

Master Drainage Study

For
Smith Field
Fort Wayne Allen County Airport Authority

Fort Wayne, Indiana



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Introduction

Smith Field is a publicly owned general aviation reliever airport to Fort Wayne International Airport, currently serving the City of Fort Wayne, Indiana and surrounding area. Smith Field is situated on 230 acres of land approximately 5 miles north of downtown Fort Wayne and less than two miles from Interstate 69. A vicinity map in Exhibit 1 depicts the Airport and the surrounding City of Fort Wayne.

Project Description

To meet the demand for expanded aviation services at Smith Field, an Airport Layout Plan (ALP) was prepared and has been approved by the Federal Aviation Administration (FAA). In order for the Airport to become self sufficient and meet growing general aviation demands, the Fort Wayne Allen County Airport Authority (FWACAA) intends to implement aviation and commercial related improvements which, in general, include the following elements of work:

1. Construct new small aircraft parking area, group hangars and associated improvements on the south/southwest side of the airport (Designated West Group Hangar Development on Exhibits).
2. Construct new mixed use aircraft hangar & instruction facilities on the northeast side of the airport (Designated East Group Hangar Development)
3. Acquire approximately 37 acres of land including 7 residential dwellings, to construct proposed improvements, to protect approaches, to ensure compatible land use and to preserve the long-term existence of the aviation facility.
4. Construct, light and mark proposed Runway 10/28 including associated parallel and connecting taxiways.
5. Close Runway 13/31; convert some existing pavements to taxiways and remove other pavements.
6. Construct new corporate aircraft parking area, hangar space and associated improvements on the north side of the airport. Portions of the airport property along Cook Road will also be reserved for potential non-aviation commercial development.
7. Redevelop the existing southeast quadrant of the airport with new general aviation facilities; including aircraft parking apron, group hangars and associated improvements.

Implementation of the various items is intended to be phased and is proposed to be undertaken individually or in combination in order to permit safe and efficient operations of the airport facilities during the development period, and to minimize any adverse effects of construction activity on airport environs and neighboring land owners.

The development discussed above and as depicted on the FAA approved ALP is intended to be a up to a 20-year plan. As such, some of these improvements will be constructed in the next few years and others will be constructed in later years. The

stormwater modeling, including storm sewer and detention sizing, completed for this study used the full build out as shown on Exhibit 3. However, the Airport identified previous items 1 through 3 as short term improvements that could be completed in the near future. As these items are constructed interim storm sewer networks will use existing and new facilities and will be compatible with the ultimate development. The detention for the short term facilities will be constructed as shown in the ultimate build out.

Analysis and Design Standards

As with most airport projects, Federal, State and local agencies have jurisdiction over some or all of the aspects development.

The Master Drainage Study takes into account the regulations these agencies have implemented and complies with them. Often several agencies regulate the same issue. Where this is the case, the Master Drainage Study adheres to the stricter regulations.

These standards can be summarized as follows:

- A. Local Development – The Airport lies within the limits of the City of Fort Wayne. In addition, the Braun Ditch crosses airport property and is regulated by the Allen County Drainage Board and the Allen County Surveyors Office. The City of Fort Wayne standards are generally stricter and have been used for this study.
- B. Airfield Development – The Federal Aviation Administration (FAA) regulates the airport drainage and grading through it Advisory Circular 150/5320-5C and 150/5300-13 on Drainage and Design, respectively. The FAA's Chicago Airport District Office ensures that these regulations are followed.
- C. Hydrology Standards – The computer software program, HydroCAD v8.10 was used to determine discharges and detention throughout the watershed. HydroCAD uses the Soil Conservation Service's TR-20 modeling methodology. The City of Fort Wayne – Department of Water Resources – *Development Criteria/Standards Manual* (Standards Manual) provided rainfall data and designated appropriate Huff Distribution's to simulate the rainfall pattern.
- D. Storm Sewer Design – The storm sewers were design in accordance with the Standards Manual criteria. A computer software program, EaglePoint, which uses HEC-22, *Urban Drainage Design Manual* methodology was used to model the proposed storm sewers.

Existing Conditions

Description of Study Area

The airport's 230 acres consist of a terminal building, 7 t-hangars, 3 single hangars

buildings, 2 runways and associated apron and taxiway pavements. Existing impervious areas consist of aviation related runways, taxiways, aprons, hangars and associated facilities. The remaining area consists primarily of grassland and cropland. Residential properties border the airport to the south, southeast and northwest. Commercial and retail development borders the airport on the west and north. Northrop High School bus terminal and athletic facilities border the airport on the east/northeast. Exhibit 2 shows the existing conditions of the Airport.

The 37 acres of land to be acquired is located adjacent to the southeast corner of the existing airport property. This land currently consists of heavily wooded, low density residential dwellings.

The terrain for the existing airport and ultimate airport property is very flat. The soils are primarily Blount Silt Loams, Made Land and Pewamo Silty Clay loams. The Made Land does not currently have a hydrologic rating by NRCS, however, the other two soils are classified as Group C soils. A Group C hydrologic soil type was used on all calculations for this study.

The airport property contains a highpoint at approximately the intersection of the two runways. The portion of the Airport that is along Lima Road drains directly into Braun Ditch which traverses north-south across the west end of the airport property. The remaining west half of the airport drains overland flow into an airport owned storm sewer network that connects to a city owned sewer along Ludwig Road. Ultimately this storm sewer outfalls into Braun Ditch draining to the southwest into the Spy Run Creek.

The eastern half of the Airport drains overland flow into an airport owned storm sewer network that outlets to City owned 24" storm sewer on the east end of the property. This sewer runs through the property to be acquired and connects with an existing 24" sewer that travels south along Ludwig Circle and eventually under Ludwig Road. The sewer ultimately outfalls into Sumner Ditch (A.K.A. Stoney Creek).

There is a small area along Cook Road in the northeast corner of the airport that drains to the north beneath Cook Road. This area ultimately travels east into the St. Joe's River. Exhibit 2 depicts the limits of each of these drainage boundaries.

The Braun Ditch, which runs north-south across the west end of airport property, drains approximately 259 acres of off airport property. This area includes residential and commercial development north and northwest of the Airport. The Northrop High School Campus has an extensive network of storm sewers that ultimately connect to outlets to the north and east along Cook Road and Coldwater Road. However, based on the City's 2' foot topographic map, it appears that the overflow for the High School Campus does traverse to the south and would cross the northeast corner of the property to be acquired.

No floodplains are present on airport property or property to be acquired as shown on the included FEMA FIRM No. 18003C0100F (Exhibit 4). According to the

National Wetlands Inventory (Exhibit 6), there is approximately 5.3 acres of freshwater emergent wetlands near the Braun Ditch on the west side of the airport. The proposed improvements will not disturb these wetlands. There is approximately 10.6 acres of freshwater forested/shrub wetland within the property to be acquired. Prior to this area being disturbed, the Airport plans to conduct an Environmental Assessment. As part of that process, the wetlands will be further studied and mitigation, if required, will be addressed in accordance with local and federal laws.

Overview of Existing Conditions Analysis

Currently the airport has limited stormwater detention in the infield underdrains and has four main outlets in the west, southwest, east and northeast corners of the property. A critical duration analysis of the existing conditions was used to determine the peak runoff and critical storm for each drainage basin. The computed events include 1-hour, 2-hour, 3-hour, 6-hour, 12-hour and 24-hour durations for each of the 2, 5, 10, 25, 50, and 100-year storm events.

The existing conditions hydrologic data map, Exhibit 2, shows the sub-drainage areas and the Existing inlet detention. Appendix 1 has a schematic of the existing conditions model and includes the detailed computation for the existing conditions.

Existing Condition – Input Parameters

Drainage Area	Area (acres)	Runoff Coefficient	Tc (mins)
A-EX	16.8	74	66
B-EX	85.8	83	66
C-EX	133.8	83	96
D-EX	1.0	86	65
E-EX	37.5	74	125

The following table summarizes the results of the critical duration analysis indicating the peak flow and critical duration for each event.

Summary – Critical Duration Analysis

Basin	Area (acre)	10 YR Existing (cfs)	10 year Critical Duration Storm	100 YR Existing (cfs)	100 YR Critical Duration Storm
Basin Z offsite	259.0	85.4	3 Hour Storm	174.8	2 Hour Storm
A-EX onsite	16.8	4.4	3 Hour Storm	10.0	2 Hour Storm
A+Z Total	275.8	80.0	3 Hour Storm	138.9	3 Hour Storm
B-EX	85.8	11.4	6 Hour Storm	13.9	12 Hour Storm
C-EX	133.8	29.8	2 Hour Storm	32.1	1 Hour Storm
D-EX	1.0	0.6	2 Hour Storm	1.1	1 Hour Storm
E-EX	37.5	7.6	12 Hour Storm	16.2	3 Hour Storm

Proposed Conditions

The proposed improvements affect 249 of the 267 acres of the airport's property including the addition of six detention ponds and 37 acres of property to be acquired. The 18 acres on the west end of Airport Property, including the Braun Ditch, will not be disturbed by these improvements. Therefore the off-site flow from the north/northwest will not be affected by this project.

In the summer of 2007, Ivy Tech State College built a training facility along Ludwig Road. This new development constructed the detention required for the added impervious area of this project. Since this area has already been approved by the City and it is at the upstream point of Watershed C-EX, it was not included in the new detention computations analyzed below. However, as individual projects are identified the Airport may elect to utilize or enlarge the existing detention basin.

The proposed site plan meets the City of Fort Wayne detention requirements with construction of 25 acre-feet minimum of new detention ponds storage. The dry bottom detention ponds are sized to store runoff for a fully developed site up to the 100-year storm without exceeding the maximum allowable release rates. The storm sewer system was designed to convey the 10-year event detailed in Exhibit 8.

For the proposed condition hydrology, a map is included in Exhibit 7 showing the drainage areas. Appendix 2 has a proposed condition schematic of the model.

The following table summarizes the proposed condition hydrologic data:

Proposed Condition – Input Parameters

Areas	Area (acres)	Runoff Coefficient	Time of Concentration (mins)
A1-PR	42.3	78	57
B1-PR	19.1	76	71
B2-PR	23.1	80	62
C1-PR	45.0	81	65
C2-PR	23.7	82	64
C3-PR	57.8	86	61
D1-PR	37.1	76	70
E1-PR	18.2	74	42

In order to determine the proposed release rates the airport property can be broken up into developed and undeveloped areas as shown on Exhibit 3.

Area A1-PR from Cook Road to the north and the centerline of the proposed new runway includes all proposed corporate development phase 2 area. Detention basin A1-PR is designed to store the 100-year 24-hour maximum storm runoff from

the entire A1-PR subcatchment and output to the south. New storm sewer networks, sized for the critical 10-year storm, will be constructed to drain impermeable surfaces toward basin A1-PR. Total 100-year output from basin A1-PR will be 6.5 cfs, and flow through a sewer that connects to the existing outfall at the southwest corner of the airport.

Drainage area B1-PR includes the runoff from the west end of the new runway and some runoff from the existing 5/23 runway. Basin B1-PR is designed to store a maximum of 1.7 acre-ft of runoff during a 100-year 24-hour storm event. The peak flow from this basin from to basin A1-PR and is 2.8 cfs.

Area B2-PR includes the proposed west group hangar development area, which consists of hangars and aircraft parking aprons. Runoff from these proposed impervious surfaces will be drained via additional storm sewer networks to detention basin B2-PR. The release rate from this basin is 3.4 cfs and connects to the existing offsite storm sewer to the southwest.

C1-PR encompasses the area northwest of Runway 5/23 including the proposed corporate development phase 1. Construction of a storm sewer network will drain this area up to the 10-year critical storm event and storms greater than the 10-year will flow over the runway into detention basin C1-PR. Flows out of this basin have been restricted to meet design standards and the proposed release rate is 7.8 cfs.

Area C2-PR is the area north of the proposed runway and east of the taxiway between the two existing runways. This area is the proposed east group hangar development draining into basin C2-PR. Initially, construction of additional storm sewer networks will connect to this basin and into the existing storm sewer network. Construction of the proposed runway will require additional storm sewer pipe and basin C2-PR will then connect to this network and flow offsite. The proposed release rate of basin C2-PR is 3.9 cfs.

Drainage area C3-PR is the southeast portion of the existing airport property limits. This area includes the recently constructed Ivy Tech Building and associated sitework, portions of Runway 13/31 and the existing terminal area. This area will be redeveloped as the airport continues to grow, however, with the removal portion of Runway 13/31 and reconfiguration of the terminal area the net change in impervious area will be minimal. No detention is needed for this area until the proposed runway is constructed and then additional storm sewer pipe will connect this area with basin D1-PR. Release rates for this area will be 28.4 cfs until detained at basin D1-PR.

Area D1-PR is currently not owned by the airport and will be acquired to allow future development of the proposed runway. Basin D1-PR will detain and restrict runoff from this area and all flow from the proposed storm sewer network constructed with the east half of the new runway. Proposed release rates from this basin are 16.6 cfs.

Area E1-PR will not be disturbed under the proposed improvements.

Provided Detention and Release Rates

Release Rate Calculations

In order to evaluate conformance to the allowable release rate detailed in the City of Fort Wayne, Department of Water Resources Standards Manual, the following equation was used for the entire project site:

$$\text{Allowable 100-Year Release Rate} = (\text{Developed Area}) \times (0.18 \text{ cfs/acre})$$

The Singular Peak Release Rate was used due to similar FAA stormwater detention requirements.

Detention Pond Summary Table

Detention Basin	Volume Required (acre-feet)	Area Drained (aces)	100-yr Allowed Outflow	100-yr Proposed Outflow
A1-PR	3.7	42.3	7.6 cfs	6.5 cfs
B1-PR	1.7	19.1	3.4 cfs	2.8 cfs
B2-PR	2.7	23.1	4.2 cfs	3.4 cfs
C1-PR	4.6	45.0	8.1 cfs	7.8 cfs
C2-PR	2.8	23.7	4.3 cfs	3.9 cfs
D1-PR	9.5	94.9	17.1 cfs	16.6 cfs

See Exhibit 9 for additional detention pond details.

HydroCAD v8.10 software was utilized to determine the storage volume requirements for each development area. The model schematics, hydrographs and results are shown in Appendix 3. A total of 28.2 acre-feet of storage will be provided in the six detention areas, with 25 acres of detention required for the 100-year 24-hour storm event.

The boundaries for each detention area will be designed in such a manner that in the event that one or more outlets become plugged, water will overtop into the subsequent detention area. General detention grading plans are shown in Exhibit 8. Each detention pond is designed to allow overtopping flows to continue towards the system's outfall points. Additional detention will be possible for all basins except B2-PR and D1-PR. The basins will be designed with 1 foot of freeboard and calculated weir overflow. Appendix 5 details the weir calculations for a typical basin design.

Proposed Storm Sewer Conditions

The storm sewer is designed to convey the 10-year event to the detention pond under gravity condition based on provided rainfall data. The storm sewer's have been sized using on the HEC-22, *Urban Drainage Design Manual*, modeling. Subject to the 10-year event in the detention pond, the storm sewer can convey stormwater without pressure conditions and surcharging the rim elevations. See the proposed storm sewer plan in Exhibit 8 for details on the storm sewer system.

A Manning's n value of 0.011 was used for the storm sewer design. The FAA Advisory Circular 150/5320-5C Table 6-1 was used to determine this value to allow future pipe design to include concrete and HDPE smooth pipes.

The existing and proposed storm sewer inlet grates have been modeled using a Neenah 24" round casting with inlet capacities as detailed in Appendix 5. If differing inlets are preferred during design the peak flows will not be increased. Actual inlets for construction will depend on location and application.

The proposed stormwater management system will be constructed concurrently with proposed grading operations and will be operational prior to the construction of any impervious areas. Detailed calculations for the storm sewer networks are included in Appendix 4.

The existing downstream storm sewer network from the airport was reviewed to determine if enough capacity was available for the proposed flows. Since the peak flows have been reduced at all outfalls from the airport, no additional capacity issues are expected. The proposed peak flows are based on the ultimate developed conditions and maximum 100-year storm peak flows.

	Existing Peak Flow (cfs)	Proposed Peak Flow (cfs)
Onsite A-EX Outfall	10.0	7.0
B-EX Outfall	13.9	12.6
C-EX Outfall	32.1	17.1
D-EX Outfall	1.1	minimal
E-EX Outfall	16.2	*

Watersheds A-EX and D-EX have minimal flows with sufficient capacity present in the existing system. Watershed B-EX connects to City of Fort Wayne's storm sewer network and connects to a main trunk line under Lima Road. The downstream system under Lima Road has been evaluated for improvement under an INDOT project.. Watershed C-EX and E-EX will connect in the proposed conditions and connect to the City's storm sewer networks to the east of the airport. The capacity of these lines has been modeled to show no increased peak flows due to the airport's developments.

Future Coordination

As the Airport proceeds with its proposed improvements, further coordination with the City of Fort Wayne, Allen County Drainage Board and other agencies will be required. In an effort to streamline the stormwater/detention review for the improvements outlined in this study, the Airport proposes to develop a summary spreadsheet of new detention and impervious area for each sub-area. A sample of the proposed spreadsheet is included as Exhibit 11.

Provided the system is in general conformance with this study a detailed drainage study should not be required. If items differ from this study they should be identified in the submittal to the City. In lieu of submitting a detailed drainage study for each project, the Airport will submit drainage and detention calculations for each project and update the summary spreadsheet which depicts the amount of new impervious area and the amount of existing and new detention created by the project. In addition detailed construction drawings would be submitted showing the storm sewer system and detention basins. Additional environmental concerns, such as wetland mitigation, will be handled on a project by project basis.

Soil Erosion and Sediment Control

Soil erosion and sediment control measures as per the City of Fort Wayne, Department of Water Resources Standards Manual include silt fencing, filter fabric inlet protection, and rip rap. The contractor shall be responsible for maintaining soil erosion and sediment control items. This includes inspecting straw bales, silt fence and inlet protection after every storm event or once per week whichever is greater.

As required by the Indiana Department of Environmental Management, a Storm Water Pollution Prevention Plan will be submitted to the State and the City of Fort Wayne Water Resources Department for each project disturbing over 1 acres prior to construction.

Additionally, the following general sequence of activities will be performed during construction.

- Install silt fencing.
- Construction entrances shall be constructed prior to site clearing or excavation.
- Offsite roads shall be swept continuously until cleared.
- Temporary seeding of graded area when final restoration is not imminent.
- Storm sewer protection shall be installed as the construction of the storm sewer progresses.
- Stockpiles remaining longer than 14 days shall be temporarily seeded.
- Permanent seeding shall be performed and allowed to reach stabilization before removal of erosion control measures.
- Inlet protection shall be removed once 95% vegetation has occurred.