KING GEORGE COUNTY
WATER SUPPLY PLAN
2018 UPDATE

KING GEORGE
VIRGINIA

December 2018

Draper Aden Associates
Engineering • Surveying • Environmental Services
Lasting Positive Impact®

DAA Project Number: **18020420-010305**

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TABLES

APPENDICES

1.0 INTRODUCTION

In November 2009, King George County and King George County Service Authority (the County and KGCSA) submitted a Water Supply Plan (the Plan) to the Virginia Department of Environmental Quality (DEQ). The Water Supply Plan was developed in order to comply with §9VAC 25-780-140 (the Regulation). Subsequent to the submittal of the Water Supply Plan, DEQ notified King George County that the Plan complied with the Regulation. The Regulation calls for a five-year review of the Plan and DEQ noted certain items that needed to be addressed in the five-year review – those items are outlined below.

1.1 Items Updated in the Five-Year Review

In a memorandum dated June 22, 2018, and accompanied by a spreadsheet, DEQ outlined specific items that needed to be provided or updated as follows[1]:

Item 1. DEQ provided a list of systems for which some water source data was missing in the 2009 Water Supply Plan. Much of the missing data is specific well data – including well depth, well diameter, etc. See Appendix A for the detailed list of requested missing data.

Item 2: DEQ requested peak day use by month for the Nindes Store and Dahlgren Community Water Systems (CWS) owned by KGCSA.

In addition, DEQ requested additional data on any self-supplied ground water users (<300,000 gallons per month) within the community water source service areas.

DEQ requested estimated disaggregated use information for the following systems:

[1] The June 22, 2018 Memorandum and the accompanying spreadsheet are included in Appendix A.

Table 1-1: Disaggregated Use Information Requested

American Historyland Trailer Park
Cedar Knoll Apartments
Chestnut Hill Mobile Home Park
Eagle Bay
Hanover Mobile Home Park
Heritage Hall Nursing Home
Holiday Inn Apartments
McDaniel Mobile Home Park
Naval Surface Weapons Center-Dahlgren Mainside
Pineview Mobile Home Park
Presidential Lakes, Section 14
Princess Anne 205
Princess Anne 301
Walnut Grove Mobile Home Park

Item 3: DEQ requested projections by individual CWS, including projected future water demands on both an annual average and peak monthly basis, and future demands disaggregated into categories of use, as requested in §9 VAC 25-780-100 D of the Regulation.

Item 4: Evaluate potential savings through water demand management actions in the analysis of alternative water sources.

Item 5: Describe practices to address water loss in the maintenance of systems to reduce unaccounted for water loss.

Other State Agency Comments: Department of Game and Inland Fisheries, "Federally Endangered Atlantic Sturgeon and Shortnose Sturgeon need to be added to the listed species discussion in water supply plan." (Note – since the Water Supply Plan document/report is not being updated at this time, the comment is noted, but no action is being taken.)

1.2 Approach

The data that *was not* included in the 2009 Water Supply Plan was not available at the time the Plan was prepared. In order to comply with DEQ's request for additional information, Draper Aden Associates (DAA) contacted the Virginia Department of Health (VDH), requested data, looked

through paper files at the VDH office in Richmond and contacted system owners, where possible. Those efforts are further documented in the following sections of this report.

In some cases, the requested data was not available or not provided by the Owner of the system.

1.3 DEQ's VAHydro Database

Much of the data provided in the 2009 Water Supply Plan was entered into DEQ's on-line database by DEQ staff. As part of the 2018 update, DAA entered missing data or updated existing data in the database. The VAHydro database is available through DEQ's website at: https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/On-LineDataReporting.aspx

-- End of Section --

2.0 WELL DATA

The Water Supply Planning Regulation requires that certain well data be provided for certain wells within the County. For most of the CWS, VDH has included known or available well data in the Engineering Description Sheet for the CWS. For many of the systems, the wells were drilled in the 1970's - 1990's – for those systems, VDH captured known well data in the Engineering Description Sheets (EDS), and the actual well-driller records (which might contain additional details about the characteristics of the well) are not in the VDH files. VDH stated that "if the information was available at the time the EDS was prepared, the data would have been included."

In November of 2018, DAA went to the VDH office in Richmond and reviewed paper records included in the VDH files. Files for the following systems were reviewed:

Table 2-1: Files Reviewed at VDH

American Historyland Trailer Park
Cedar Knoll Apartments
Chestnut Hill Mobile Home Park
Eagle Bay
Hanover Mobile Home Park
Heritage Hall Nursing Home[2]
Holiday Inn Apartments
McDaniel Mobile Home Park
Naval Surface Weapons Center-Dahlgren Mainside
Pineview Mobile Home Park (includes the former Princess Anne 205)
Presidential Lakes, Section 14
Princess Anne 301
Walnut Grove Mobile Home Park

[2] When the Water Supply Plan was prepared and submitted in 2009, the Heritage Hall Nursing Home operated a community water system that served only the nursing home facility. Since that time the facility has abandoned the well(s) that served the nursing facility and has connected to the KGCSA's Courthouse system Therefore, in this update, water usage at the nursing home is included in the data for the Courthouse CWS. Annual usage is 3,800,000 gallons, or, approximately 300,000 gallons per month.

2.1 Well Driller Records

While VDH has extensive files on hand for the CWS, none of the file folders include any additional data concerning the well depths, diameter, casing, etc. – outside of information included in the EDS. None of the files included well driller logs or similar data that would have been recorded at the time the well was drilled.

To the extent that additional data was available, that data has been entered into the spreadsheet in Appendix A and entered into VAHydro. The spreadsheet in Appendix A was prepared by DEQ and DEQ highlighted the data that is "missing". In Appendix A, DAA has entered any information that was found in the VDH records (highlighted in yellow). For some systems, no additional well data was available.

-- End of Section --

3.0 WATER USE DATA

DEQ's June 22, 2018 Memorandum requested peak day use by month for the Nindes Store and Dahlgren systems (both are KGCSA systems).

In addition, DEQ wanted additional information on any small self-supplied users (<300,000 gallons per month) within the service areas of any of the CWS.

3.1 Peak Day Usage by Month

The following table provides peak day use by month for the Nindes Store CWS. The data is for the 12-month period from November 2107 through October 2018. During this 12-month period, the well meter was frequently not working. Several months have estimated data based on pumping times. The max day and max month are highlighted.

Table 3-1: Withdrawal Data – Nindes Store CWS

Month	Total Withdrawal (gallons)	Peak Day (gallons)
Nov-17	158,089	5,748
Dec-17	179,518	5,967
Jan-18	261,240	13,230
Feb-18	213,570	11,340
Mar-18	221,130	11,550
Apr-18	124,950	11,760
May-18	135,450	8,610
Jun-18	168,630	10,710
Jul-18	148,890	8,190
Aug-18	131,670	N/A
Sep-18	123,280	N/A
Oct-18	83,460	N/A
Total Withdrawal	**1,949,877**	

Table 3-2 on the following page provides withdrawal data for the Dahlgren system. The data for May is estimated. The max day and max month are highlighted. The withdrawal data is from October 2012 – September 2013.

Table 3-2: Withdrawal Data – Dahlgren CWS (gallons)[3]

Month	Bayberry (Standby)	Bumbrey	Monmouth Woods I	Monmouth Woods II	Saft	Payne	Total Withdrawal	Max Day
Oct 2012	-	206,800	-	2,135,400	1,140,000	3,877,500	7,359,700	225,500
Nov 2012	-	196,300	4,500	1,977,600	1,155,000	3,658,700	6,992,100	222,900
Dec 2012	-	194,100	44,600	1,984,000	1,193,000	3,541,600	6,957,300	199,500
Jan 2013	-	160,100	43,200	2,153,000	1,043,000	3,768,000	7,167,300	211,800
Feb 2013	-	236,100	42,800	1,536,200	1,370,000	3,364,700	6,549,800	440,500
Mar 2013	-	189,800	29,700	1,469,000	1,100,000	4,058,200	6,846,700	359,600
Apr 2013	-	166,800	23,900	2,179,500	997,000	4,219,500	7,586,700	259,200
May 2013	-	-	-	-	-	-	7,692,839	-
Jun 2013	-	785,300	43,900	100	3,832,000	3,635,900	8,297,200	335,900
Jul 2013	-	591,600	51,000	-	4,607,000	2,905,700	8,155,300	337,200
Aug 2013	-	568,100	113,600	-	3,398,000	4,045,300	8,125,000	349,800
Sept 2013	-	585,800	48,600	-	3,372,000	3,837,500	7,843,900	389,900
Total	**-**	**3,880,800**	**445,800**	**13,434,800**	**23,207,000**	**40,912,600**	**89,573,839**	

The information highlighted in the previous tables has been entered into VAHydro.

3.2 Small Self-Supplied Users within the Service Area of the CWS

The KGCSA's Regulation includes the following language regarding connecting to the water facilities:

> **SECTION 2. CONNECTION REQUIRED**
>
> The following regulations shall be observed to determine who shall be required to connect to the facilities of the Authority.
>
> A. Service to existing structures. An owner of property adjacent to a right-of-way or easement within which there is located a public water main or public wastewater line or both shall connect each existing structure or mobile home situated thereon to the facilities of the Authority; provided, however, an owner of property shall not be required to connect an existing structure or mobile home situated thereon to a public water main or to a public wastewater line when the following conditions apply;
>
> 1. When the Board determines that it is in the best interest of the Authority not to require connection: and

[3] The Owens CWS is included in the Dahlgren CWS under the Groundwater Withdrawal Permit. However, since the Owens system is reported separately in VAHydro – the Owens well is not included in these calculations (to avoid "double-counting" that withdrawal).

2. Water: the existing structure or mobile home is used principally for residential or commercial purposes and is served by a domestic supply or source of potable water which meets the standards established by the Virginia Department of Health.

B. Time to connect. The owner of an existing structure shall comply with this connection regulation within one (1) year after receiving from the Authority written notice that utility service is available.

C. Plumbing facilities. An existing structure required by these Regulations to connect to a utility service of the Authority but equipped with plumbing facilities required by the Virginia Uniform Statewide Building Code shall be so equipped and connected to the available utility service.

D. Service to future structure, new development. An owner of property shall be required to connect to the facilities of the Authority when a development, or a future structure not part of a development, shall be situated on property adjacent to a right-of-way or easement within which there is located a public water main or wastewater line. A replacement structure that is required due to a natural disaster or fire is not considered a future structure or new development.

As outlined above, all new construction (both residential and non-residential) that is within the service area of any of KGCSA's water systems is required to connect to the water system. The only homes or businesses that are not connected would be those that were in existence prior to the construction or extension of the water system and which have a well that meets VDH's regulations for drinking water.

In December 2018, DAA communicated with Jerry Gouldman, water operator for the KGCSA, and he verified that the KGCSA does not keep a database of "not-connected" homes or other structures, and, that to the best of his knowledge, there are very few, if any, such structures within the service areas that are not connected.

While the community water systems owned by other entities are not governed by the KGCSA regulation, there is no reason to believe that the mobile home parks and smaller subdivisions have any homes that are self-supplied. Review of available mapping verified that the service area of the small CWS (mobile home parks, in particular) appeared to include the number of homes that VDH reports – indicating that all homes within the service area are connected.

3.3 Disaggregated Use

DEQ researched disaggregated use information for the CWS shown in Table 3-3. Most of these systems are 100% residential, DAA reviewed mapping to verify that the systems appeared to serve only residential lots.

Table 3-3: Estimated Disaggregated Use

Community Water System	% Residential	% Non-Residential
American Historyland Trailer Park	100%	0%
Cedar Knoll Apartments	100%	0%
Chestnut Hill Mobile Home Park	100%	0%
Eagle Bay	100%	0%
Hanover Mobile Home Park	100%	0%
Heritage Hall Nursing Home	100%	0%
Holiday Inn Apartments	100%	0%
McDaniel Mobile Home Park	100%	0%
Naval Surface Weapons Center-Dahlgren Mainside[4]	6%	94%
Pineview Mobile Home Park	100%	0%
Presidential Lakes, Section 14	100%	0%
Princess Anne 205 / 301	100%	0%
Walnut Grove Mobile Home Park	100%	0%

-- End of Section --

[4] DAA spoke with Adrian Mood at the Naval Service Weapons Center (NSWC) to request disaggregated data for the Dahlgren Mainside system. The phone conversation was followed by an email. Mr. Moody replied that "disaggregated data is not available at this time". Based on the population (number of persons living on the base and an average of 50 gallons per person per day, it is estimated that the residential use is approximately 6% of the overall usage at the facility. DAA calculation and assumptions).
Assuming that the system has obtained a groundwater withdrawal permit, DEQ may already have access to disaggregated use provided by the CWS at the time the permit application was submitted. DAA made no additional attempts to obtain data from NSWC.

4.0 PROJECTIONS FOR COMMUNITY WATER SYSTEMS

DEQ's June 22, 2018 Memorandum requests projections by individual CWS including:

- Projected future demands – including annual average and peak monthly demands
- Projected future demands – disaggregated (i.e. into residential, non-residential, water losses, industrial, etc.)

4.1 Approach to Demand Projections

Most of the KGCSA systems submitted Groundwater Management Area existing user permits to DEQ in June 2014. Those permit applications included an analysis of water withdrawals by system for the timeframe from January 2009 – November 2013. The data included average month, maximum month and average day. In addition, the permit application included an analysis of the number of residential and non-residential connections in 2007 and in 2014. This analysis provided an indication of the growth rate or new connections per year during that seven-year period.

In addition, DAA reviewed the current demands and the permitted capacity of the CWS owned by others. Conservative growth projections were applied to each.

King George County provided information detailing the number of homes built in 2016, 2017 and 2018 – and the number of homes that were self-supplied vs. within the area of a community water system. The data is shown in the table below.

Table 4-1: New Homes, 2016 – 2017

	2016	2017	2018
Number of New Homes – Self-Supplied	54	69	72
Number of New Homes – CWS	53	32	59
Total	**107**	**101**	**131**

DAA reviewed available data for each of the twenty-one (21) CWS. Data reviewed included:

- Number of connections (VDH records)
- Estimated population (VDH records)
- Annual withdrawal for the most recent year that data is available (KGCSA records and VDH records)

- Disaggregated Usage
- For all KGCSA systems, the peak month and peak factor were calculated – for all other systems, peak factor was assumed to be 1.5.
- Disaggregation for the KGCSA systems was based on a review of billing data.
- Many of the smaller CWS are limited to a certain number of connections – for those systems, no growth was assumed.
- For all the larger systems, estimates of growth are based on recent data concerning number of connections per year.

The projected future demands are summarized below. The detailed demand projections are included in Appendix B, and DEQ has indicated that they will enter the information into VAHydro.

Table 4-2: Summary of Projected Demands – All CWS in King George County

Projected Growth / Assumptions	2018	2020	2025	2030	2035	2040
Projected Annual Withdrawal	405.82	421.07	439.64	458.18	475.06	491.94
Number of Connections	5,331	5,628	5,980	6,330	6,662	6,994
Residential Use %		57%	58%	59%	60%	61%
Non-Residential Use %		43%	42%	41%	40%	39%
UAW %		-	-	-	-	-
Residential Use (MGD)		239.35	255.64	271.90	286.50	301.10
Non-Residential Use (MGD)		181.72	184.00	186.28	188.56	190.84
Average Month	33.81	35.09	36.64	38.18	39.59	40.99

-- End of Section --

5.0 DEMAND MANAGEMENT

As noted in DEQ's June 22, 2018 Memorandum (see Appendix A), DEQ wants an "evaluation of the potential savings through water demand management actions."

5.1 Water Conservation and Management Plan

KGCSA will be submitting a detailed "Water Conservation and Management Plan" (WCMP) to DEQ in early 2019. The WCMP was developed in conjunction with the Expanded Use Permit Application for the Hopyard CWS. The WCMP is in draft form, and DEQ has provided some comments on the draft. Some of the strategies to reduce water consumption include the following:

- Provide training to every Service Authority employee that emphasizes water conservation and demand management. The training will include information about the Eastern Virginia Groundwater Management Area, the importance of reducing water use and strategies to monitor and record water used for flushing, backwashing and other operational uses – so that water losses can be monitored. The importance of identifying losses within the system (leaks, line breaks) – and effecting a repair a quickly as possible will be emphasized. Recommendation is that every employee receives training at the start of employment, and that the entire staff receive additional training on at least an annual basis.

- Develop improved KGCSA processes to evaluate withdrawal records and billing records on a monthly basis to constantly monitor and ***record*** any indication of leaks within the systems. Promptly address any known or suspected system leaks. Identify and notify customers who appear to have a leak on the customer side of the meter.

- Provide training for other County employees – including Parks and Recreation and the Public School employees to provide an understanding of the value of water conservation in their daily operations. Specific topics may focus on irrigation practices and facilities management – including leaking taps, sinks, toilets, etc. Recommendation is that training

is provided on an annual basis to all employees that manage facilities. May be conducted in conjunction with KGCSA training.

- Develop information for residential users that highlights the need to conserve water and that helps consumers understand that conservation is needed in order to conserve supply and to avoid or postpone additional capital investment in water source development. Recommendation is that the Service Authority develop consumer information for the website and provide informational mailers with the bills on at least a bi-annual basis.

- Evaluate the larger business/non-residential water users and develop strategies for providing water conservation information to those users.

It is important to recognize the KGCSA has fairly high water rates. As a result, consumers tend to be conscious of water use – because the bi-monthly bill increases with increased usage. And, for most customers, increased water usage means that not only the water bill goes up, but the sewer bill goes up too. A simple analysis of the average residential use per household is shown in Table 5-1 on the following page – the data is based on actual billing data. Many of these systems are showing average residential usage of less than 4,000 gallons per month. As a result, it is difficult to expect that dramatic reductions will take place as public awareness increases.

Table 5-1: Average Monthly Usage per Residential Connection

System	GPD / per Residential Connection	Average Usage Per Month (gallons)
Dahlgren CWS	149	4,470
Canterbury CWS	210	6,300
Hopyard CWS	132	3,960
St. Paul CWS	116	3,480
Fairview CWS	88	2,640
Circle CWS	109	3,270
Oakland Park CWS	140	4,200
Courthouse CWS	147	4,410

It is reasonable to expect that most businesses are aware of the cost of wasting water, and regardless of the amount of water needed to operate the business, they reduce consumption where possible. However, the information envisioned for the website and to be included in bills will encourage businesses/non-residential users to analyze water usage, and to the extent that it is cost-effective, to reduce water usage by fixing leaks, installing fixtures or equipment that that are more water-efficient, by changing landscaping practices, where practical to reduce outside water usage and to encourage employees to be water-wise.

5.2 Water Use Reduction

The County and KGCSA have not undertaken significant efforts to educate users as described above – outside of the incentive to reduce usage to save money. Therefore, it is difficult to predict how public education and improved practices of County employees/facilities will reduce usage. The WCMP targets an initial reduction of 5%. A 5% reduction in use would mean a reduction of approximately 21-25 million gallons per year. This 5% reduction is applied to the total CWS demands – including the systems not owned by KGCSA, and including the Dahlgren/NSWS system. KGCSA has less ability to influence the usage in those systems.

A 5% reduction applied only to the KGCSA systems would mean a reduction of approximately 11-14 million gallons per year.

-- End of Section --

Appendix A:

DEQ Memorandum Dated June 22, 2018 and Spreadsheet of Missing Well Data

Water Supply Plan Five-Year Update and Compliance Sheet

Office of Water Supply
Water Supply Planning Program

LOCALITY: KING GEORGE COUNTY | PLANNING REGION: LOCAL PLAN

DATE REVIEW INITIATED: 3/16/2018 | DATE REVIEW COMPLETED: 6/22/2018

LEAD WSP PLANNER: A. KIRK | REVIEWING WSP TEAM MEMBER: LAWSON

Outstanding Compliance Items from 2013 Final Compliance Checklist.

Item 1: Provide water source data for all community water systems and self-supplied users.

King George County:

☐ Complete ☒ Incomplete ☒ Not Applicable

Comments- See attached Excel sheet for specific missing information, I am working with our groundwater program to help find as much missing information as we can as well.

Item 2: Provide water use data for all community water systems and self-supplied users.

King George County:

☐ Complete ☒ Incomplete ☐ Not Applicable

Comments- **Peak day use by month not provided for:**

- **Nindes Store**
- **Dahlgren**

According to the plan, there are some self-supplied ground water users <300k per month within the community water source service areas, but the number is unknown. Provide any information for self-supplied users within community water system service areas.

Provide estimated disaggregated use information for:

- American Historyland Trailer Park
- Cedar Knoll Apartments
- Chestnut Hill Mobile Home Park
- Eagle Bay
- Hanover Mobile Home Park

- Heritage Hall Nursing Home
- Holiday Inn Apartments
- McDaniel Mobile Home Park
- Naval Surface Weapons Center-Dalgren Mainside
- Pineview Mobile Home Park
- Presidential Lakes, Section 14
- Princess Anne 205
- Princess Anne 301
- Walnut Grove Mobile Home Park

Item 3: Provide projections by individual community water system, including projected future water demands on both an annual average and peak monthly basis, and future demands disaggregated into categories of use, as requested in §9 VAC 25-780-100 D of the regulation.

King George County:

☐ Complete ☒ Incomplete ☐ Not Applicable

Comments-

Item 4: Evaluate potential savings through water demand management actions in the analysis of alternative water sources.

King George County:

☐ Complete ☒ Incomplete ☐ Not Applicable

Comments-pg. 132 additional water may be needed to serve Community Water Systems after 2030. Demand may exceed supply earlier if build-out occurs sooner than anticipated or a larger water user seeks to locate within the County. There are consideration with the possible expansion of the Groundwater Management Area into the County.

There is no description of potential water savings through demand management actions.

No description of various alternative including demand management and conservation measures.

Item 5: Describe practices to address water loss in the maintenance of systems to reduce unaccounted for water loss.

King George County:

☐ Complete ☒ Incomplete ☐ Not Applicable

Comments-"Currently, in King George there is no water loss monitoring plan that allows the Service Authority or community systems to monitor water losses." WSP pg. 129. The report suggests the County develop such a plan to monitor loss and manage leaks in the system. Provide an update on this plan or practices to address unaccounted water loss.

Other State Agency Comments:

Comments- Department of Game and Inland Fisheries, "Federally Endangered Atlantic Sturgeon and Shortnose Sturgeon need to be added to the listed species discussion in water supply plan."

Well Information for Wells in King George County VA

The cells highlighted in yellow indicate any information that was added to VAHydro in December 2018.

Source Name	System Name	System Type	DEQ Well ID	Well Depth (ft)	Well Diameter (inches)	Casing Depth (ft)	Screen Depth (ft)	Water Zones (ft)	Source Average Withdrawal Design Capacity (MGD)	Source Maximum Withdrawal Design Capacity (MGD)	Source Status	Notes
Well	American Historyland Trailer Park	Community Water System	148-00040	370	6	273	330-370	330-370		0.02	Active	6 (0-273), 3.875(273-370)
Well	Cameron Hills Golf Course	Large Self-Supplied User (more than 300,000 gpm)		363	4	363					Active	No Additional Info Available from VDH Records, presumably this user has a GW withdrawal permit. DEQ may have additional information in the Owner's permit application
Well	Cedar Knoll Apartments	Community Water System		475	12	475				0.08	Active	No Additional Info Available from VDH Records
Well	Chestnut Hill Mobile Home Park	Community Water System		920	4	four inches 0 to 357 feet and 2-inch 357 to 886 feet	886 to 920 feet	static water level 149 feet	No information		Active	Source EDS dated March 28, 2014
Well	Eagle Bay	Community Water System	PWSID 6099231	408	6	408	320-370			0.08	Active	
Well	Hanover Heights Mobile Home Park	Community Water System		483	4	483	477			0.024	Active	
Well	KGCSA: Nindes Store	Community Water System	148-00026	596	6	596	555-575	555-575		0.0312	Active	6(0-315), 3.875(315-896)
Well	KGCSA: Owens	Community Water System	148-00020	898	9.875	885	726-736, 790-800, 841-857, 865-880			0.048	Active	
Well	KGCSA: Potomac Landing	Community Water System		360	11	360	300-320, 335-350			0.076	Active	
Well 1	KGCSA: Presidential Lakes, Section 1-13	Community Water System	148-00039	881	7,6	745	475-505, 700-731, 835-855	475-510, 700-730, 835-855		0.12	Active	
Well 2	KGCSA: Presidential Lakes, Section 1-13	Community Water System	148-00041	1035	7,6	925	514-524, 560-570, 650-660	514-524, 560, 650-660		0.0664	Active	
Well	McDaniel Mobile Home Park	Community Water System	PWSID 6099305	800	8	789	761-781				Active	
Bronson Well	Naval Surface Weapons Center-Dahlgren Mainside	Community Water System		936	10	680	730				Active	No additional Information available / as per NSWC
Caskey Well	Naval Surface Weapons Center-Dahlgren Mainside	Community Water System	148-00018	900	20,15	710	674-686, 698-726, 739	674-686, 698-726, 732-739		0.5328	Active	
Reservoir Well	Naval Surface Weapons Center-Dahlgren Mainside	Community Water System		800	16	739	760				Active	
Well 1	Princess Anne 205	Community Water System	PWSID 6099556		10						Active	now Pineview MHP since 2010 / No additional well data available from VDHs files
Well 2	Princess Anne 205	Community Water System	PWSID 6099556		10						Active	
Well	Princess Anne 301	Community Water System	PWSID 6099555								Active	No well information available in VDH files
Well	Walnut Grove Mobile Home Park	Community Water System		250	4	250					Active	No additional information available in VDH records

Appendix B:

Demand Projections

Demand Projections - through 2040 - All CWS in King George County

Name of Community Water System	Owner	# of Connections	Estimated Population	Annual Withdrawal (Gallons) for most recent year that data is available	Annual Withdrawal (MG)	GPD	MGD and Max Day	Gallons Per Person Per Day	Projected Growth / Assumptions	Projected Annual Withdrawl (MG) 2020	2025	2030	2035	2040
AMER HISTORYLAND CORP TR PK	American Historyland	20	40	347,115	0.3471	951	0.0010	23.8	Limited to 30 ERCs, assume 1 connection per year over the next 10 years	0.3818	0.4686	0.5207	0.5207	0.5207
							0.0014		Number of Connections	22	27	30	30	30
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	0.38183	0.46861	0.52067	0.52067	0.52067
									Non-Residential Use (MGD)	-	-			
									UAW	-	-	-	-	-
									Average Month	0.0318	0.0391	0.0434	0.0434	0.0434
									Peak Factor (assumed)	1.50	1.50	1.50	1.50	1.50
									Peak Month	0.0477	0.0586	0.0651	0.0651	0.0651
PRESIDENTIAL LAKES, SECT. 14	Aqua Virginia	317	951	19,464,355	19.4644	53,327	0.0533	56.1	Capacity is at least 87,200 gpd (or 31.82 MGY). Assume four connections per year until capacity is reached.	19.9544	21.7555	23.5566	25.3577	27.1588
							0.0800		Number of Connections	325	345	365	385	405
									Residential Use % (includes community center, pool, etc.)	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	19.95436	21.75547	23.55659	25.35771	27.15883
									Non-Residential Use (MGD)	-	-	-	-	-
									UAW	-	-	-	-	-
									No data available to determine % of UAW or the usage at the community center, etc.					
									Average Month	1.6629	1.8130	1.9630	2.1131	2.2632
									Peak Factor (assumed)	1.50	1.50	1.50	1.50	1.50
									Peak Month	2.4943	2.7194	2.9446	3.1697	3.3949
CEDAR KNOLL APT	Cedar Knoll Apartments LLC	8	50	347,115	0.3471	951	0.0010	19.0	Design Capacity is 21 apartments. No growth projected.	0.3471	0.3471	0.3471	0.3471	0.3471
							0.0014		Number of Connections	8	8	8	8	8
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%

Name of Community Water System	Owner	# of Connections	Estimated Population	Annual Withdrawal (Gallons) for most recent year that data is available	Annual Withdrawal (MG)	GPD	MGD and Max Day	Gallons Per Person Per Day	Projected Growth / Assumptions	2020	2025	2030	2035	2040
									Residential Use (MGD)	0.34712	0.34712	0.34712	0.34712	0.34712
									Non-Residential Use (MGD)	-	-			
									UAW	-	-	-	-	-
									Average Month	0.0289	0.0289	0.0289	0.0289	0.0289
									Peak Factor (assumed)	1.50	1.50	1.50	1.50	1.50
									Peak Month	0.0434	0.0434	0.0434	0.0434	0.0434
NAVAL SUPPORT FACILITY, DAHLGREN	Dahlgren Naval Support	870	7,872	152,876,235	152.8762	418,839	0.4188	53.2	Design Capacity is 1.17 MGD	152.8000	152.8000	152.8000	152.8000	152.8000
									Number of Connections	870	870	870	870	870
									Residential Use %	6%	6%	6%	6%	6%
									Non-Residential Use %	94%	94%	94%	94%	94%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	9.16800	9.16800	9.16800	9.16800	9.16800
									Non-Residential Use (MGD)	143.63200	143.63200	143.63200	143.63200	143.63200
									UAW	-	-	-	-	-
									UAW	-	-	-	-	-
									Average Month	12.7333	12.7333	12.7333	12.7333	12.7333
									Peak Factor (assumed)	1.50	1.50	1.50	1.50	1.50
									Peak Month	19.1000	19.1000	19.1000	19.1000	19.1000
WALNUT GROVE MHP	Green Acres Landscaping	16	48	438,000	0.4380	1,200	0.0012	25.0	There is no meter assume 25 gallons per person per day; EDS limits the connections to 15 homes. Assume no growth	0.4380	0.4380	0.4380	0.4380	0.4380
							0.0018		Number of Connections	16	16	16	16	16
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	0.43800	0.43800	0.43800	0.43800	0.43800
									Non-Residential Use (MGD)	-	-	-	-	-
									UAW	-	-	-	-	-
									Average Month	0.0365	0.0365	0.0365	0.0365	0.0365
									Peak Factor	1.50	1.50	1.50	1.50	1.50
									Peak Month	0.0548	0.0548	0.0548	0.0548	0.0548
HOLIDAY INN MHP	Holiday Inn Apts.	11	50	1,311,810	1.3118	3,594	0.0036	71.9	Limited to 11 connections, assume no growth	1.3118	1.3118	1.3118	1.3118	1.3118
							0.0054		Number of Connections	11	11	11	11	11
									Residential Use %	100%	100%	100%	100%	100%

Name of Community Water System	Owner	# of Connections	Estimated Population	Annual Withdrawal (Gallons) for most recent year that data is available	Annual Withdrawal (MG)	GPD	MGD and Max Day	Gallons Per Person Per Day	Projected Growth / Assumptions	2020	2025	2030	2035	2040
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	1.31181	1.31181	1.31181	1.31181	1.31181
									Non-Residential Use (MGD)	-	-	-	-	-
									UAW	-	-	-	-	-
									Average Month	0.1093	0.1093	0.1093	0.1093	0.1093
									Peak Factor	1.50	1.50	1.50	1.50	1.50
									Peak Month	0.1640	0.1640	0.1640	0.1640	0.1640
MCDANIEL MOBILE HOME PARK	Indian Town Properties	49	147	2,925,110	2.9251	8,014	0.0080	54.5	Limited to 49 connections, assume no growth	2.9251	2.9251	2.9251	2.9251	2.9251
							0.0120		Number of Connections	49	49	49	49	49
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	2.92511	2.92511	2.92511	2.92511	2.92511
									Non-Residential Use (MGD)	-	-	-	-	-
									UAW	-	-	-	-	-
									Average Month	0.2438	0.2438	0.2438	0.2438	0.2438
									Peak Factor	1.50	1.50	1.50	1.50	1.50
									Peak Month	0.3656	0.3656	0.3656	0.3656	0.3656
HANOVER MHP	M. Rollins	53	108	2,353,155	2.3532	6,447	0.0064	59.7	Limited to 55 connections, assume no growth	2.3532	2.3532	2.3532	2.3532	2.3532
							0.0097		Number of Connections	53	53	53	53	53
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	2.35316	2.35316	2.35316	2.35316	2.35316
									Non-Residential Use (MGD)	-	-	-	-	-
									UAW	-	-	-	-	-
									Average Month	0.1961	0.1961	0.1961	0.1961	0.1961
									Peak Factor	1.50	1.50	1.50	1.50	1.50
									Peak Month	0.2941	0.2941	0.2941	0.2941	0.2941
CHESTNUT HILL MOBILE HOME PARK	Office Hall Properties	30	65	2,349,505	2.3495	6,437	0.0064	99.0	Limited to 30 connections, assume no growth	2.3495	2.3495	2.3495	2.3495	2.3495
							0.0097		Number of Connections	30	30	30	30	30

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Name of Community Water System	Owner	# of Connections	Estimated Population	Annual Withdrawal (Gallons) for most recent year that data is available	Annual Withdrawal (MG)	GPD	MGD and Max Day	Gallons Per Person Per Day	Projected Growth / Assumptions	2020	2025	2030	2035	2040
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	2.34951	2.34951	2.34951	2.34951	2.34951
									Non-Residential Use (MGD)	-	-	-	-	-
									UAW	-	-	-	-	-
									Average Month	0.1958	0.1958	0.1958	0.1958	0.1958
									Peak Factor	1.50	1.50	1.50	1.50	1.50
									Peak Month	0.2937	0.2937	0.2937	0.2937	0.2937
PRINCESS ANNE 301	Office Hall Properties	13	30	1,411,455	1.4115	3,867	0.0039	128.9	Limited to 49 connections, assume no growth	1.4115	1.4115	1.4115	1.4115	1.4115
							0.0058		Number of Connections	13	13	13	13	13
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	1.41146	1.41146	1.41146	1.41146	1.41146
									Non-Residential Use (MGD)	-	-	-	-	-
									UAW	-	-	-	-	-
									Average Month	0.1176	0.1176	0.1176	0.1176	0.1176
									Peak Factor	1.50	1.50	1.50	1.50	1.50
									Peak Month	0.1764	0.1764	0.1764	0.1764	0.1764
PINEVIEW MHP 1-3	Pineview Park LLC	134	400	11,337,995	11.3380	31,063	0.0311	77.7	Limited to 19,600 gpd; unless system capacity has been increased, the system cannot support additional units. Assume no growth.	11.3380	11.3380	11.3380	11.3380	11.3380
							0.0466		Number of Connections	134	134	134	134	134
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	11.33800	11.33800	11.33800	11.33800	11.33800
									Non-Residential Use (MGD)	-	-			
									UAW	-	-	-	-	-
									Average Month	0.9448	0.9448	0.9448	0.9448	0.9448
									Peak Factor	1.50	1.50	1.50	1.50	1.50
									Peak Month	1.4172	1.4172	1.4172	1.4172	1.4172

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Name of Community Water System	Owner	# of Connections	Estimated Population	Annual Withdrawal (Gallons) for most recent year that data is available	Annual Withdrawal (MG)	GPD	MGD and Max Day	Gallons Per Person Per Day	Projected Growth / Assumptions	2020	2025	2030	2035	2040
EAGLE BAY	SEVentures, Inc.	15	25	1,188,440	1.1884	3,256	0.0033	130.2	Limited to 49 connections or 43,200 gpd (15.77 MGY), whichever comes first. Assume 3 connections per year until capacity is reached.	2.1297	3.7341	5.3385	5.3385	5.3385
							0.0049		Number of Connections	18	33	48	48	48
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	2.12968	3.73408	5.33847	5.33847	5.33847
									Non-Residential Use (MGD)	-	-			
									UAW	-	-	-	-	-
									Average Month	0.1775	0.3112	0.4449	0.4449	0.4449
									Peak Factor	1.50	1.50	1.50	1.50	1.50
									Peak Month	0.2662	0.4668	0.6673	0.6673	0.6673
CANTERBURY SUBDIVISION	KGCSA	76	158	6,074,330	6.0743	16,642	0.0166	105.1	Recent growth has been one connection per year - design capacity is 40,000 gpd (14.6 MGY)	6.6327	7.0315	7.4303	7.8291	8.2280
							0.0275		Number of Connections	83	88	93	98	103
									Residential Use %	91%	91%	91%	91%	91%
									Non-Residential Use %	9%	9%	9%	9%	9%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	6.03574	6.39866	6.76159	7.12451	7.48744
									Non-Residential Use (MGD)	0.59694	0.63283	0.66873	0.70462	0.74052
									UAW	-	-	-	-	-
									Average Month	0.5527	0.5860	0.6192	0.6524	0.6857
									Peak Factor	1.65	1.65	1.65	1.65	1.65
									Peak Month	0.9120	0.9668	1.0217	1.0765	1.1313
FAIRVIEW BEACH/POT. LANDING	KGCSA	336	853	13,047,290	13.0473	35,746	0.0357	41.9	Recent growth has been ten connections per year - assume only 5 per year - design capacity is 42,000 gpd (15.33 MGY).	13.5518	14.4117	15.2717	16.1316	16.9916
							0.0647		Number of Connections	377	402	427	452	477
									Residential Use %	81%	81%	81%	81%	81%

Name of Community Water System	Owner	# of Connections	Estimated Population	Annual Withdrawal (Gallons) for most recent year that data is available	Annual Withdrawal (MG)	GPD	MGD and Max Day	Gallons Per Person Per Day	Projected Growth / Assumptions	2020	2025	2030	2035	2040
									Non-Residential Use %	19%	19%	19%	19%	19%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	10.97695	11.67350	12.37006	13.06661	13.76317
									Non-Residential Use (MGD)	2.57484	2.73823	2.90162	3.06501	3.22840
									UAW	-	-	-	-	-
									Average Month	1.1293	1.2010	1.2726	1.3443	1.4160
									Peak Factor	1.81	1.81	1.81	1.81	1.81
									Peak Month	2.0441	2.1738	2.3035	2.4332	2.5629
HOPYARD FARM	KGCSA	243	486	12,325,685	12.3257	33,769	0.0338	69.5	Recent growth has been approximately 25 connections per year year - projections assume 25 per year - design capacity is 552,134 gpd (201.53 MGY).	18.1081	21.2783	24.4485	27.6187	30.7889
							0.0652		Number of Connections	357	482	607	732	857
									Residential Use %	94%	94%	94%	94%	94%
									Non-Residential Use %	19%	6%	6%	6%	6%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	17.02162	20.00159	22.98157	25.96154	28.94152
									Non-Residential Use (MGD)	1.08649	1.27670	1.46691	1.65712	1.84733
									UAW	-	-	-	-	-
									Average Month	1.5090	1.7732	2.0374	2.3016	2.5657
									Peak Factor	1.93	1.93	1.93	1.93	1.93
									Peak Month	2.9124	3.4223	3.9321	4.4420	4.9519
KGCSA-DAHLGREN	KGCSA	1,099	3,129	73,306,235	73.3062	200,839	0.2008	64.2	Recent growth has been approximately 10 connections per year year - design capacity is +260,000 gpd (+94.9 MGY).	74.6416	78.2556	81.8697	85.4837	89.0977
							0.2531		Number of Connections	1,099	1,149	1,199	1,249	1,299
									Residential Use %	74%	74%	74%	74%	74%
									Non-Residential Use %	26%	26%	26%	26%	26%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	55.23481	57.90918	60.58355	63.25792	65.93228
									Non-Residential Use (MGD)	19.40682	20.34647	21.28611	22.22575	23.16540
									UAW	-	-	-	-	-

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Name of Community Water System	Owner	# of Connections	Estimated Population	Annual Withdrawal (Gallons) for most recent year that data is available	Annual Withdrawal (MG)	GPD	MGD and Max Day	Gallons Per Person Per Day	Projected Growth / Assumptions	2020	2025	2030	2035	2040
									Average Month	6.2201	6.5213	6.8225	7.1236	7.4248
									Peak Factor	1.26	1.26	1.26	1.26	1.26
									Peak Month	7.8374	8.2168	8.5963	8.9758	9.3553
KING GEORGE CO. COURTHOUSE	KGCSA	1,525	4,179	93,669,585	93.6696	256,629	0.2566	61.4	Recent growth has been approximately 15 connections per year year - design capacity is 478,400 gpd (174.47 MGY). Usage includes Heritage Hall.	97.3549	102.5667	107.7785	112.9903	118.2021
							0.3234		Number of Connections	1,617	1,692	1,767	1,842	1,917
									Residential Use %	87%	87%	87%	87%	87%
									Non-Residential Use %	26%	13%	13%	13%	13%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	84.6988	89.2331	93.7673	98.3016	102.8358
									Non-Residential Use (MGD)	12.65614	13.33368	14.01121	14.68874	15.36627
									UAW	-	-	-	-	-
									Average Month	8.1129	8.5472	8.9815	9.4159	9.8502
									Peak Factor	1.26	1.26	1.26	1.26	1.26
									Peak Month	10.2223	10.7695	11.3167	11.8640	12.4112
NINDES STORE	KGCSA	36	108	1,949,877	1.9499	5,342	0.0053	49.5	Limited to 37 connections	1.9499	1.9499	1.9499	1.9499	1.9499
							0.0086		Number of Connections	36	36	36	36	36
									Residential Use %	100%	100%	100%	100%	100%
									Non-Residential Use %	0%	0%	0%	0%	0%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	1.9499	1.9499	1.9499	1.9499	1.9499
									Non-Residential Use (MGD)	-	-	-	-	-
									UAW	-	-	-	-	-
									Average Month	0.1625	0.1625	0.1625	0.1625	0.1625
									Peak Factor	1.61	1.61	1.61	1.61	1.61
									Peak Month	0.2616	0.2616	0.2616	0.2616	0.2616
OAKLAND PARK	KGCSA	325	972	1,949,877	1.9499	49,482	0.0495	50.9	Assume 5 new residential connections per year and 1 new non-residential connection per year. and	3.7830	5.4495	7.1160	8.7825	10.4490
							0.0777		Number of Connections	355	385	415	445	475
									Residential Use %	86%	86%	86%	86%	86%

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Name of Community Water System	Owner	# of Connections	Estimated Population	Annual Withdrawal (Gallons) for most recent year that data is available	Annual Withdrawal (MG)	GPD	MGD and Max Day	Gallons Per Person Per Day	Projected Growth / Assumptions	2020	2025	2030	2035	2040
									Non-Residential Use %	14%	14%	14%	14%	14%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	3.2534	4.6866	6.1198	7.5529	8.9861
									Non-Residential Use (MGD)	0.52962	0.76293	0.99624	1.22955	1.46286
									UAW	-	-	-	-	-
									Average Month	0.3153	0.4541	0.5930	0.7319	0.8707
									Peak Factor	1.57	1.57	1.57	1.57	1.57
									Peak Month	0.4949	0.7130	0.9310	1.1490	1.3671
ST. PAUL`S CHURCH	KGCSA	62	132	2,559,745	2.5597	7,013	0.0070	53.1	Limited to 60 connections	2.5597	2.5597	2.5597	2.5597	2.5597
							0.0109		Number of Connections	62	62	62	62	62
									Residential Use %	98%	98%	98%	98%	98%
									Non-Residential Use %	2%	2%	2%	2%	2%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	2.5086	2.5086	2.5086	2.5086	2.5086
									Non-Residential Use (MGD)	0.05119	0.05119	0.05119	0.05119	0.05119
									UAW	-	-	-	-	-
									Average Month	0.2133	0.2133	0.2133	0.2133	0.2133
									Peak Factor	1.55	1.55	1.55	1.55	1.55
									Peak Month	0.3306	0.3306	0.3306	0.3306	0.3306
CIRCLE	KGCSA	93	191	4,586,590	4.5866	12,566	0.0126	109.0	Design capacity is 23,600 gpd (8.61 MGY). Assume 2 connections each 5 years.	4.7457	4.9049	5.0640	5.2232	5.3823
							0.0195		Number of Connections	93	95	97	99	101
									Residential Use %	75%	75%	75%	75%	75%
									Non-Residential Use %	25%	25%	25%	25%	25%
									UAW %	0%	0%	0%	0%	0%
									Residential Use (MGD)	3.5593	3.6787	3.7980	3.9174	4.0367
									Non-Residential Use (MGD)	1.1864	1.2262	1.2660	1.3058	1.3456
									UAW	-	-	-	-	-
									Average Month	0.3955	0.4087	0.4220	0.4353	0.4485
									Peak Factor	1.55	1.55	1.55	1.55	1.55
									Peak Month	0.6130	0.6335	0.6541	0.6747	0.6952

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Name of Community Water System	Owner	# of Connections	Estimated Population	Annual Withdrawal (Gallons) for most recent year that data is available	Annual Withdrawal (MG)	GPD	MGD and Max Day	Gallons Per Person Per Day	Projected Growth / Assumptions	2020	2025	2030	2035	2040
Totals		**# of Connections**	**Estimated Population**	**Annual Withdrawal (Gallons) for**	**Annual Withdrawal (MG)**	**GPD**	**MGD and Max Day**	**Gallons Per Person Per Day**	**Projected Growth / Assumptions**	**2020**	**2025**	**2030**	**2035**	**2040**
		5,331	19,994	405,819,504	405.8195	1,155,974	1.1560	55.6	Projected Annual Withdrawal	421.0675	439.6402	458.1782	475.0597	491.9412
									Number of Connections	5,628	5,980	6,330	6,662	6,994
									Residential Use %	57%	58%	59%	60%	61%
									Non-Residential Use %	43%	42%	41%	40%	39%
									UAW %	-	-	-	-	-
									Residential Use (MGD)	239.3470	255.6400	271.8981	286.4999	301.1016
									Non-Residential Use (MGD)	181.7205	184.0002	186.2800	188.5598	190.8395
									UAW	-	-	-	-	-
									Average Month	35.0890	36.6367	38.1815	39.5883	40.9951
									Peak Factor					
									Peak Month					

Summary:					
Increase in Connections (5 years)		352	350	332	332
Number of New Connections Per Year		70	70	66	66
Increase in annual withdrawal (per 5-year period is <1%)	4%	4%	4%	4%	4%
5% Reduction - All CWS	21.05	21.98	22.91	23.75	24.60
Projected Demands KGCSA Systems	223.33	238.41	253.49	268.57	283.65
5% Reduction - KGCSA systems	11.17	11.92	12.67	13.43	14.18