

**SANITARY SEWER FEASIBILITY
NARRATIVE**

**THE WHEELER FIELD
AT
ARDROSSAN FARM**

**SUBMITTED AS PART OF
THE CONDITIONAL USE APPLICATION
FOR DENSITY MODIFICATION DEVELOPMENT**

BY:

**MOMENEE AND ASSOCIATES INC.
924 COUNTY LINE ROAD
BRYN MAWR, PA 19010**

JULY 31, 2013

PROJECT SEWAGE FLOWS
THE WHEELER FIELD AT ARDROSSAN FARM

The Ardrossan Family Trusts own the land known as the Ardrossan Farm in Radnor Township. The total tract, located at Newtown and Darby-Paoli Roads, contains 352.5 acres and is composed of several individual parcels. Parcels 'B' and "E" known as the Wheeler Field and the School House Lot contain a combined area of 27.65 acres and are located on the west side of Darby-Paoli Road extending along Darby-Paoli Road between Saw Mill Road and Godfrey Road. These parcels collectively termed the Wheeler Field at Ardrossan Farm are the subject of this report. The trust proposes to develop the site in accordance with Radnor Township's Density Modification provisions of the zoning ordinance which permits cluster development with the provision of open space areas.

The site currently contains an old dwelling and a few farm buildings. The site borders Darby Creek and a majority of the site is open floodplain meadow. There is an area of higher ground outside the floodplain bordering Darby-Paoli Road containing meadow areas and areas of steep slopes. Under the Density Modification concept, the uplands portion of the site will be developed with approximately 5 new single family dwellings on 6 new individual residential building lots. The existing dwelling will as part of the 6th lot.

An existing sanitary sewer trunk line extends along Darby Creek traversing the adjacent Trust parcels located between Darby Creek and Darby-Paoli Road. It is proposed to extend a collector line from an existing manhole on the interceptor line to provide service to the new lots.

Aqua Pennsylvania currently owns and maintains a water main in Darby-Paoli Road that terminates south of the site at Lawrence Lane. This line will be extended to serve the new lots.

ESTIMATED SEWER FLOWS ACCORDING TO SEWER AUTHORITY STANDARDS:

Total Residential Units	6 EDU's
Estimated Flows/Unit	262.5 GPD
Total Estimated Flows	1,575 GPD

It is proposed to convey sewage flows to the existing Darby Creek Interceptor. This system conveys flows through lines operated by Radnor Township, the Radnor-Haverford-Marple Sewer Authority, Springfield Township, the Darby Creek Joint Authority and the Delaware County Regional Authority before final treatment by the City of Philadelphia. These authorities were contacted to determine if sufficient capacity exists within their facilities to handle the additional flows. DELCORA responded that

capacity exists at their Darby Creek Pump Station to serve the additional flows and the Radnor-Haverford-Marple Sewer Authority responded that they currently have the capacity available but noted that the member townships needed to approve the flow allocation.

In discussions with the Radnor Township Public Works Department they noted that they had witnessed accumulation of grit within portions of the Darby-Creek Interceptor within the portion of the Ardrossan Lands south of Saw Mill Road where the size of the pipe changes as it flows downstream.

It was uncertain the grit accumulation was causing diminished capacity in this portion of the line and the township noted that further investigation was needed. As part of our review, we obtained copies of the original design plans for the Darby-Creek Interceptor to review pipe sizes and slopes to determine the approximate capacity of the line. Per the design plans, each manhole is assigned a number which increases as the line moves upstream following the path of Darby Creek. Manhole #47 is located at the southern portion of the tract. The interceptor line is 20" in diameter at this location. Upstream of this location the size of the interceptor decreases to 16" at manhole #54 which is located on the north side of the Saw Mill Road Bridge over Darby Creek. The township has noted the accumulation of grit within the five or so pipe runs downstream of Manhole #54. The connection point proposed for the new extension is manhole 48 which is beyond the noted sediment accumulation area.

In an effort to review the capacity of the existing interceptor, preliminary review of full flow capacity was performed using the Manning Equation. Based on the shallowest pipe slope of the 16' pipe downstream of manhole #57, it was calculated that the full flow capacity of this 20" line is 1.80 million gallons per day (MGD). The proposed total flow from the optional development scenario of 1,575 GPD 0.0016 MGD represents less than 0.1% of the total capacity of this line.

Capacity calculations are attached as part of this narrative.



Aqua Pennsylvania, Inc.
762 W. Lancaster Avenue
Bryn Mawr, PA 19010

www.aquapennsylvania.com

February 4, 2008

David R. Fiorello, P.E.
Momenee & Associates, Inc.
924 County Line Road
Bryn Mawr, PA 19010

Re: Water Availability
Ardrossan Farm
Radnor Township, Delaware County, Pennsylvania

Dear Mr. Fiorello:

This letter will serve as confirmation that the above referenced project is situated within Aqua Pennsylvania, Inc.'s service territory. Service would be provided in accordance with Aqua Pennsylvania Inc.'s Rules and Regulations.

Service to this project will require a main extension. Main extension projects are completed under a Builder's Extension Agreement. Under this agreement, the Builder is responsible for installing the main extension, including fire hydrants and service connections, with a pre-qualified contractor that he or she hires. In addition, the Builder is required to have his or her engineer prepare main extension plans in accordance with Aqua Pennsylvania, Inc. plan specifications and submit these plans to Aqua Pennsylvania, Inc. for review and approval. To proceed with this project please forward a full set of land development and main extension plans to my attention.

Once all of the requirements have been met and the main extension plans have been approved the builder will be able to enter into a Builder's Extension Agreement. Please refer to the New Business Package on disk enclosed for the specific requirements.

Flow data information for this area, if required, can be obtained upon written request to Lisa Thomas-Oliva of our Production Department so that you may determine the adequacy of our supply for your project's needs. If you have specific questions related to flow test requests, you may reach Mrs. Oliva at (610) 645-1034.

If you require further information, please contact me at (610) 645-4230.

Sincerely,

Gary J. Horne
New Business Representative



DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
P.O. Box 999 • Chester, PA 19016-0999

May 3, 2013

Mr. David Fiorella, P.E.
Momenee and Associates, Inc.
924 County Line Road
Bryn Mawr, PA 19010

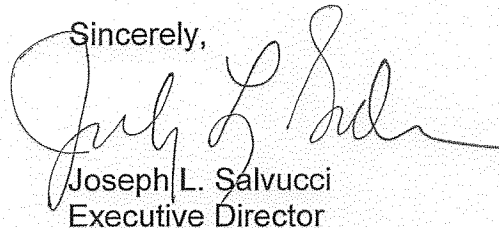
RE: Sewer Availability – Ardrossan Farm
Radnor Township

Dear Mr. Fiorella:

Per your request to verify sewer service, DELCORA has capacity at its Darby Creek Pump Station to serve the 102 proposed houses in the Ardrossan Farm development. Please also note that this letter does not serve as formal approval in the PaDEP Sewage Facilities Planning Module process. Please contact Christine Volkay-Hilditch, P.E., Director of Engineering at 610-876-5523, extension 116, if you have any questions.

Thank you for your attention.

Sincerely,



Joseph L. Salvucci
Executive Director

JLS:smf

cc: File

ADMINISTRATION

610-876-5523

FAX: 610-876-2728

CUSTOMER SERVICE/BILLING

610-876-5526

FAX: 610-876-1460

PURCHASING & STORES

610-876-5523

FAX: 610-497-7959

PLANT & MAINTENANCE

610-876-5523

FAX: 610-497-7950



RADNOR • HAVERFORD • MARPLE

SEWER AUTHORITY

600 GLENDALE ROAD • HAVERTOWN, PA 19083

(610) 446-0867

FAX (610) 446-4926

Mr. David R. Fiorello, P.E.
Momenee and Associates
924 County Line Road
Bryn Mawr, Pa. 19010

05/24/2013

RE: Sewer Availability - Ardrossan Farm
Radnor Township, Delaware County

File #16-012

Dear Mr. Fiorello:

In response to your April 22, 2013 letter to the Radnor Haverford Marple Sewer Authority (RHM) for flow capacity, within the RHM pipeline, for a feasibility study of your project. RHM currently has the capacity available for allocation within its service area. The Board will take no action on requested flow until its member Townships up stream (depending on the flow path, it may be more than one Township) approve flow allocation to the project first before it is sent to RHM for flow allocation, then it has to be approved by all entities downstream to the Philadelphia Treatment Plant before connecting to the system.

If I can provide any further clarification to you with regards to the above information, Please do not hesitate to telephone me at 610-446-0867.

Very truly yours,
RHM Sewer Authority

David E. Adams, Manager

DATE _____
NAME OF CLIENT _____
PROJECT _____
SUBJECT _____

SHEET 1 OF _____
COMPUTED BY _____
CHECKED BY _____

DARBY CREEK INTERCEPTOR
PIPE SIZE CHANGE AT MW # 54
(W. SIDE STRUWILL ROAD BRIDGE)
FROM PLANS OF DARBY CREEK & LITTLE DARBY CREEK
INTERCEPTOR SEWER DATED 11/21/1952 REV 1/29/57

Approach Line

16" ~~Asbestos~~ Cement pipe @ $n = 0.035$

Capacity: (full flow)

$$\frac{1.486}{n} A R^{2/3} S^{1/2}$$

$n = 0.011$ minimum 0.013 Normal 0.015 maximum

$$A = 16" \text{ pipe} = 1.396 \text{ SF}$$

$$\text{Wetted Perimeter (WP)} = \text{circumference} = 4.189$$

$$R = A/WP = 1.396/4.189 = 0.3333$$

$$R^{2/3} = 0.481$$

$$S = 0.035 \quad S^{1/2} = 0.187$$

$$Q = \frac{1.486}{0.035} \times 1.396 \times 0.481 \times 0.187$$

DATE _____
NAME OF CLIENT _____
PROJECT _____
SUBJECT _____

SHEET 2 OF _____
COMPUTED BY _____
CHECKED BY _____

$$Q = 14.35 \text{ CFS}$$

$$1 \text{ CFS} = 0.646 \text{ MGD}$$

$$14.35 \text{ CFS} = 9.27 \text{ MGD}$$

Assume peak flow = 2.5 x Average flow

$$\text{Average flow capacity} = 3.71 \text{ MGD}$$

Discharge Line

$$20'' \text{ ~~ABS~~ Cement @ GR} = 0.0032$$

$$\text{full flow capacity} = \frac{1.486}{n} \times R^{2/3} S^{1/2}$$

$$n \text{ use } 0.013 \text{ normal}$$

$$A = 20'' \text{ pipe} = 2.181 \text{ SF}$$

$$\text{wp} = \text{circumference} = 5.236$$

$$R = A/\text{wp} = 2.181/5.236 = 0.4165$$

$$R^{2/3} = 0.5577$$

$$S = 0.0032 \quad S^{1/2} = 0.0566$$

$$Q = \frac{1.486}{0.013} \times 2.181 \times 0.5577 \times 0.0566$$

$$Q = 7.87 \text{ CFS}$$

DATE _____
NAME OF CLIENT _____
PROJECT _____
SUBJECT _____

SHEET 3 OF _____
COMPUTED BY _____
CHECKED BY _____

$$Q_{full} = 7.87 \text{ CFS}$$

$$1 \text{ CFS} = 0.646 \text{ MGD}$$

$$\therefore \text{Full flow capacity} = 5.084 \text{ MGD}$$

$$\text{Assume peak flow} = 2.5 \times \text{Ave flow}$$

$$\therefore \text{Ave flow} = 2.03 \text{ MGD}$$

Downstream pipe sections:

$$\text{shallowest slope} = 0.0025$$

$$S = 0.0025 \quad S^{1/2} = 0.05$$

$$Q = \frac{1.486}{0.013} \times 2.181 \times 0.5577 \times 0.05$$

$$Q = 6.95 \text{ CFS}$$

$$1 \text{ CFS} = 0.646 \text{ MGD}$$

$$\therefore \text{Full flow capacity} = 4.49 \text{ MGD}$$

$$\text{Assume peak flow} = 2.5 \times \text{Ave flow}$$

$$\therefore \text{Ave flow} = 1.80 \text{ MGD}$$

DATE _____
NAME OF CLIENT _____
PROJECT _____
SUBJECT _____

SHEET 4 OF _____
COMPUTED BY _____
CHECKED BY _____

Reverse Pipe Velocities @ MH # 31

Inflow pipe:

16" Asbestos cement pipe @ 0.035

$$\text{Velocity} = Q/A$$

$$Q_{\text{full}} (\text{cfs}) = 14.35 \text{ cfs}$$

$$A = 1.396 \text{ ft}^2$$

$$\therefore V = 14.35 / 1.396 = 10.28 \text{ FPS}$$

Outflow pipe:

20" Asbestos cement pipe @ 0.0032

$$\text{Velocity} = Q/A$$

$$Q_{\text{full}} (\text{cfs}) = 7.87 \text{ cfs}$$

$$A = 2.181$$

$$V = 7.87 / 2.181 = 3.61 \text{ FPS}$$

DATE _____
NAME OF CLIENT _____
PROJECT _____
SUBJECT _____

SHEET 5 OF _____
COMPUTED BY _____
CHECKED BY _____

Pipe Capacity at MH 57

16" Asbestos Cement Pipe (MIO grade) 0.0075

full flow capacity

$$\frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$n = 0.13$$

$$A = 1.396$$

$$R^{2/3} = 0.481$$

$$S = 0.0075$$

$$S^{1/2} = 0.0866$$

$$Q = \frac{1.486}{0.13} \times 1.396 \times 0.481 \times 0.0866 = 6.65 \text{ CFS}$$

$$1 \text{ CFS} = 1.48 \text{ MGD}$$

$$6.65 \text{ CFS} = 4.29 \text{ MGD peak}$$

Assume peak flow = 2.5 x average flow

$$\therefore \text{Ave flow} = 1.71 \text{ MGD}$$