi-res images at least 266 dpi in RAW .jpg format.
- Final document must be saved as a hi-res PDF with all art and images embedded.
- All files shall be submitted using the method directed by SWANA staff prior to the deadline. The submission method will be communicated directly to participating teams in March 2025.
- Be clear and concise with infographic design and content. Overcrowding the infographic makes it difficult to read.
- Your infographic must include the university represented and all team member names. Figures, graphs, and tables should be uncluttered and simple and arranged in the sequence in which you want them to be viewed.
- Remember contrast and accessibility. Put light-colored text on dark backgrounds and dark text on light-colored backgrounds so that your viewer can see your text clearly.
- Drawings, illustrations, and/or diagrams (with the exception of open-source icons and clipart available through the design software of your choice) must be the student's own work.

Tips for imbedded graphics:

- Use high-resolution images.
- Do not cut and paste art or screen-filled shapes from PowerPoint.
- Text may be copied and pasted from PowerPoint into the layout software, but it will require applying the "create to outline" setting after pasting.

Refer to the judging sheet provided as **Attachment 3** to gauge the expectations of the judges.

7. Presentation Guidelines

Each of the participating teams will present their design solution virtually. Presentation dates and times will be communicated by SWANA in March 2025. Presentation order will be chosen randomly, and all team members need to actively participate in the presentation and/or question and answer period. Plan for a 20-minute presentation followed by 10 minutes for question and answer.

Presentation Guidelines and Tips:

- Treat the judges as if they are your client and your firm is hired to solve their "real world" problem.
- Presentations must be limited to 20 slides.
- The presentation needs to flow in a way that makes sense. Your team should present the problem, discuss alternatives, and provide a solution.
- Do not read word-for-word from the slides. Slides should contain a summary of what

students will say.

- Do not overwhelm the slide with too many images or complicated animations. Slides should be clean and easy to read with a common theme.
- Be sure to thank anyone who provided mentorship and information throughout the project.
- Each speaker should have somewhat equal time presenting. We recommend at least 50% of team members participate in oral presentations, with a minimum of 2 presenters for each team. For a team of two (2) members, both members must present. It is expected that most (if not all) team members will participate when responding to questions from the judges.

- Clearly state the main points, assumptions, and conclusions. You will have to make assumptions in the real world, so the judges need to understand your thought process.
- Understand that there is a balance to the amount of background information that should be presented. You can assume that there might be people in your audience (including judges) that will not be familiar with the topic, so a little background is helpful, but it should be limited, since it is not the main purpose of the competition.
- Discuss the challenges that you were faced with and how that affected the outcome. Practice presenting and answering questions in front of an audience. The judges understand that you are a student but like to see that you understand the basic technical principles, and that you can think about their questions and come up with a thoughtful answer.
- Consider recording yourself during a practice presentation and make notes of distracting mannerisms (i.e. saying “ummm” or “like” too often). Practice timing yourself.
- Make sure you dress for the part. You are presenting as though you are trying to win a job. Attire is business professional.

8. Judging

Judging sheet is provided as **Attachment 3**. The following Table provides a breakdown of the total points:

Item	Maximum Points
Design Report	100
Infographic	50
Presentation	100
TOTAL	**250**

9. Award

Team awards will be presented to the top teams with maximum overall scores (see chart below). A minimum of one member from each team must attend the Awards Ceremony for the team and individual members to be eligible for awards. The Awards ceremony will be April 9, 2026.

Participating students will receive complementary registration for a SWANA Annual National Conference.

Rank	Prize
First Place Prize	$2,000

Second Place Prize	$1,500
Third Place Prize	$1,000

Best Team Presentation and Emerging Leader/Rising Star awardees will receive $500. It is possible for a team to receive more than one award.

Please note: Cash prizes are subject to the laws of the winning team's country including Somalia, Iran, Cuba, Sudan, Syria, North Korea, or any other nation that may be under sanction by the United States at the time of the competition or award distribution.

10. Closing Remarks

Although most information may be available online, participants should note that additional information may require contacting vendors. If this is the case, always identify yourself as a student working on a project where you are acting as a consultant. Be professional, polite, persistent, and concise in the requests to obtain necessary information.

At the end of the day, a consultant may need to contact the client for data requests. If you run into an issue that requires critical information that you believe is not provided, please contact the persons listed below.

11. Contact Person

Submissions must be made electronically (unless specified otherwise) to SWANA. Tracy Schorle (tschorle@swana.org) and Cory Bristol (cbristol@swana.org) are the staff liaisons for the competition.

Questions regarding the projects may be directed to SDC co-chairs:

- Samarjeet Kadam (skadam@cecinc.com)

12. Use of Material

License: Team hereby grants to SWANA a royalty-free license to use, reproduce and distribute the infographic and presentation (including all handouts and PowerPoint presentations) to SWANA members and customers through the SWANA website, with appropriate attribution to Team.

Promotion: It is understood that SWANA may use Team's University name, photograph, and biographical material solely for the purpose of advertising and promoting Team's participation and appearance SWANA's Student Design Competition.

Recording: Team provides consent for SWANA to record the presentation in audio and/or visual form. Team understands that SWANA will be the sole copyright owner of the recording and can distribute it, along with any supporting materials. Teams will receive a link to the recording.

Warranty: Team warrants and represents that, to the best of Participant's knowledge, nothing in the presentation violates any proprietary or personal rights of others (including, without limitation, any copyright or privacy rights), the presentation is factually accurate and contains nothing libelous or otherwise unlawful. The team further represents and warrants that the presentation is Team's own original work or has obtained all necessary permissions or licenses from any persons or organizations whose material is included or used in the presentation.

ATTACHMENT 1 – Problem Statement

AI-Driven Route Optimization and Hazardous Waste Sorting for Municipal Solid Waste Management

Challenge

Riverton, a city of 500,000, faces rising waste management costs and safety hazards. Inefficient collection routes lead to wasted fuel, excessive emissions, and frequent missed pickups. Meanwhile, hazardous materials such as lithium-ion batteries, chemicals, sharps, and paints continue to enter the recycling stream, causing fires and damaging equipment at the City's Material Recovery Facility (MRF).

Background

The City of Riverton (City), a growing metropolitan area with a population of 500,000, prides itself on achieving aggressive sustainability goals. Yet, its municipal waste management system is struggling. Every day, Riverton's fleet of 50 collection trucks navigates congested streets using static routes designed years ago. These routes fail to account for real-time traffic, bin fill levels, or seasonal waste fluctuations. As a result, trucks often drive empty miles, burning excess fuel and increasing greenhouse gas emissions. Operational costs have increased by 15 percent in the last three years, and complaints about missed pickups continue to rise.

At Riverton's central Material Recovery Facility (MRF), hazardous waste contamination presents another critical issue. Lithium-ion batteries, chemicals, paint, sharps, and other universal waste frequently slip into recycling streams. In 2024 alone, Riverton reported six fires at its MRF, all traced to improperly sorted hazardous materials. These incidents endangered workers, caused more than $250,000 in damages, and forced multi-week shutdowns of recycling operations.

The City Council has set ambitious targets: reduce collection costs by 20 percent and eliminate hazardous waste contamination by 2030. Manual route planning and visual sorting alone are no longer adequate to meet these goals. Instead, Riverton is exploring how engineering-driven system design, supported by AI-enabled commercial technologies, can improve efficiency, safety, and environmental performance.

Technology-Enabled Route Optimization

Modern route optimization platforms use automated decision-support tools to incorporate traffic conditions, historical collection data, weather, and assumed container fill trends to improve collection efficiency. These systems are already deployed by municipalities to reduce vehicle miles traveled, fuel consumption, overtime labor, and missed pickups.

Hazardous Waste Detection

AI-powered computer vision systems can identify batteries, chemicals, and other dangerous items on conveyor belts with accuracy approaching 95 percent, reducing fire risk and increasing recycling purity.

Cities such as Burgdorf (Switzerland) and Mexico City (Mexico) have already piloted AI-driven routing and sortation systems and have reported cost savings of 20-30 percent and notable safety improvements. Riverton now seeks to join this movement toward innovation.

MRF Equipment and System Elements

Students should assume Riverton operates a modern single-stream MRF equipped with commonly used processing systems. The following components may be referenced when proposing AI integration points:

Front-End Systems

- Tipping floor
- Conveyors and loading systems
- Bag breakers
- Manual pre-sort stations

Material Separation Equipment

- OCC screens
- Fines screens
- Ballistic separators
- Glass breaker
- Steel magnet
- Eddy current separator
- Optical sorting units
- Quality control (QC) manual sort lines

End-of-Line Systems

- Fire suppression and hazard isolation zones
- Baling equipment
- Bale storage areas

Teams may conceptually incorporate AI-enabled cameras, sensors, robotic sorters, or anomaly-detection systems at appropriate locations, focusing on engineering feasibility and operational impact rather than software development.

Problem Scenario and Objective

Riverton's waste management department faces:

- Inefficient routing: Static schedules lead to wasted fuel, overtime costs, and missed pickups.
- Hazardous contamination: Manual sorting fails to consistently detect dangerous items, resulting in fires and equipment damage.
- Budget strain: Increased operational costs threaten service quality and sustainability commitments.

Without intervention, Riverton risks falling short of its climate goals and exposing workers to ongoing hazards.

Objective

The goal of this project is to design a municipal solid waste management system that integrates commercially available AI-enabled technologies to improve routing efficiency and reduce hazardous waste contamination.

1. Conceptually apply AI-enabled routing tools to improve waste collection efficiency using assumed or simulated data.
2. Integrate AI-assisted hazardous waste detection into an existing MRF process flow.
3. Evaluate financial and environmental impacts, including capital cost estimates, operating costs, potential savings, and achievable emissions and safety benefits.

The design should illustrate how Riverton can achieve measurable environmental and safety benefits while maintaining economic viability. The system should serve as a scalable model that other municipalities can adopt. Students are not required to write code or develop AI algorithms. The emphasis is on civil and environmental engineering judgment, system design, and quantitative evaluation.

Scope & Constraints

- City population: 500,000 (assume 1 percent annual growth for the next 20 years)
- Fleet: 50 collection trucks
- One central MRF
- Compliance with all applicable U.S. EPA and local safety regulations

Expected Deliverables

Teams must submit the following:

- Conceptual system design illustrating how routing optimization and hazardous detection technologies integrate into municipal operations.
- Cost-benefit and lifecycle analysis, with assumptions clearly stated.
- Environmental impact assessment.
- Presentation deck tailored to non-technical municipal stakeholders.
- Infographic summary that concisely explains the proposed solution.
- Technical report detailing assumptions, calculations, system concepts, and references.

Evaluation Criteria

Projects will be assessed based on overall technical rigor, creativity, and clarity. The following scoring structure will be used to evaluate submissions:

- Innovation (25 percent) - Creativity of AI approach and design solution.
- Technical Feasibility (25 percent) - Sound assumptions and realistic designs
- Impact (20 percent) - Demonstrated environmental, safety, and cost benefits.
- Presentation (15 percent) - Clarity, professionalism, and effectiveness of communication.
- Collaboration & Research (15 percent) - Depth of references, interviews, and teamwork.

Important Clarification for Students

Students are not expected to develop or train AI models, write code, or perform advanced data science. AI-enabled tools should be treated as commercially available engineering technologies

References for Students

Students are encouraged to visit the following resources for high-level introductions to the AI technologies referenced in this problem statement:

1. AI-Driven Optimization of Waste Collection Routes
2. Smart Waste Collection with AI-Empowered Planning
3. AI in Waste Sortation: Robotics, Algorithms, & More
4. ZenRobotics AI Waste Sorting
5. Route Optimization Software for Waste Collection
6. AI-Driven Innovations in Waste Management

Additional research may include web resources, journal articles, textbooks, trade publications, and interviews with industry professionals. All sources must be cited appropriately.

Mentorship Note

Students are encouraged to engage with waste industry professionals, technology developers, municipal leaders, and academic experts throughout the design process. Mentorship may be available through SWANA chapters and industry partners to support team development and enhance project quality.

ATTACHMENT 2

Team Commitment Form

SWANA
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Please use the link to complete the information below for your team.

Name of School: _____

Team Members and Contact Information:

Name	Email	Phone	Anticipated Graduation (MM/YY)

(Maximum team members = 8)

Chosen Name of Your Consulting Firm: _____

Designated Team Contact (Captain): _____

School Faculty Name/Phone Number/Email: _____/_____/_____

School Faculty Signature: _____

Any Requested Exception to Section 3 Criteria: Yes □ No □

If NO, we understand that the participant complies with requirements of Section 3. If YES, briefly state the requested exemption and reason below:

_____

_____

Use of Materials

By submission of this application, each team member gives SWANA permission to use any and all of my voice, image and likeness, with or without using my name, in connection with the products and/or services of SWANA for the purposes of advertising and promoting such products and/or services and/or SWANA and/or for other purposes deemed appropriate by SWANA in its reasonable discretion, except to the extent expressly prohibited by law.

ATTACHMENT 3

SWANA
YOUNG PROFESSIONALS

Judging Form

Design Report (Maximum Points = 100)			
Description	**Max. Points**	**Awarded**	**Comment #**
Introduction	5		
Realistic / Innovative Assumptions and Data Analysis	15		
Approach to Updating MRF	20		
Approach to Route Optimization & Evaluation of Available Tech	20		
Conclusion and Recommendations	10		
Cost Analysis	10		
References	5		
Formatting & Appearance	5		
Grammar, Spelling & Overall Technical Writing	5		
Visual Aids (Graphs, Pictures etc.) presented clearly	5		
Infographic (Maximum Points = 50)			
Proposed solutions are summarized succinctly in a communication appropriate for the general public	10		
All components of decommissioning plan given appropriate level of attention	10		
Infographic includes clear messaging that conveys safety topics to the public	10		
Visually attractive, legible text, effective use of figures, tables, & graphic devices	10		
Easy to follow, focused, and organized	10		
Presentation (Maximum Points = 100)			
Clear introduction that sets stage for presentation	15		
Main points are developed, organized, and well formulated	10		
Material presented at an appropriate level and pace for audience, yet includes relevant detail and clarity	10		
Visual aids are clear, well-constructed, and effective, aiding in understanding	10		
Realistic plan with high likelihood of success	10		
Solution considers broad range of impacts such as environment, economics, society, and sustainability	10		
Questions answered competently, all members demonstrate a clear understanding of topic	15		
Team presents a professional image, projecting enthusiasm and competence	10		
Timing (presentation rehearsed and less than 15 min.)	10		