Comprehensive System Design

Drainage Impact Automation System

Prepared by: Dozier Tech Group, LLC Prepared for: LCR & Company, LLC Date: October 30, 2025

Confidential and proprietary to Dozier Tech Group and LCR & Company. This document provides a full engineering design for automating drainage impact analysis, specification management, plan QA, and document generation.

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1. Executive Summary

Dozier Tech Group will deliver an end-to-end automation platform that integrates directly with Civil 3D, Excel-based Rational Method workbooks, and municipal standards. The platform computes areas, determines Tc, pulls NOAA/UDC coefficients, and produces permit-ready Drainage Impact Analysis (DIA) reports with exhibits. The design emphasizes reproducibility, audit trails, and conformance to LCG/LUS and DOTD standards.

Business outcomes include a significant reduction in manual effort (80–90%), standardization of DIA outputs, automatic QA of plan sets, and a living UDC/DOTD specification database. This document details architecture, modules, data models, APIs, deployment, security, QA, and an implementation timeline.

2. Architecture Overview

The system's architecture is designed for a seamless, end-to-end workflow, from initial data input to final report generation. It is composed of several interconnected modules that work in concert to automate the drainage impact analysis process. The core of the system is a **unified Geospatial Database**, which serves as a central, auditable repository for all project data and regulatory specifications. A secure **API**

Service exposes the system's functionality, while a user-friendly **Web Portal** provides a central interface for uploading project artifacts (such as DWG, PDF, CSV, and Excel files) and downloading the generated reports. For engineers, a custom **Civil 3D Add-in** allows for the native and direct export of geometric data from the CAD environment.

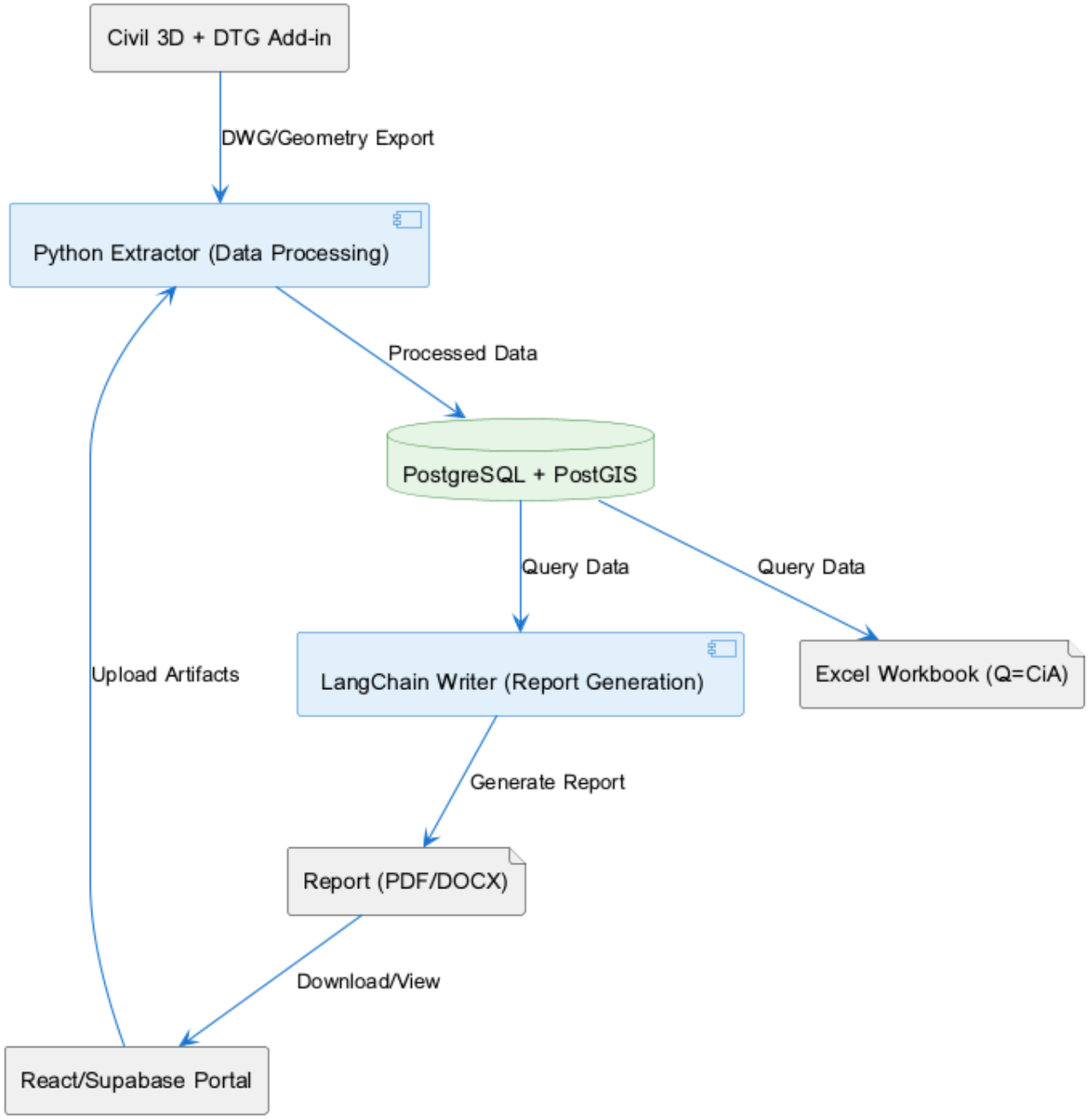

Fig 1. System Architecture & Data Flow

3. System Components

This section details the five modules: Area Extraction, UDC Parser, Drainage Impact Report Generator, Plan Review & QA, and Proposal Generator.

3.1 Area Calculation Module

The primary objective of this module is to accurately compute surface areas from Civil 3D drawings and prepare the data for use in the Rational Method workbook. The process begins with a custom Civil 3D add-in that identifies and extracts geometric data from the drawing. This data is then aggregated and processed to calculate the weighted runoff coefficient (C), which is a critical input for the hydraulic analysis.

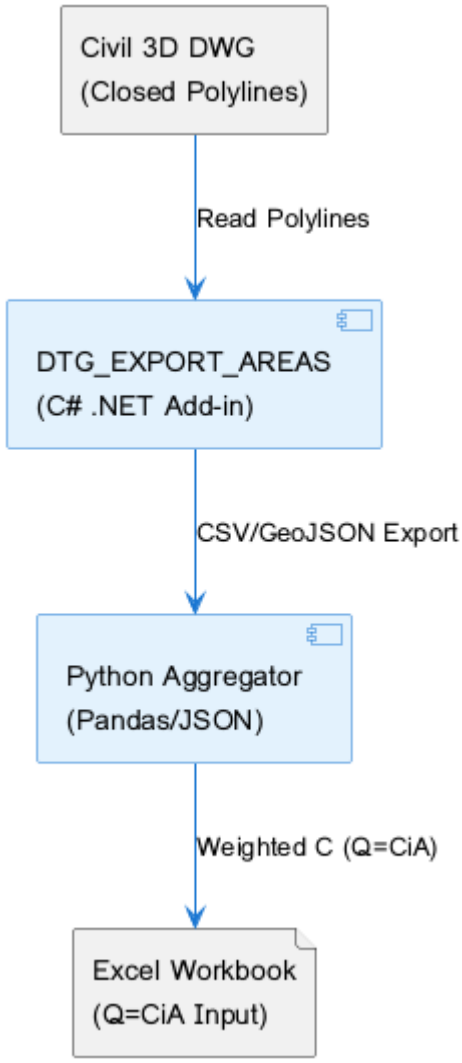

Fig 2. Area Extraction Flow

3.2 UDC Specification Parser

This module is responsible for ingesting and digitizing regulatory documents, such as the Unified Development Code (UDC) or municipal specifications. It automatically extracts key data—like runoff coefficients and design standards—from PDF documents and stores them in the central database, creating a living, auditable specification library.

3.3 Drainage Impact Report Generator

This is the core calculation engine. It retrieves the computed areas and weighted C values, combines them with time of concentration (Tc) data and NOAA Atlas 14 rainfall intensity data, and executes the Rational Method calculation (Q=CiA) for multiple storm events. The module then generates the final, permit-ready Drainage Impact Analysis (DIA) report and the supporting Excel workbook.

3.4 Plan Review & QA Automation

This module automates the quality assurance (QA) process for plan sets. It analyzes submitted plan PDFs to ensure compliance with municipal standards (e.g., LCG/LUS, DOTD). Checks include verifying required sheets, checking for mandatory general notes, and validating scales and text heights. The output is a clear QA report and an overlay PDF highlighting any non-compliant areas.

3.5 Proposal & Document Generator

This module streamlines the business process by automatically generating proposals and other project documents. It pulls project-specific metadata (client, jurisdiction, scope, costs) from the database and merges it into a branded document template, producing a final, ready-to-send document (e.g., DOCX or PDF).

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4. Database Design

Key entities and relationships are illustrated below. The database is structured to ensure data integrity, auditability, and efficient querying for all project, calculation, and regulatory data.

Table	Primary Key	Foreign Key	Key Fields
projects	id		name, jurisdiction, site_acres
drawings	id	project_id	file_hash, export timestamp
drainage_areas	id	project_id	name, area, weighted C, Tc
results	id	run_id, da_id	storm, calculated flow (Q)
runs	id	project_id	revision tracking (specs, drawings, survey)
specs	id	jurisdiction_id	type, value, source reference

Fig 3. ERD (key tables and relations)

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5. API Layer

Method	Path	Description	Request	Response
POST	/runs	Start a DIA run	{project_id, storm_set}	{run_id}
GET	/runs/{id}	Get run status & artifacts	—	{status, links[]}
POST	/qa	Run plan QA checks	{project_id, file_id}	{report_url, issues[]}
GET	/specs/{jurisdiction}	Fetch standards	—	{coeffs[], storms[]}
POST	/proposals	Render a proposal	{project_id}	{docx_url, pdf_url}

```python
```

FastAPI sample

The API layer provides a secure, programmatic interface for all system functions, allowing the Web Portal and other integrated tools to interact with the core logic. Key endpoints manage the start and status tracking of a Drainage Impact Analysis (DIA) run, Plan QA checks, and the retrieval of regulatory specifications. ```

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6. Deployment Infrastructure

The system is designed for flexible deployment, supporting both cloud environments (such as Azure) and on-premise servers. To ensure consistency and simplify management, the entire application is built using a **containerized architecture**. This approach encapsulates the core services—the API, the background processing Worker, the Database, and the Web Portal—into portable, self-contained units, streamlining both initial setup and ongoing maintenance.

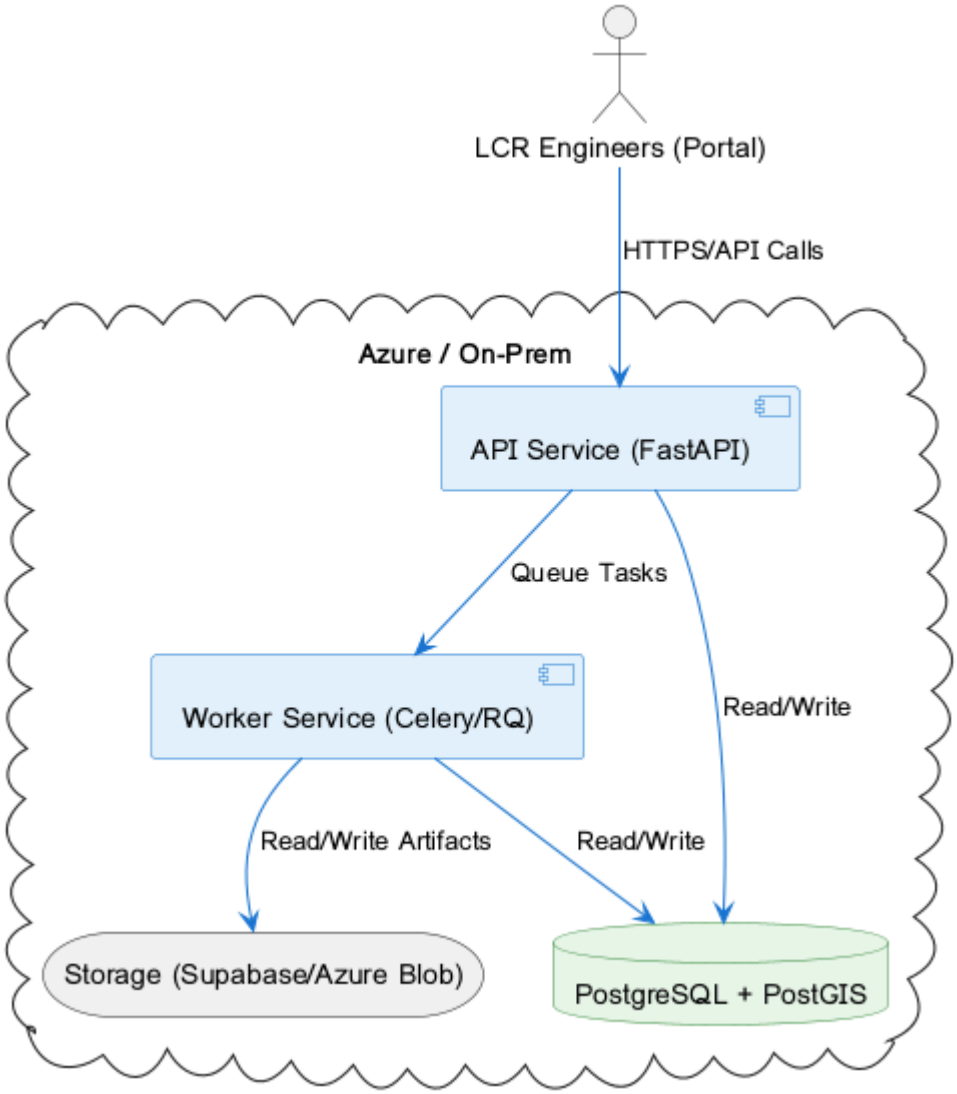

Fig 4. Deployment Overview

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7. Security & Data Governance

Control	Implementation
Encryption at Rest	Supabase/Azure Blob with server-side encryption
Transport Security	HTTPS/TLS 1.2+, strict HSTS
Access Control	Supabase RBAC roles: Engineer, Reviewer, Admin
Auditability	Run manifests with input/output hashes
Backups	Nightly DB & storage backups, 30-day retention

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8. Quality Assurance & Testing

Test Input	Expected Result	Tolerance
Area Accuracy	DWG polylines Sum(area_ac) match Civil 3D	±0.5%
Weighted C	Layer/Class map C_weighted per DA	Exact
Tc Computation	Survey CSV Tc per DA reproducible	±1.0 min
Q=CiA	Excel + Atlas14 Q per DA & storm	±2%
Plan QA	Plan PDF Missing sheets/notes flagged	Deterministic

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9. Implementation Timeline

Phase	Duration	Milestones / Acceptance
Foundations	1 wk	DB ready; storage configured; CI skeleton
Area Module	2 wks	C3D export + Excel writer; area QA pass
DIA Generator	4 wks	Pre/Post tables + report v1; match reference
Specs Parser	3 wks	UDC DB seeded; diff notifier live
Plan QA	3 wks	QA overlay; rule set validated
Proposal Gen	2 wks	Branded proposal template live

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10. Maintenance & Support

Dozier Tech Group provides 90 days of included support post-delivery and an optional annual maintenance plan (SLA) for updates and enhancements.

Appendix A. Example JSON Outputs

```json { "project": "Sample High School", "drainage_areas": [{"name": "DA-1", "area_ac": 13.71, "C_weighted": 0.73, "tc_min": 19.7}, {"name": "DA-2", "area_ac": 15.13, "C_weighted": 0.50, "tc_min": 30.8}], "Q_results": [{"DA":"DA-1","storm":10,"Q_cfs":65.6}, {"DA":"DA-1","storm":25,"Q_cfs":76.8}] } ```

Appendix B. LangChain Prompt Template (Excerpt)

You are preparing a Drainage Impact Analysis report for {jurisdiction}. Include sections: Introduction, Methodology, Results, No-Net-Fill, Exhibits. For each drainage area, summarize C_weighted, Tc_min, and Q values, and cite Atlas 14 intensities.

Appendix C. Excel Named Ranges (Mapping)

Range	Description
Areas!B5:B20	Area (acres) per DA
Areas!C5:C20	Weighted C per DA
Hydrology!B5:B20	Tc (min) per DA
Results!D5:G20	Q (cfs) for 10/25/50/100-yr

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