ENVISION
CONSULTANTS LTD

6415 NORTHWEST DRIVE
UNITS 37-40
MISSISSAUGA, ON L4V 1X1

December 18, 2024

Project #: 22-0223

2695867 Ontario Inc.
71 Shannon Street
Toronto, Ontario M6J 2E6

Sent via email: john@jandjdevelopments.ca

Attention: John Cooper

SUBJECT: ON-SITE SEWAGE SYSTEM SIZING STUDY – UDORA DEVELOPMENT

EnVision Consultants Ltd. (EnVision) was retained by 2695867 Ontario Inc. (the 'Client') to conduct a sewage system sizing study in accordance with the applicable regulations and guidelines of the Ontario Building Code (2012), and the Regional Municipality of Durham, to support the proposed 7-lot residential development on Part of Lots 34 and 35, Concession 6, Udora, Ontario (the 'Site'), see *Figure 1*.

It is understood that the requisite D-5-4 and D-5-5 studies for on-site sewage and water supply systems has been completed by others. The scope of this letter report is to determine if the proposed development lot fabric can support private sewage (septic) systems, drinking water wells, and building envelopes as per the Durham Region Lot Sizing Policy (*Drilled Wells and Lot Sizing Policies as Applied to Consents (Severances) and Draft Plans of Subdivision, 2010).*

As the Durham Region Lot Sizing Policy uses conceptual sewage flows, over ranges of soil percolation rates, it does not necessarily reflect the expected sewage system sizes for the planned subdivision dwellings. To better understand the actual sizing of the sewage system infrastructure at the site, and to explore the possibility for reduced leaching bed areas through alternative servicing methodologies; specifically advanced (Level IV) sewage treatment a detailed sewage servicing assessment has also been completed.

DESCRIPTION OF THE SITE

The Site is located in Durham Region, approximately 150 m southwest of the intersection of Durham Road 1 and Ravenshoe Road, in the community of Udora. The southern portion of the development lands connect with the northern extent of Birdie Smith Court. The legal description of the lands is Part of Lots 34 and 35, Concession 6, Udora, Ontario. In the recent past the site has remained vacant. The area immediately surrounding the site generally consists of rural residential properties, with extensive agricultural uses further to the east and south.

The proposed residential development, excluding roadway areas, is approximately 1.7 hectares (4.2 acres), while the average lot size for the proposed development is 0.21 ha, although lot sizes will vary. The plan also includes a 0.25 ha stormwater management block. It is understood that the dwellings will vary in size from 3 to 4 bedrooms, approximately 200 m^2 to 325 m^2 in floor area, with 3 to 4 bathrooms. Municipal services are not available at the site; therefore, the site will be serviced via private water supply and private on-site sewage system.

Based on the literature reviewed, and EnVision's knowledge of the study area, the site lies within the Peterborough Drumlin Field physiographic region as described by the Ontario Geological Survey (*Chapman and Putnam, 1984*). The Peterborough Drumlin Field is characterized by a rolling till plain containing approximately 3,000 drumlins, generally oriented in a northeast to southwest manner. Available mapping notes the nearest drumlin to be approximately 250 m southeast of the site.

The literature and mapping review describes the local surficial geology as sandy silt to silty sand till. Observations made from previous site investigations, completed by WSP Canada Inc., are consistent with the literature review as detailed later in this letter report.

The site is underlain by sedimentary bedrock belonging to the Lindsay Formation, which is primarily characterized by fine to coarse grained limestone. Drift thickness at the site is expected to be approximately 30 to 40 m in extent.

SITE INVESTIGATIONS

Historic field investigations were completed by WSP Canada Inc. as detailed in the *D-5-4 Assessment and Preliminary Water Balance Study (2018).* The historic site investigation work was completed in 2016 and 2017 and included the advancement of a total of four (4) boreholes and ten (10) test pits across the site. The shallow soils at the site generally consisted of a layer of topsoil followed by a deposit of sandy silt to silty sand till with trace clay and gravel, although in some areas a layer of sand fill was observed up to depths of 1.5 m below ground level (bgl).

WSP also completed additional soil investigations in 2019, advancing an additional ten (10) test pits to a depth of 2 m across the site. Ten (10) shallow soil samples were analyzed by WSP for particle size distribution, the results indicated that in seven (7) of the test pits, the soil percolation rate was 25 min/cm, one (1) test pit had a reported percolation rate of 45 min/cm while in one (1) test pit the percolation rate was reported as 15 min/cm and one (1) test pit reported as 10 min/cm. The particle size distribution curves have been attached to this report.

Based on the historic results EnVision has used a percolation rate of 25 min/cm this as the basis for our sewage system sizing assessment that follows.

DURHAM REGION LOT SIZING POLICY

To demonstrate that the proposed lot fabric of the subdivision (7 lots) will be capable of supporting single family dwellings with on-site sewage disposal systems, a conceptual layout has been completed. This conceptual plan assists in demonstrating that each lot on the property could be serviced in the future with an on-site sewage disposal system and a drinking water well. The conceptual layout has been provided as ***Figure 2*** which has been

completed in accordance with the Durham Region planning document titled *Drilled Wells and Lot Sizing Policies as Applied to Consents (Severances) and Draft Plans of Subdivision, 2010.*

As noted in the previous section, EnVision has inferred that the prevailing soil type at the site will be a sandy silt to a silty sand till with a percolation rate of approximately 25 min/cm. Based on the Durham Region Lot sizing policy the minimum area that should be dedicated to prime and reserve leaching bed areas for this soil type is 750 m^2 (375 m^2 prime area and a 375 m^2 reserve area), as displayed in the table below:

Table 1 Conceptual Sewage System Area Estimates (Durham Region Policy)

Soil Percolation Rate	Loading Rate (L/m2)	Daily Sewage Flow (L)	Sewage System Area (Combined Prime and Reserve) ((B/A)x2)
1<T<20	10	3,000	600
20<T<35	8	3,000	750
35<T<50	6	3,000	1000
50<T	4	3,000	1500

The conceptual layout (***Figure 2)*** uses a generic house footprint, a drilled well, and a generic sewage disposal system layout that was based on the Durham Region Lot Sizing Policy. The generic house footprint for each lot was demonstrated as a 20 m by 15 m rectangular block, which would contain the residence as well as the garage. The 300 m^2 footprint was inferred to be representative of the extent of the building envelopes to be constructed at the development.

The building footprints were shown to have a minimum 7 m setback from the front and rear property lines, as well as a minimum 3 m side yard setback. Driveways were demonstrated to be 6 m wide and generally perpendicular to the house footprint.

A drilled well was also shown on each lot. Each well has a 15 m protected radius illustrated; sewage system distribution piping and septic tanks cannot be located within this area.

The conceptual layout demonstrates that adequate area is available on each lot to meet the Durham Region Lot Sizing Policy. During the detailed design and approval process, these sewage systems may be somewhat smaller or larger depending on the exact house details, soil percolation rates, and if advanced sewage treatment systems are used.

A further assessment of the likely sewage system sizes is provided in the section below.

DETAILED SEWAGE SERVICING ASSESSMENT

In order to provide more specific guidance as to the probable size of the septic systems servicing the subdivision properties, EnVision has undertaken a detailed sewage system assessment below.

The theoretical total daily design sewage flow for the dwellings within the development has been based on conceptual house plan information provided by the Client and the requirements of the Ontario Building Code (2012); specifically, Table 8.2.1.3.A. The theoretical sewage flow for the dwellings was determined as outlined in the table below.

Table 2 Theoretical Sewage Flow Calculations

	LOWER LIMIT OF EXPECTED FLOW		UPPER LIMIT OF EXPECTED FLOW	
Description of Unit	Number of Units	Total Flow (L/day)	Number of Units	Total Flow (L/day)
1) Bedrooms	3	1,600	4	2,000
2) Ground Floor Area	200	0	325	1,300
3) Fixture Units	25	250	31	550
Total (Row 1 Plus Higher of Rows 2 or 3)		1,850		3,300

It is noted that detailed house plans are not available at this time. To approximate the sewage flow contribution from the fixture units, EnVision has assumed that each bathroom would be a full bathroom group, and each dwelling would also have a dishwasher, kitchen sink, food preparation sink, laundry machine, and laundry sink.

Based on the above calculated sewage flow values, the daily design sewage flow for each resident is estimated to vary between 1,850 L/day to 3,300 L/day. It should be noted that the theoretical flows calculated are conservative and overestimate the actual daily sewage flow, however they have been calculated using the applicable regulations.

SCENARIO 1 – PRIMARY SEWAGE TREATMENT

Due to the predominate soil type at the site and the size of the proposed dwellings, it is likely that the Primary sewage treatment scenario may be applicable to design sewage flows less than 3,000 L/day. At this flow rate, single pod filter bed sewage disposal systems could be used. Filter bed systems are not typically advantageous at flow rate of greater than 3,000 L/day due to the requirement for a second filter pod (effective area) spaced a minimum 5 m apart.

In this scenario, sewage would be treated in a conventional manner whereby all blackwater and greywater from the dwellings would exit the house in a combined fashion and enter a septic tank. Sewage would then exit the septic tank and typically enter a pumping chamber. From the pumping chamber sewage would be pumped, on demand, to the filter bed sewage disposal system.

Filter beds are comprised of a stone layer, housing the distribution piping network, situated on top of a specified sand layer (the Filter Sand). Where a filter bed is installed on soil having a percolation rate of greater than 15 min/cm, imported sand fill shall be used to create a 15 m mantle area. The imported sand fill shall be a minimum of 250 mm deep at all locations within the leaching bed area and extend a minimum of 15 metres beyond the distribution pipe in the direction of horizontal shallow groundwater flow. The minimum area of the filter bed, constructed on native soil with a percolation rate of 25 min/cm, is calculated using the formula:

$$A = \frac{Q}{8}$$

where:

A = the area of contact (sand area) (m^2)
Q = the total daily design sanitary sewage flow (L)

Based on the above formula and the minimum and maximum expected sewage flows noted in *Table 2*, the minimum size of the leaching beds is calculated in *Table 3* below:

Table 3 Minimum Sewage System Contact Area

DESIGN SCENARIO	MINIMUM CONTACT AREA (LOWER FLOW LIMIT)	MINIMUM CONTACT AREA (UPPER FLOW LIMIT (3,000 L/DAY))
Leaching Bed Sizing	231 m^2	375 m^2

An effective area, comprised of septic stone meeting the gradation criteria set forth in Table 8.7.3.3., Division B, of the *Ontario Building Code*, overtop of the filter sand, is required to accommodate the distribution piping. The stone layer shall be rectangular in shape with the long dimension parallel to site contours and be protected by a permeable geo-textile (or equivalent). The minimum effective area (for sewage flows less than 3,000 L/day) is calculated based on:

$$A = \frac{Q}{75}$$

where:

A = the stone and pipe loading on the surface of the filter medium (m^2)
Q = the total daily design sewage flow (L)

Based on the above formula and the minimum and maximum expected sewage flows noted in *Table 2,* the minimum size of the effective area is calculated in *Table 4* below:

Table 4 Minimum Sewage System Stone Area

DESIGN SCENARIO	MINIMUM EFFECTIVE AREA (LOWER FLOW LIMIT)	MINIMUM EFFECTIVE AREA (UPPER FLOW LIMIT (3,000 L/DAY))
Effective Area Sizing	25 m^2	40 m^2

Although the theoretical minimum values in the previous tables provide the lower extent of how large a sewage system must be, the minimum constructable size can be marginally different due to factors such as the requirements for an imported sand mantle, sloping requirements, piping network design, etc.

Based on EnVision's design experience, we infer the likely minimum filter bed size for the lower flow scenario to be approximately 286 m^2 (13 m x 22 m), while the likely minimum filter bed size for the upper flow scenario (3,000 L/day) would be 380 m^2 (16.5 m x 23 m).

SCENARIO 2 – ADVANCED (LEVEL IV) SEWAGE TREATMENT

In an effort to reduce the overall area required, the Client may choose to install advanced (Level IV) sewage treatment systems prior to ultimate sewage disposal.

In this scenario the sewage would undergo primary treatment in the septic tank and then would be supplemented by further treatment with an advanced sewage treatment system. The advanced treatment unit would polish the sewage effluent to Level IV standards (10 mg/L TSS, 10 mg/L $CBOD_5$) through aerobic processes and/or physical filtration. The treated sewage effluent would be pumped, on demand, to a partially raised *Type A* dispersal bed.

Using a *Type A* sewage disposal system, in conjunction with an advanced treatment unit, there is capacity to hydraulically load the contact soils at a greater rate than conventional systems due to the reduced strength of the sewage being discharged. This allows for a reduction in the total area required for the installation.

Type A leaching beds are comprised of a stone layer, housing the distribution piping network, situated on top of a sand layer. As per the Ontario Building Code, where a *Type A* bed is installed on soil having a percolation rate of greater than 15 min/cm, imported sand fill shall be used in its construction. The imported sand fill should have a corresponding percolation rate between 6 and 10 min/cm and contain less than 5% fines (silt and clay). The imported sand fill shall be a minimum of 300 mm deep at all locations within the leaching bed area and extend a minimum of 15 metres beyond the distribution pipe in the direction of horizontal shallow groundwater flow. The minimum area of the *Type A* bed is calculated using the formula:

$$A = \frac{QT}{400}$$

where:

A = the area of contact (sand area) (m^2)
Q = the total daily design sanitary sewage flow (L)
T = the percolation rate of the native soil to a maximum of 50 (min/cm)

Based on the above formula, the minimum and maximum expected sewage flows noted in *Table 2,* and a native soil percolation rate of 25 min/cm, the minimum size of the leaching beds is calculated in *Table 5* below:

Table 5 Minimum Sewage System Contact Area

DESIGN SCENARIO	MINIMUM CONTACT AREA (LOWER FLOW LIMIT)	MINIMUM CONTACT AREA (UPPER FLOW LIMIT)
Leaching Bed Sizing	116 m^2	207 m^2

A stone layer, comprised of septic stone meeting the gradation criteria set forth in Table 8.7.3.3., Division B, of the Ontario Building Code, shall be installed to accommodate the distribution piping to obtain even distribution of the treated sewage effluent. The stone layer shall have a minimum thickness of 200 mm, be rectangular in shape with the long dimension parallel to site contours and be protected by a permeable geo-textile (or equivalent). The minimum stone area is calculated based on:

$$A = \frac{Q}{50 \; or \; 75}$$

where:

A = the area of contact between the base of the stone layer and the underlying soils (m^2)
Q = the total daily design sewage flow (L)

The denominator of the equation is chosen based on the design flow rate. For flows less than 3,000 L/day the denominator is 75; otherwise, it is 50.

Based on the above formula, the minimum and maximum expected sewage flows noted in *Table 2*, the minimum size of the stone and pipe area is calculated in *Table 6* below:

Table 6 Minimum Sewage System Stone Area

DESIGN SCENARIO	MINIMUM STONE AREA (LOWER FLOW LIMIT)	MINIMUM STONE AREA (UPPER FLOW LIMIT)
Stone and Pipe Area	25 m^2	66 m^2

Although the theoretical minimum values in the previous tables provide the lower extent of how large a sewage system must be for the advanced sewage treatment scenario, the minimum constructable size can be different due to factors such as the requirements for an imported sand mantle, sloping requirements, piping network design, etc. Based on EnVision's design experience, we infer the likely minimum Type A bed size for the lower flow scenario to be approximately 286 m^2 (13 m x 22 m), while the likely minimum Type A bed size for the upper flow scenario would be 368 m^2 (16 m x 23 m).

SUMMARY OF DETAILED SEWAGE SERVICING SCENARIOS

As displayed in the scenarios above, the impact to the on-site sewage system sizes by incorporating advanced (Level IV) sewage treatment is nominal, primarily due to the sandy till nature of the soil type at the site. The requirement for a 15 m imported sand mantle necessitates larger than minimum basal contact area in the advanced treatment scenario, such that the additional capital and operating costs of advanced treatment would not be preferable.

Advanced system treatment may be preferable for the largest expected houses in the development (i.e. flows greater than 3,000 L/day) or if isolated areas of siltier soils are found in untested areas.

Advanced sewage treatment would be required should nitrate reduction be required as part of the development approval process.

CLOSING

Based on the information throughout this letter report, EnVision presents the following key findings:

- Adequate area is available on each lot to meet the Durham Region Lot Sizing Policy for the proposed 7 lot development.
- Detailed sewage servicing was evaluated under two different lot level scenarios; primary treatment discharging to filter beds and Level IV treatment discharging to Type A leaching beds.
- Based on the conceptual house details provided by the Client, and the soil information previously analyzed by WSP Canada Inc., the leaching beds will likely vary in size from about 286 m^2 to 375 m^2 in area.
- Advanced (Level IV) sewage treatment provides minimal reduction in sewage system design sizing for flows less than 3,000 L/day. Advanced sewage treatment may be preferable for flows >3,000 L/day or if nitrate reduction is required as part of the development approval process.

We trust that this information will be sufficient for the purposes of a sewage system sizing study. Please contact the undersigned at (905) 868-4032 or mvarty@envisionconsultants.ca to discuss the information contained within this letter report.

Yours sincerely,

EnVision Consultants Ltd

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INCLUSIONS:

Figures

Figure 1 Site Plan

Figure 2 Conceptual Sewage System Sizing – Durham Lot Sizing Policy

Attachments

WSP Particle Size Distribution Curves

FIGURES

Drafted by: LS

LEGEND

- Site Boundary
- Topographic Contours
- Waterbodies

Title: SITE LOCATION MAP

Project: On-Site Sewage System Sizing Study
Udora Development
Part of Lots 34 & 35, Concession 6, Udora, Ontario

Project No: 22-0223

Date: Sept 2022

Client: 2695867 Ontario Inc.

Designed by: MV

Reviewed by: MV

Figure: 1

LEGEND:

- H — Conceptual Building Envelope
- P — Conceptual Prime Leaching Bed (375 sq. m)
- R — Conceptual Reserve Leaching Bed (375 sq. m)
- W — Proposed Drinking Water Well with a 15m Protected Radius
- Existing Well to be abandoned in Accordance with Regulation 903
- TP19-5 (T=25min/cm) — Approximate Test pit Location and Estimated Percolation Rate (T-Time), WSP Canada Inc. 2019

DW = Driveway

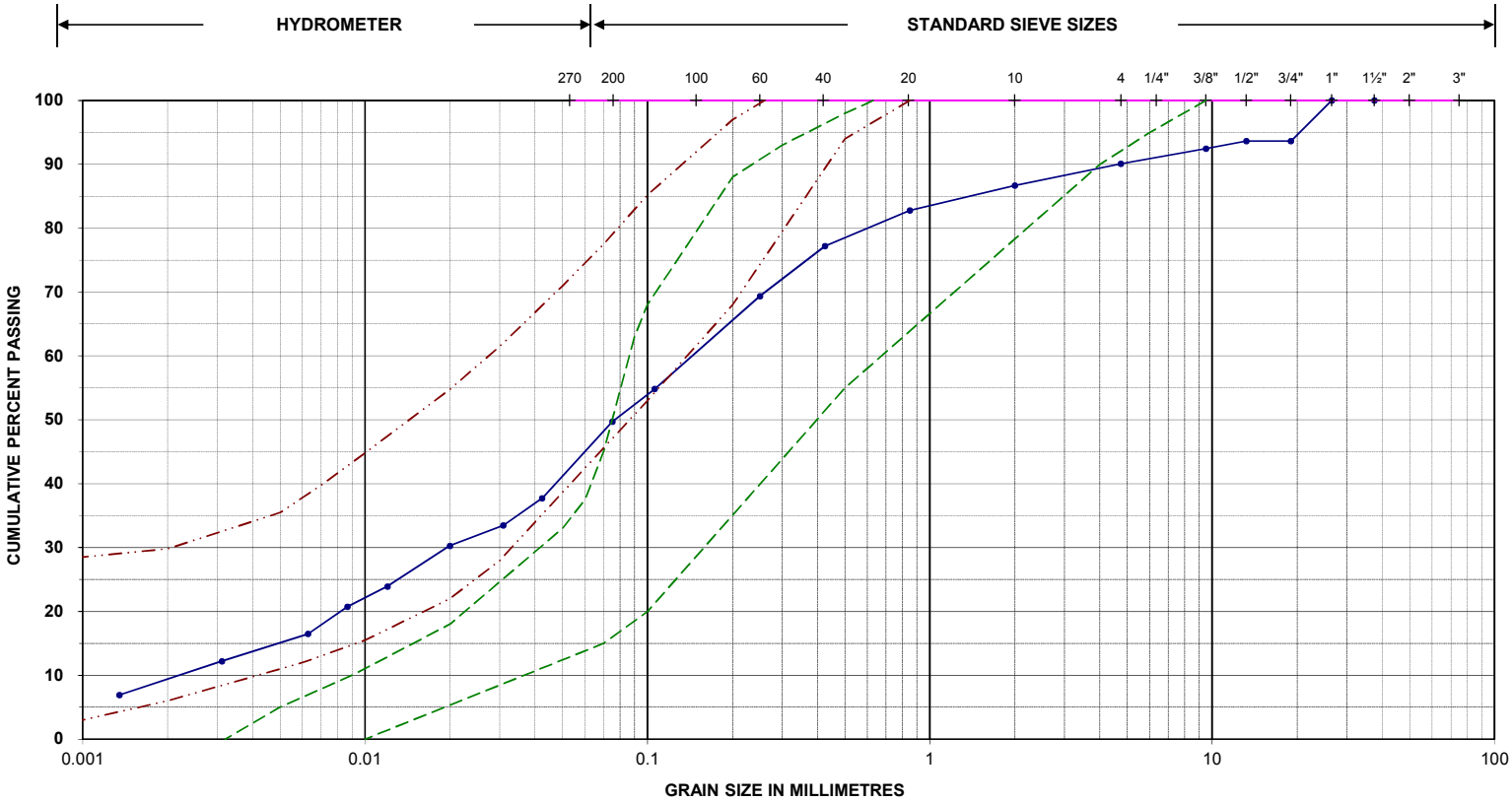
TITLE: Conceptual Servicing Plan

PROJECT : On-Site Sewage System Sizing Study - Udora Development

CLIENT :	PREPARED BY:	DATE:
2695867 Ontario Inc.	MV	December 2024
PROJECT NO: 22-0223	CHECKED BY: PLM	FIGURE NO: 2

ATTACHMENT A

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	10	%
SAND	40	%
SILT	43	%
CLAY	7	%

---------- sm envelope T = 8 - 20 min/cm

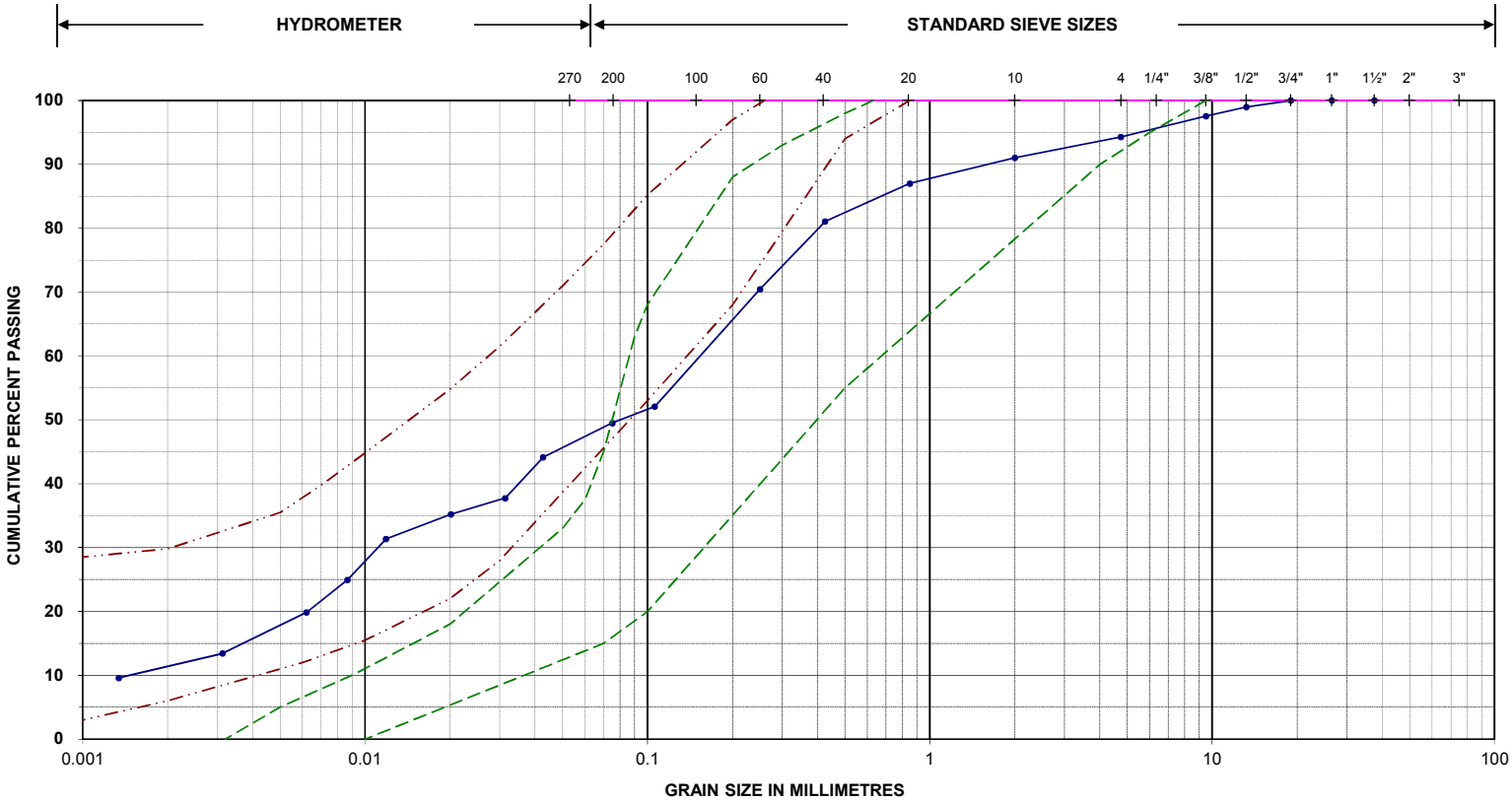
– – – – ml envelope T = 20 - 50 min/cm

Estimated T = 25 min/cm

Project Name:	Udora Subdivision	**Project No.:**	181-12360-00
Location ID.:	TP19-1	**Sample No./Depth:**	SS2

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	86.67	**0.042**	37.7
26.5 mm	100.0	**0.850 mm**	82.8	**0.020**	30.3
19.0 mm	93.7	**0.425 mm**	77.2	**0.009**	20.7
13.2 mm	93.7	**0.250 mm**	69.4	**0.003**	12.2
9.50 mm	92.4	**0.106 mm**	54.9	**0.001**	6.9
4.75 mm	90.1	**0.075 mm**	49.7		

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	6	%
SAND	45	%
SILT	40	%
CLAY	10	%

---------- sm envelope T = 8 - 20 min/cm

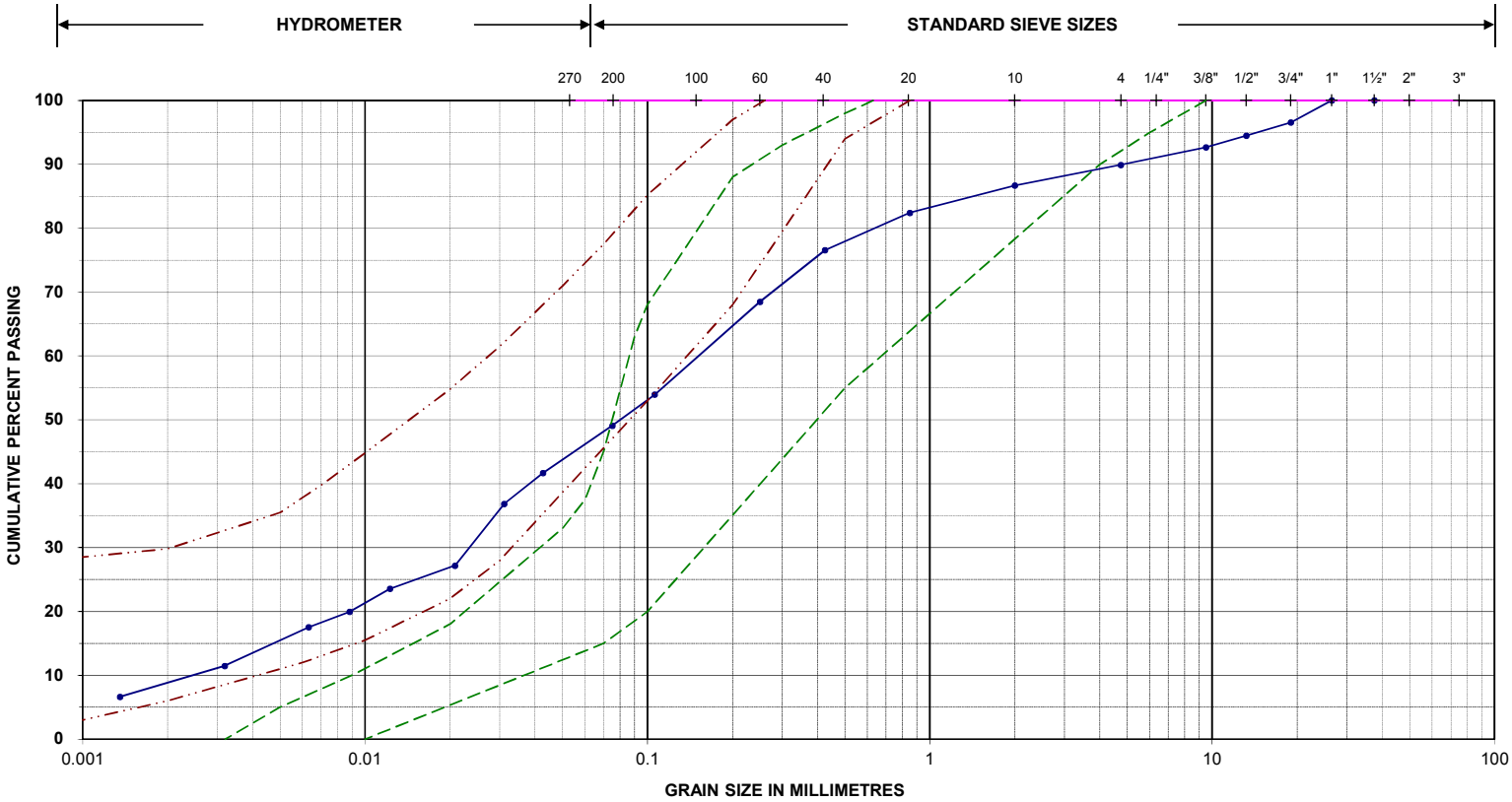
– – – – – – ml envelope T = 20 - 50 min/cm

Estimated T = 25 min/cm

Project Name:	Udora Subdivision	**Project No.:**	181-12360-00
Location ID.:	TP19-2	**Sample No./Depth:**	SS1

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	91.02	**0.043**	44.1
26.5 mm	100.0	**0.850 mm**	87.0	**0.020**	35.2
19.0 mm	100.0	**0.425 mm**	81.1	**0.009**	24.9
13.2 mm	99.0	**0.250 mm**	70.4	**0.003**	13.4
9.50 mm	97.6	**0.106 mm**	52.1	**0.001**	9.6
4.75 mm	94.3	**0.075 mm**	49.5		

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	10	%
SAND	41	%
SILT	42	%
CLAY	7	%

---------- sm envelope T = 8 - 20 min/cm

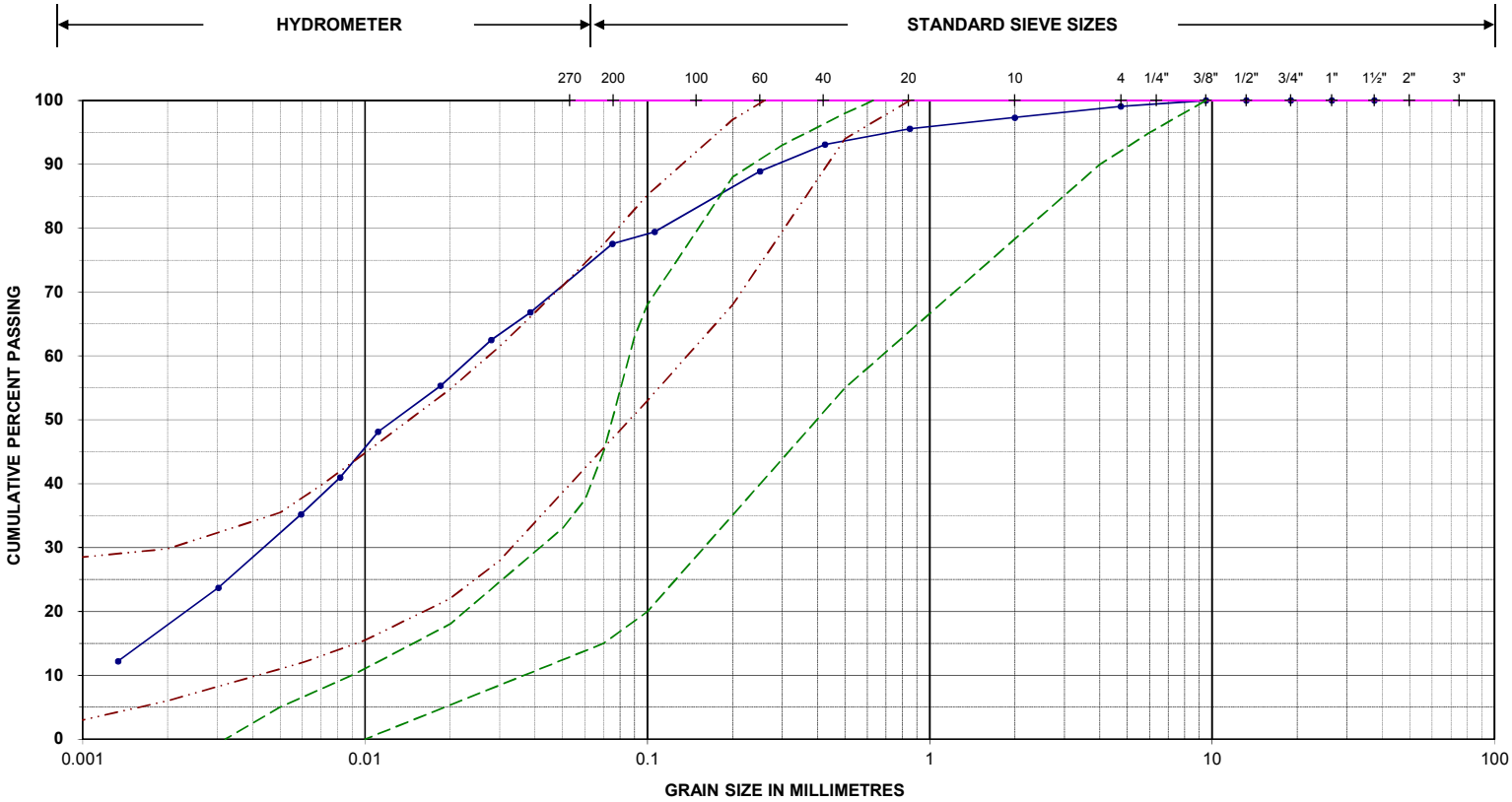
– – – – – – ml envelope T = 20 - 50 min/cm

Estimated T = 25 min/cm

Project Name:	Udora Subdivision	**Project No.:**	181-12360-00
Location ID.:	TP19-3	**Sample No./Depth:**	SS1

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	86.69	**0.043**	41.7
26.5 mm	100.0	**0.850 mm**	82.4	**0.021**	27.2
19.0 mm	96.6	**0.425 mm**	76.6	**0.009**	19.9
13.2 mm	94.5	**0.250 mm**	68.5	**0.003**	11.5
9.50 mm	92.7	**0.106 mm**	53.9	**0.001**	6.6
4.75 mm	89.9	**0.075 mm**	49.1		

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	1	%
SAND	22	%
SILT	65	%
CLAY	12	%

---------- sm envelope T = 8 - 20 min/cm

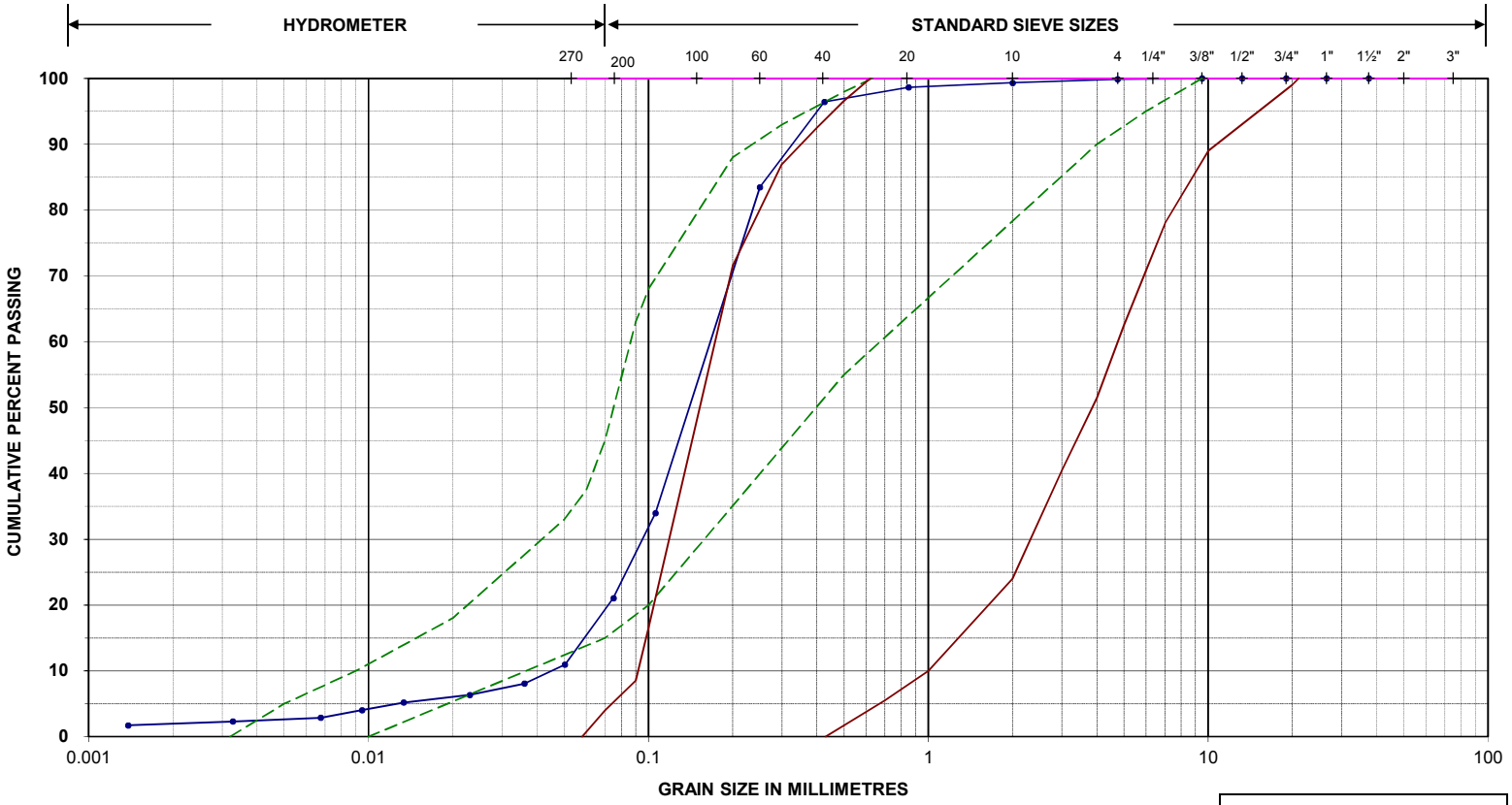
– – – – – – ml envelope T = 20 - 50 min/cm

Estimated T = 45 min/cm

Project Name:	Udora Subdivision	**Project No.:**	181-12360-00
Location ID.:	TP19-4	**Sample No./Depth:**	SS1

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	97.32	**0.038**	66.8
26.5 mm	100.0	**0.850 mm**	95.6	**0.018**	55.3
19.0 mm	100.0	**0.425 mm**	93.1	**0.008**	41.0
13.2 mm	100.0	**0.250 mm**	88.9	**0.003**	23.7
9.50 mm	100.0	**0.106 mm**	79.4	**0.001**	12.2
4.75 mm	99.1	**0.075 mm**	77.6		

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	**0**	**%**
SAND	**79**	**%**
SILT	**19**	**%**
CLAY	**2**	**%**

---------- sm envelope T = 8 - 20 min/cm

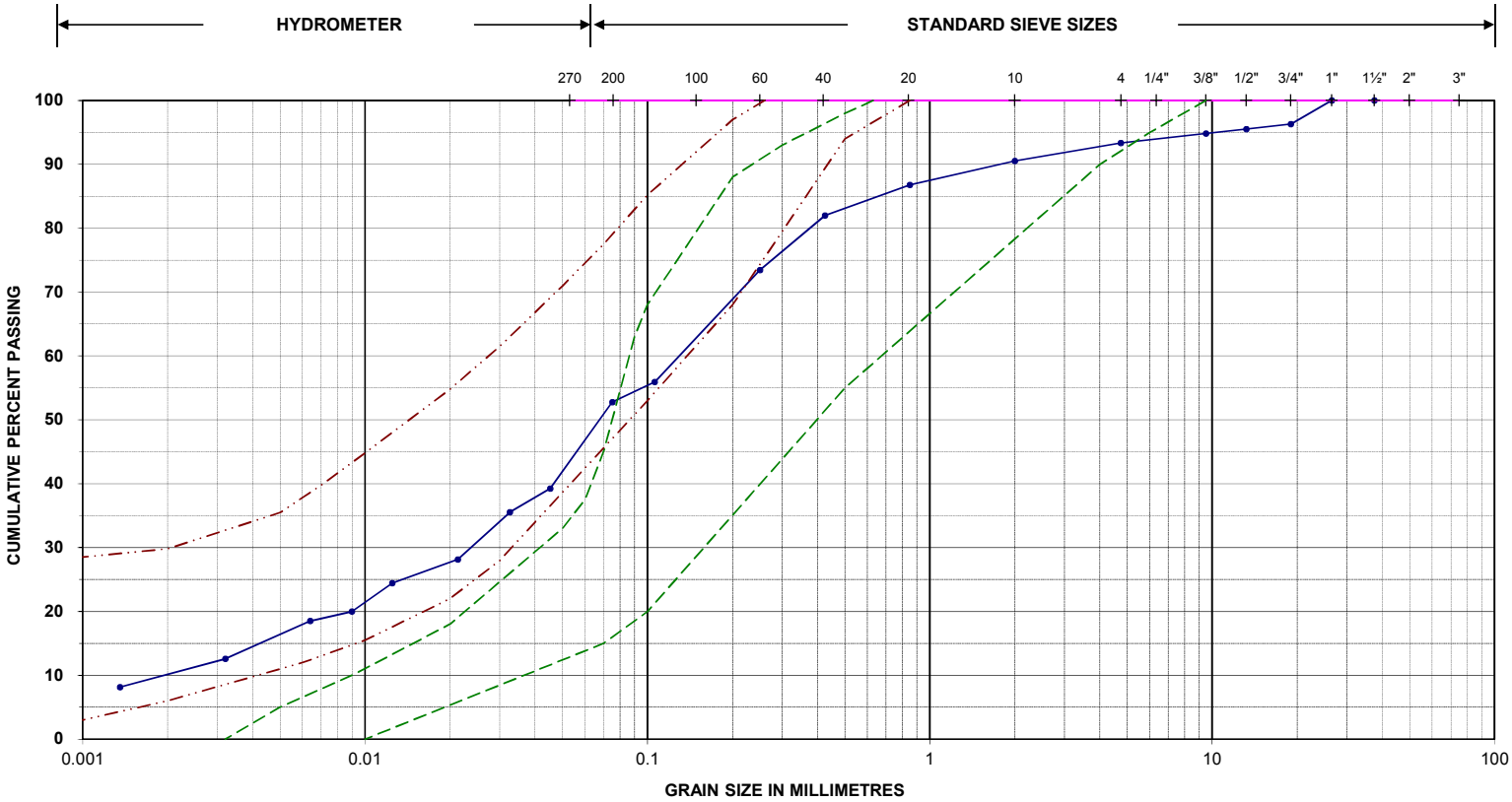
———— sp envelope T = 2 - 8 min/cm

Estimated T = 10 min/cm

Project Name:	Udora Subdivision	**Project No.:**	181-12360-00
Location ID.:	TP19-5	**Sample No./Depth:**	SS2

Sieve Size	% Passing Coarse	**Sieve Size**	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	99.33	**0.050**	10.9
26.5 mm	100.0	**0.850 mm**	98.6	**0.023**	6.3
19.0 mm	100.0	**0.425 mm**	96.4	**0.009**	4.0
13.2 mm	100.0	**0.250 mm**	83.5	**0.003**	2.3
9.50 mm	100.0	**0.106 mm**	34.0	**0.000**	1.7
4.75 mm	99.9	**0.075 mm**	21.1		

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	7	%
SAND	41	%
SILT	45	%
CLAY	8	%

---------- sm envelope T = 8 - 20 min/cm

– – – – – – ml envelope T = 20 - 50 min/cm

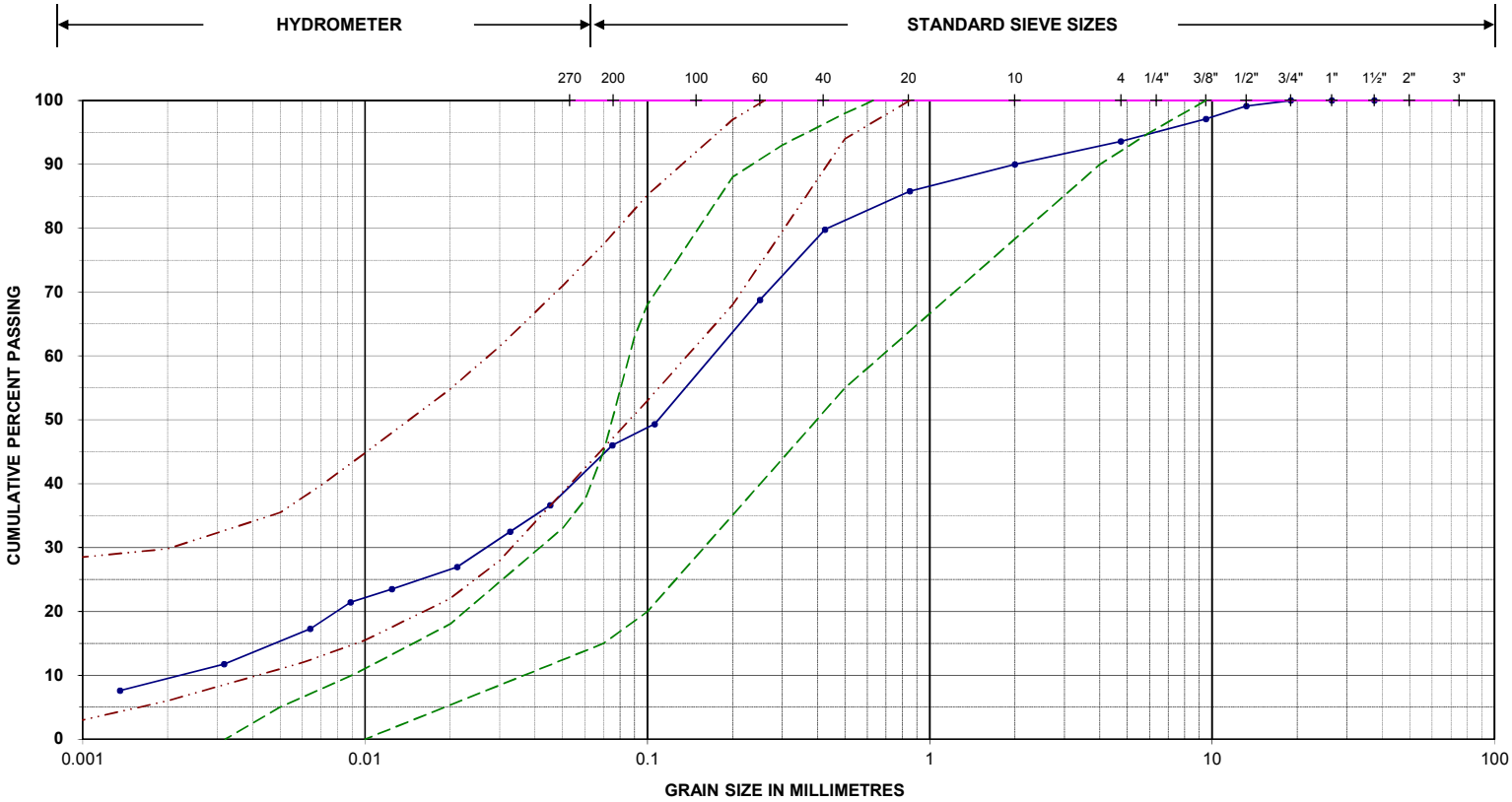
Estimated T = 25 min/cm

Project Name: Udora Subdivision **Project No.:** 181-12360-00

Location ID.: TP19-6 **Sample No./Depth:** SS1

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	90.52	**0.045**	39.2
26.5 mm	100.0	**0.850 mm**	86.8	**0.021**	28.1
19.0 mm	96.3	**0.425 mm**	82.0	**0.009**	20.0
13.2 mm	95.5	**0.250 mm**	73.4	**0.003**	12.6
9.50 mm	94.8	**0.106 mm**	55.9	**0.001**	8.1
4.75 mm	93.4	**0.075 mm**	52.8		

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	6	%
SAND	48	%
SILT	38	%
CLAY	8	%

---------- sm envelope T = 8 - 20 min/cm

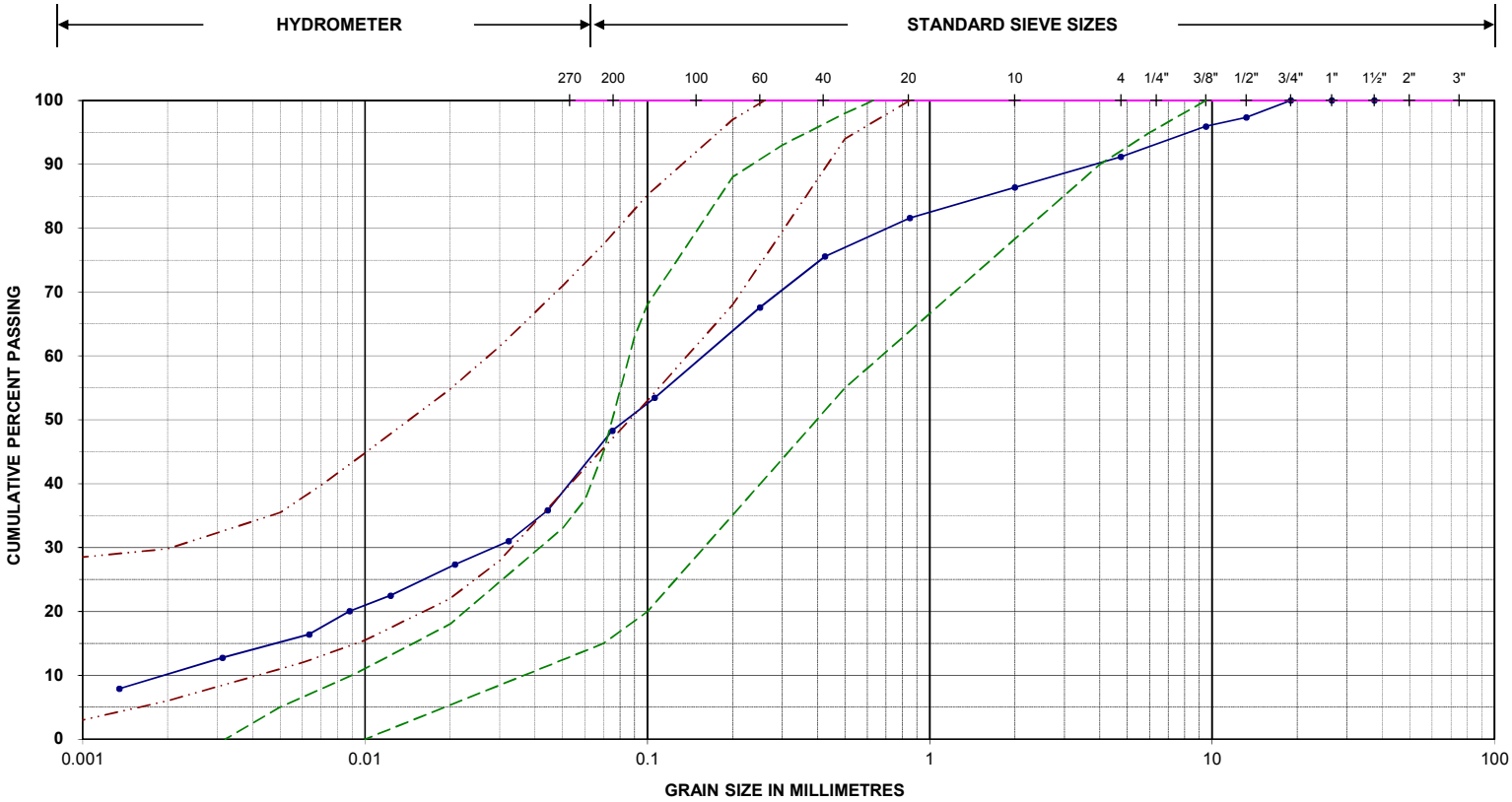
– – – – – – ml envelope T = 20 - 50 min/cm

Estimated T = 25 min/cm

Project Name:	Udora Subdivision	**Project No.:**	181-12360-00
Location ID.:	TP19-7	**Sample No./Depth:**	SS1

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	90.00	**0.045**	36.6
26.5 mm	100.0	**0.850 mm**	85.8	**0.021**	26.9
19.0 mm	100.0	**0.425 mm**	79.8	**0.009**	21.4
13.2 mm	99.1	**0.250 mm**	68.8	**0.003**	11.7
9.50 mm	97.1	**0.106 mm**	49.3	**0.001**	7.6
4.75 mm	93.6	**0.075 mm**	46.0		

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	9	%
SAND	43	%
SILT	40	%
CLAY	8	%

---------- sm envelope T = 8 - 20 min/cm

– – – – – – ml envelope T = 20 - 50 min/cm

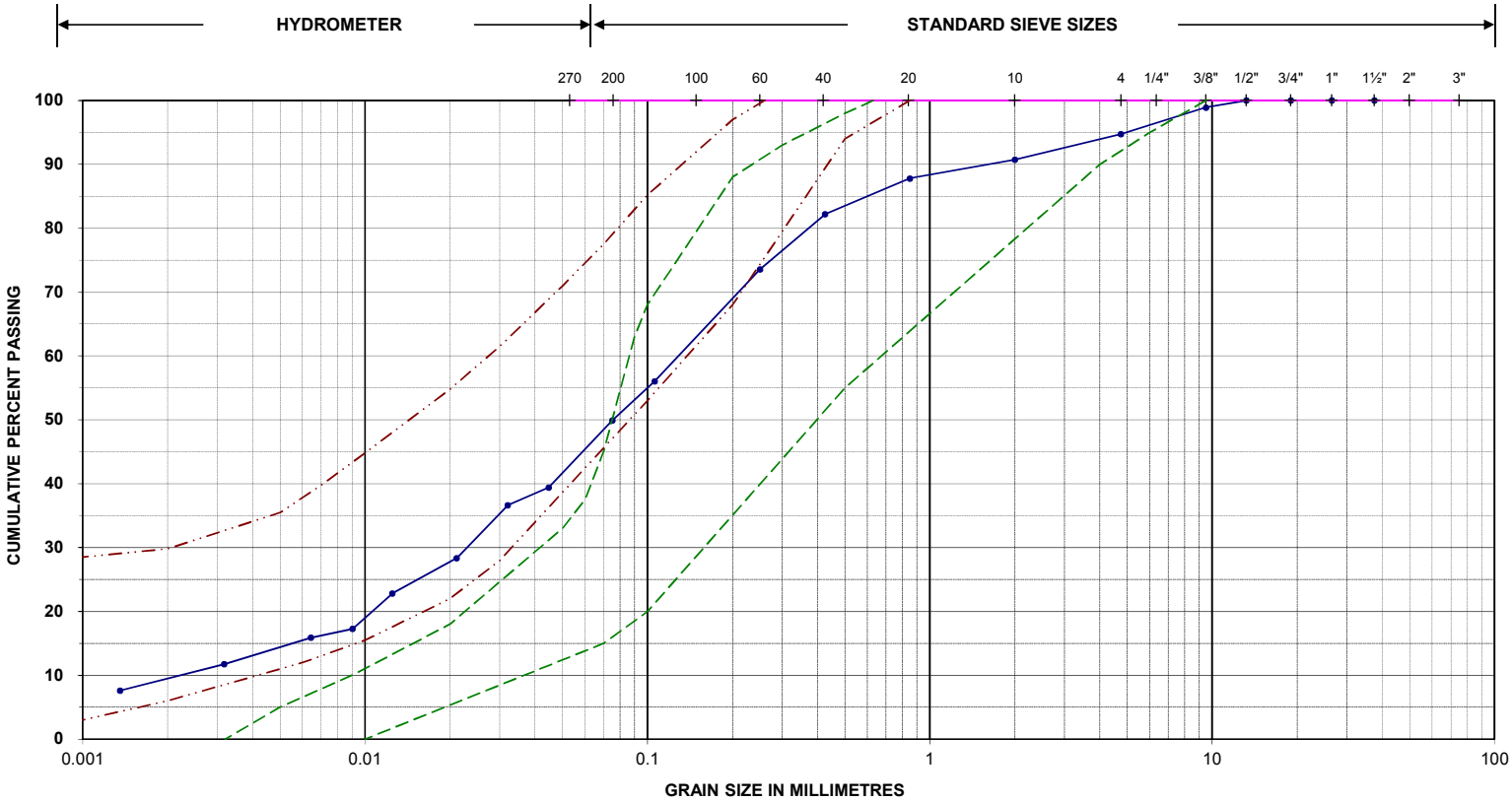
Estimated T = 25 min/cm

Project Name: Udora Subdivision **Project No.:** 181-12360-00

Location ID.: TP19-8 **Sample No./Depth:** SS1

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	86.39	**0.044**	35.8
26.5 mm	100.0	**0.850 mm**	81.6	**0.021**	27.3
19.0 mm	100.0	**0.425 mm**	75.6	**0.009**	20.0
13.2 mm	97.4	**0.250 mm**	67.6	**0.003**	12.8
9.50 mm	95.9	**0.106 mm**	53.5	**0.001**	7.9
4.75 mm	91.2	**0.075 mm**	48.3		

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	5	%
SAND	45	%
SILT	42	%
CLAY	8	%

---------- sm envelope T = 8 - 20 min/cm

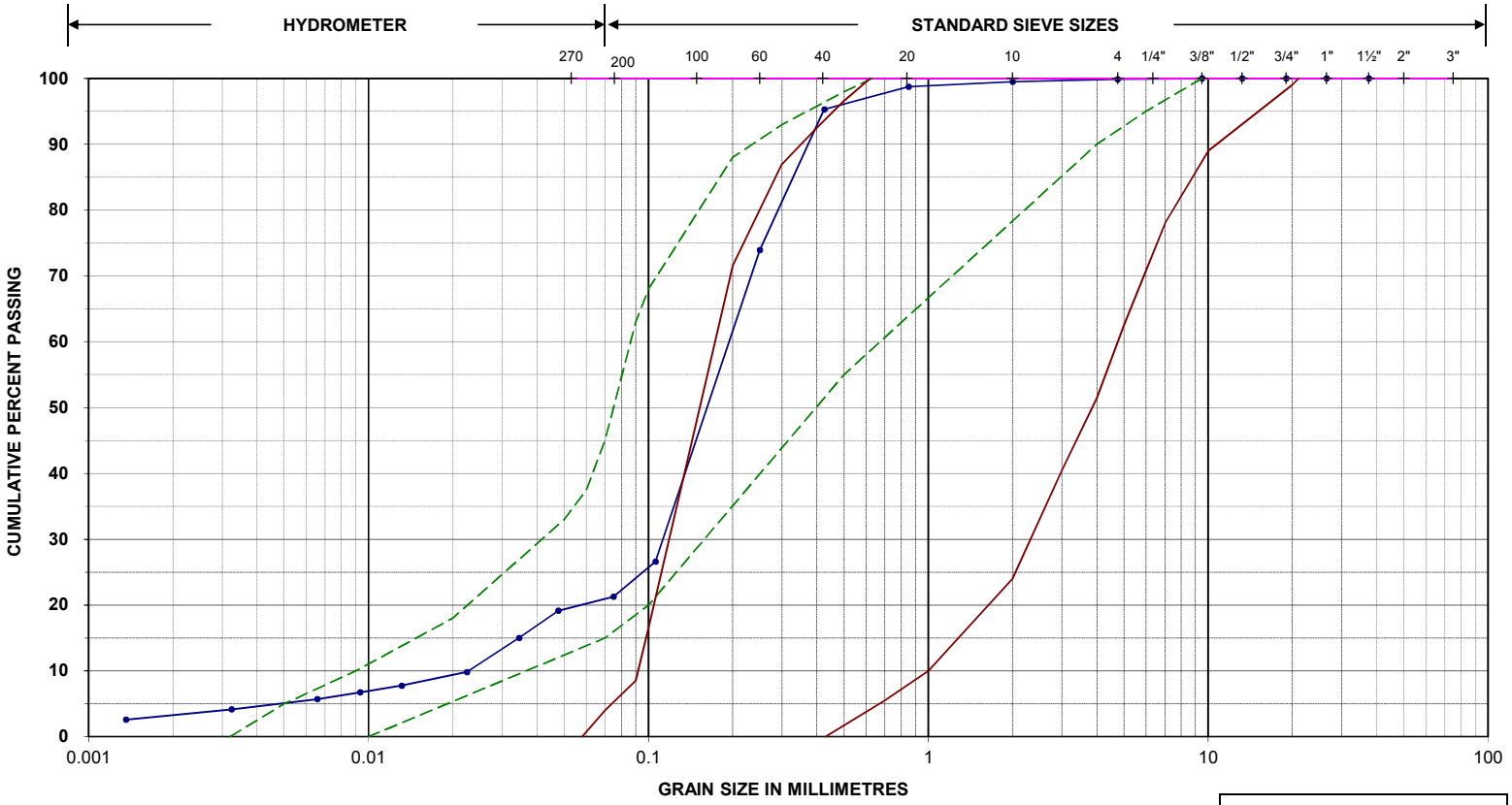
– – – – – – ml envelope T = 20 - 50 min/cm

Estimated T = 25 min/cm

Project Name:	Udora Subdivision	**Project No.:**	181-12360-00
Location ID.:	TP19-10	**Sample No./Depth:**	SS1

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	90.74	**0.045**	39.4
26.5 mm	100.0	**0.850 mm**	87.8	**0.021**	28.3
19.0 mm	100.0	**0.425 mm**	82.2	**0.009**	17.3
13.2 mm	100.0	**0.250 mm**	73.5	**0.003**	11.8
9.50 mm	98.9	**0.106 mm**	56.1	**0.001**	7.6
4.75 mm	94.7	**0.075 mm**	49.9		

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	0	%
SAND	79	%
SILT	19	%
CLAY	3	%

---------- sm envelope T = 8 - 20 min/cm

———— sp envelope T = 2 - 8 min/cm

Estimated T = 15 min/cm

Project Name:	Udora Subdivision	**Project No.:**	181-12360-00
Location ID.:	TP19-9	**Sample No./Depth:**	SS1

Sieve Size	% Passing Coarse	**Sieve Size**	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	99.48	**0.048**	19.2
26.5 mm	100.0	**0.850 mm**	98.7	**0.022**	9.8
19.0 mm	100.0	**0.425 mm**	95.3	**0.009**	6.7
13.2 mm	100.0	**0.250 mm**	73.9	**0.003**	4.1
9.50 mm	100.0	**0.106 mm**	26.6	**0.000**	2.6
4.75 mm	99.9	**0.075 mm**	21.3		