



# Final Drainage Report

New Horizon Academy

“Subject Development”

Parker, Colorado

NHOAC 156217 | August 26, 2020



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New Horizon Academy  
"Subject Development"  
Parker, Colorado

SEH No. NHOAC 156217

August 26, 2020

Owner:

**New Horizon Academy**  
3405 Annapolis Lane N., Suite 100  
Plymouth, MN 55447

Applicant/Developer:

**Patriot Construction Services**  
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Engineer:

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Duluth, MN 558802



### Engineer's Certification

I hereby certify that this Final Drainage Report for the design of New Horizon Academy was prepared by me (or under my direct supervision) in accordance with the provisions of the *Town of Parker Storm Drainage and Environmental Criteria Manual* for the owners thereof. I understand that the Town of Parker does not and will not assume liability for drainage facilities designed by others, including the designs presented in this report.

(Name)  
Registered Professional Engineer  
State of Colorado No. (#)



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# Final Drainage Report

## New Horizon Academy

Prepared for New Horizon Academy

## 1 General Location and Description

### 1.1 Name and Location of Project

The New Horizon Academy development project is located in the Southwest Quarter of Section 29, Township 6 South, Range 66 West of the 6<sup>th</sup> Principal Meridian, within the Town of Parker, County of Douglas, Colorado.

The project site is also known as Lot 11 of Chambers and Hess Filing No. 1 Development. The site is 1.518 acres in area. “Subject Development” is located entirely within the Chambers and Hess Filing No. 1 development.

Bordering the “Subject Development” development to the north is South Red Sky Drive, a residential local street, and to the west is Sliceroo Drive. East of “Subject Development” is Block 12 of Douglas 234, Filing No. 1, 1<sup>st</sup> Amendment. Please refer to Figure 1 below for a vicinity map.



Figure 1 Vicinity Map (ESRI ArcGIS)

## 1.2 Description of Property

“Subject Development is within the Cherry Creek watershed. Cherry Creek is located about 1.75 miles east of Chambers and Hess Filing No. 1.

A National Resources Conservation Service (NRCS) soils map is in the Appendix. Two distinct soil types are encountered within “Subject Development”. Newlin-Satanta (NsE) complex, Hydrologic Soil Group B, described as gravelly sandy clay loam. Renohill-Buick (RmE) complex, Hydrologic Soil Group D, described as clay loam.

Lott 11 contains 1.518 acres of undeveloped but recently disturbed land. The existing ground cover mostly consists of short grass prairie. The site generally slopes from west to east with grades varying between 1% and 33%. The entire site will be disturbed as part of this project and will result in 0.85 acres of new impervious surface.

There are numerous drainage, utility, public access, and access easements within and adjacent to the property. See Appendix A for a site plan sheet detailing the location of these easements.

The New Horizon Academy project will provide a new daycare center to the Vista Ridge Development. The project will consist of the following work:

- Remove unsuitable soils from under the building and pavement areas
- Grading operations across the entire site
- Asphalt parking lot and access road, curb and gutter, and storm sewer construction
- Slab on grade building construction
- Playground construction
- Topsoil and seed all disturbed areas

## 2 Drainage Basins and Sub-Basins

### 2.1 Major Drainage Basins

Major Drainage Basins were described in the Preliminary Drainage Report dated May 5, 2020 by Rick Engineering Company as follows:

“Chambers and Hess Filing No. 1 is located within two major drainage basins, Cherry Creek and Oak Gulch. Oak Gulch is tributary to Cherry Creek.

Chambers and Hess Filing No. 1 is approximately 2 miles upstream of Cherry Creek. The most recent Flood Hazard Area Delineation for Cherry Creek in 2003 by URS did not include Chambers and Hess Filing No. 1 in the report.

Oak Gulch was studied as part of the “Oak Gulch and Lemon Gulch Flood Hazard Area Delineation” (Reference 4). Chambers and Hess Filing No. 1 is part of sub-basin 109.

Chambers and Hess Filing No.1 is in FEMA Zone X, an area of minimal flood hazard. A FEMA LOMR will not be required.

The Chambers and Hess Filing No. 1 site was originally studied as part of the Parker 234 Subdivision Final Drainage Report (Reference 3). The report identified that the site is part of the Cherry Creek watershed and Oak Gulch watershed. The report assigned historic drainage basin

C-3 (area tributary to Cherry Creek) and historic drainage basin D-3 (area tributary to Oak Gulch).”

## 2.2 Minor Drainage Basins

Minor Drainage Basins were described in the Preliminary Drainage Report dated May 5, 2020 by Rick Engineering Company as follows:

“Referring to the Historic Drainage Map in Appendix C, the basin designations were adopted from the Parker 234 Final Drainage Report to maintain clarity and continuity.

Historic Basins C1, C2, C3 and C4, tributary to Cherry Creek, drain from west to east. Basin C1 drains to an existing area inlet that was constructed as part of the Parker 234 subdivision improvements. The runoff then travels north and east via storm sewer to existing detention Pond “A”. Basin C2 drains from west to east, ultimately through the residential lots on Block 2 of Douglas 234 Filing No. 1, eventually to the existing Red Sky Drive, then to existing pond “A”. Basin C3 drains from west to east through the residential lots on Block 2 of Douglas 234 Filing No. 1, eventually to existing Detention Pond “A”. Detained runoff from Pond “A” is conveyed under Jordan Road to the east, to an unnamed drainage way that ultimately connects to Cherry Creek. Basin C4 drains to the north to Red Sky Drive, then to the east and ultimately captured by existing storm sewer and routed to Pond “A”.

Historic Basins D1 and D2, tributary to Oak Gulch, drain to the west and south to existing South Chambers Road and Hess Road. Runoff from Historic Basins D1 and D2 travels south on Chambers Road, then east on Hess Road, to Pond F (Reference 5). Runoff from Pond F is conveyed south, under Hess Road to Oak Gulch.

There is no offsite runoff that flows onto Chambers and Hess Filing No. 1.”

The Preliminary Drainage Report also included a post-development drainage map, included in Appendix C, dividing the site into further sub-basins. The “Subject Development” site is located almost entirely within sub-basin A12 which drains to an area drain in the south east corner of the lot and constructed as part of Chambers & Hess Filing No. 1.

There was no additional offsite runoff that flows on sub-basin A12. Drainage Design Criteria

## 3 Drainage Design Criteria

### 3.1 Regulations

#### 3.1.1 Design Standards

The Town of Parker Storm Drainage and Environmental Criteria Manual was used for site design on this project.

#### 3.1.2 Flood Plains

“Subject Development” is not located within a regulated flood plain, therefore, “Subject Development” is in compliance with the Town of Parker’s floodplain ordinance.

### 3.1.3 Town's Stream Preservation Standards

"Subject Development" is not located within the Town of Parker Stream Preservation Area. However, the Preliminary Drainage Report states that the project "will implement BMP measures to ensure that no adverse impact to water quality due to land disturbances. There are no Minor or Major Modifications requested. There are no planned improvements that would be eligible for Mile High Flood District's maintenance eligibility."

### 3.1.4 Development Criteria and Constraints

The Preliminary Drainage Report for Chambers and Hess Filing No. 1 states the following criteria were considered:

"Chambers and Hess Filing No. 1 will comply with the drainage improvements outlined in the Final Drainage Report for the Parker 234 Subdivision. The report assigned the area of Chambers and Hess Filing No. 1 as future commercial development, 95% impervious. Chambers and Hess Filing No. 1 is using 75% impervious for the commercial lots, according to Mile High Flood District Table 6-3 (see Appendix) Business: Suburban Area. The proposed impervious is 73%. By reducing the impervious area, there will be no adverse impact to the downstream drainage conveyance elements, including the existing storm sewer and existing detention Pond "A".

Following design of "Subject Development" a more accurate percent impervious was determined to be 76% using 90% for roofs and drives and 25% for playgrounds. This impervious is slightly higher than was considered for Chambers and Hess Filing No. 1 but below what the downstream drainage conveyance systems were sized for in Parker 234 Subdivision.

### 3.1.5 Hydrology Criteria

The minor storm is in the 5 year recurrence interval. The major storm is the 100 year recurrence interval.

The site is 1.52 acres. The Rational Method is the method used to determine runoff rates for the minor and major storm. Rational method runoff coefficients are based on the NRCS Hydrologic Soil Ratings. The predominant soil type (73%), Newlin-Satanta, has Hydrologic Soil Group Rating as Type "B". The remaining 27% of the site has a Type D rated soil. The Type D rated soil is confined to the northwest corner of the site, entirely within the ST-3 sub-area, therefore the Rational Method Runoff Coefficients were calculated assuming Type B for all other sub-areas and Type D for ST-3.

There are no detention facilities proposed for "Subject Development". Existing detention pond "A" will receive developed runoff from "Subject Development", as designated in the Final Drainage Report for the Parker 234 Subdivision.

### 3.1.6 Hydraulic Criteria

Inlet capacities for the parking lot and swale were calculated using UD-Inlet Version 4.06. The minor storm flow depth is limited to no overtopping. Minor storm runoff can spread to the end of the parking stall (18' from the curb line). The major storm flow depth was checked using the same constraints. Appendix B contains inlet capacity calculations.

Hydraulic grade lines are calculated using Bentley StormCAD software. The hydraulic grade line for the minor storm must be located below the crown of the pipe. The hydraulic grade line for the major storm must be located at least 12" below finished grade as a maximum condition.

### 3.1.7 Variance from Criteria

There are no variances from criteria being sought.

## 4 Drainage Facility Design

### 4.1 General Concept

#### 4.1.1 5' Type R Inlet

Two inlets will be installed within the proposed parking area to intercept all flows from the new impervious surface. A detailed analysis of each inlet's capacity utilizing UD-Inlet Version 4.06 is attached in Appendix B.

#### 4.1.2 Type C Inlet

One inlet was previously constructed in the southeast corner of the site and will be utilized to capture overland flow from the playground. A detailed analysis of this inlet capacity is attached in Appendix B

#### 4.1.3 Roof Drains

Four downspouts will collect the water from the roof of the structure and convey it underground through 6" PVC pipe to connections on the inlets as shown on the plans. The 5-year storm event will produce a flow from the roof of 0.27 cfs per downspout and the pipe capacity is at least 0.55 cfs.

#### 4.1.4 Site Storm Pipe

All storm pipe on the site is 18" RCP per the Town standards.

#### 4.1.5 Overland Flow

Site drainage east of the proposed building within the playground area will sheet flow to the existing Type C inlet either overland or through a small swale along the east property line. This overland flow will be limited to 200' and will have a maximum slope of 2.00% prior to reaching the edge of the playground and from there breaking to a 3:1 slope. No channelization or stream flow is anticipated to occur with this storm water.

#### 4.1.6 Swale Flow

Site drainage along the east property line will be collected into a small swale and conveyed to the existing private detention pond. The swale will have a 1.5% slope and will require an underdrain. See Appendix B for swale design calculations utilizing UD-BMP Version 3.07.

## 4.2 Specific Details

### 4.2.1 Detention Storage Required for Full-Spectrum Detention

The Preliminary Drainage Report includes the following discussion regarding on-site detention for Chambers and Hess Filing No. 1, of which the “Subject Development” is fully included in.

“the property was included in the tributary area to the existing detention Pond “A”, about 1200 feet east of Chambers and Hess Filing No. 1. The appendices contain original design calculations for Pond “A”. When Pond “A” was designed, the Chambers and Hess Filing No. 1 property was assigned a percent impervious of 95%. The proposed site impervious for Chambers and Hess Filing No. 1 is 69%. There is no additional drainage area tributary to Pond “A”. Therefore, the detention volume requirements for Pond “A” are not adversely impacted by a developed Chambers and Hess Filing No. 1 property because the pond will receive more pervious drainage area than originally designed.”

As previously discussed the actual site impervious for “Subject Development” is actually 76%, however it is still below the assigned percent impervious of 95%.

### 4.2.2 Storm Sewer Configuration

Currently a Type C inlet has been constructed in the southeast corner of Lot 11 to collect overland flows from the preliminary site grading. This structure is connected through an 18” RCP at a grade of 8.78% to an inlet to the south and from there discharges to Pond “A” through further conveyance pipes. The inlet will have an 18” RCP pipe connected to the west side which will run into manhole ST-2 in the parking lot. An 18” RCP will run north and south from the manhole to connect to the two parking lot inlets (ST-1 and ST-3). The south side roof drain pipes will also connect to this manhole. The north side roof drain pipes will connect to inlet ST-3. See Appendix A for the storm sewer site plans.

The Manning’s pipe flow equation was used to check the full flow capacity of the pipe. The maximum discharge of an 18” RCP at an 8.78% slope was 30.4 cfs, much greater than the 8.81 cfs major storm discharge from this project. The design calculations for this pipe assumed a flow of 9.0 cfs as shown in Appendix C, which is greater than the major storm discharge from this project. All other pipes have at least 4.8 cfs of excess capacity above the major storm discharge.

StormCAD was used to model this pipe network for both 5- and 100-year storm events and the results are attached as Appendix B. The model showed that the hydraulic grade line remains within the pipe throughout the network and did not have any hydraulic jumps at structures.

### 4.2.3 Channel Design and Soil Erodibility Within Channel

There is only one minor drainage grass lined swale proposed for “Subject Development”. The calculations for this swale is in the appendix. The relatively low developed runoff conveyed by this swale yields velocities less than 1.0 feet per second, resulting in stable grass swales that do not require grade drops or armoring. The swale slope is less than 2.0% so pipe underdrain is included in the design.

## 5 Environmental Protection Criteria

### 5.1 General

There are no wetlands located in “Subject Development”. There are no “Water of the U.S.” located in “Subject Development”.

### 5.2 Construction BMP Plan

Construction BMP’s will be implemented in a three phase schedule, initial, interim, and final stabilization.

The initial phase will install construction fencing, perimeter construction BMP’s like Silt Fencing and Sediment Control Logs. Vehicle tracking control to reduce the tracking of soils into the surrounding public streets and subdivision. Inlet Protection will be installed at the existing Type C storm drain inlet in the southeast corner of the site to prevent sediments from entering the existing storm drain systems.

The interim phase will have the erosion and sediment controls associated with ongoing construction and grading operations. As grading operations bring the ground to finished grade elevations, trenching for proposed utilities, and rough street cuts prior to paving, BMP’s like rock socks are installed to reduce stormwater runoff to non erosive velocities.

The final phase is where the site is to be stabilized by revegetating disturbed areas, installing erosion control blankets or similar on steeper grades.

### 5.3 Permanent BMP Plan

The permanent BMPs are described as follows in the Preliminary Drainage Report for Chambers and Hess Filing No. 1, of which the “Subject Development” is fully a part of:

“Chambers and Hess Filing No. 1 will utilize a regional Permanent BMP by discharging developed runoff to existing Pond “A”. Pond “A” acts as the Water Quality Enhancement BMP for Chambers and Hess Filing No. 1.”

## 6 Summary

### 6.1 Compliance with Standards

The proposed drainage designs presented in this report effectively maintain existing drainage patterns for the proposed condition and follow the intent of the Preliminary Drainage Report within the proposed building site. The existing and proposed drainage elements have been sized to convey the 100-year peak runoff event in accordance with the Town of Parker criteria. All drainage features designed in support of the proposed New Horizon Academy improvements fully meet the Town of Parker design criteria requirements as described in the Town of Parker’s Storm Drainage and Environmental Criteria Manual by utilizing the design methods and requirements outlined in the SDECM.

### 6.2 Drainage Concept

The drainage design for “Subject Development” effectively controls developed runoff by constructing storm sewer and storm drain inlets that convey developed runoff to the existing

storm water infrastructure previously constructed as part of Chambers and Hess Filing No. 1. By reducing the impervious area from the original drainage concept this development ensures that there are no adverse downstream impacts to the existing storm drainage infrastructure within the Parker 234 subdivision.

## 7 References

*Preliminary Drainage Report for Chambers and Hess Filing No. 1* dated May 5, 2020. Rick Engineering Company

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