

# **Furry Creek Updated Wastewater Master Plan**

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## 1. INTRODUCTION

An original rezoning design brief was submitted to the SLRD in May 2019 and revised in September and November of 2019. The SLRD retained WSP to review details regarding, Water, Storm and Sanitary infrastructure. WSP requested separate design briefs for each. Creus submitted a separate Sanitary Design Brief in April 2020. WSP provided a review by email dated April 21, 2020. These comments were addressed and responded to within an updated report Rev 3 on May 27th. Further review and discussion were had with WSP which resulted in the email of June 6, 2020 which is included in Appendix 24: The Rev 4 version of the report included the title renaming to “Master Wastewater Plan” alongside with addressing the comments and was submitted on June 24<sup>th</sup> 2020.

The Furry Creek lands are an assembly of private lands that were created in the early part of the last century and assembled together and sold to Tanac Lands in 1990. The lands are within the SLRD in Area D located approximately 30 km's north of West Vancouver and 15 km's south of Squamish. The original subject property comprises approximately 1036 acres and is just south of Britannia Beach along Howe Sound. The project extents are shown in Figure 1. Which is also contained in Appendix 1:

Planning for the Furry Creek community began in 1990 following the purchase of the property by Tanabe Corporation of Japan under the Canadian company, Tanac Land Development Corporation. Since the lands are in an unincorporated area, an application was submitted to the Ministry of Transportation and Highways, and in 1991 Preliminary Layout Approval (PLA) was granted for a complete community comprising a golf course, up to 920 residential units, a 300-room resort or hotel, marina, commercial and community facilities. This PLA was reissued a number of times based on a number of studies including geotechnical studies by Thurber Engineering, Water studies by Thurber and Brown Erdman, road designs, sewage treatment studies, archeological reviews and foreshore and upland environmental assessments. The development areas were identified as Marina, Waterfront, Benchlands, Uplands, Northwest, Northeast, Mountain and Highlands. Currently there is 56 townhouse units in Oliver's Landing strata, an 8,000 ft<sup>2</sup> community building, 4 duplex lots (1 duplex built), 90 single family lots and the golf course. These single family and duplex are freehold other than single family strata at Oceans Crest at the south entrance

In 2017 Fine Peace Furry Creek Developments Ltd (FPFCD), the Canadian subsidiary of an international company active in the development of golf course and resort oriented residential communities, purchased the holdings of Burrard Group. In 2018, it acquired the Tanac Lands from Parklane Homes. FPFCD is determined to realize the original vision of a complete recreational/residential community at Furry Creek, with a variety of housing choices, neighborhood village retail space, resort facilities, a residents'-only marina, community facilities and an extensive open space and trail network.

Creus Engineering Ltd. has been retained by FPFCD to provide a review of the civil servicing requirements for the above project which includes site access, water works, sanitary collection and treatment, stormwater, outside utilities, Canada post and solid waste management. One of the Principals of Creus had previously been an employee of Tanac during the development stages and had worked as a consultant for Tanac, Burrard Group and Parklane on the project.

The lands are part of an overall zoning proposal. Creus prepared a design brief in support of the zoning and submitted that to the SLRD originally in September of 2019. This report formed part

of that submission but has been segregated for convenience. The Appendix numbers have been maintained from the original reports.

Each subdivision requires approval of the Provincial Approving officer. The subdivision process would include referrals to all relevant regulatory authorities including CN rail when works are adjacent to rail, Ministry of Transportation and Infrastructure (MOTI) roads division for any public roads or roads accessing public road, BC Hydro when adjacent to BC Hydro Right-of-Way (ROW), DFO and FLNRO in relation to environmental concerns, Vancouver Coastal Health (VCH) to confirm that the water system expansion is permitted for expansion and that the operating permit is in good standing and can accommodate the additional demand, Waste Management Branch to ensure that the WWTP permit is in good standing and that the additional flows can be accommodated by the permit. The SLRD has always played a significant role in any subdivision as the local governing authority but also as it related to SLRD being the agency that owns and manages the water system, the sanitary sewer system, streetlights, diking, public open space and fire protection. As such each subdivision will have to gain a significant number of permits and approvals from all levels of government including geotechnical sign-offs, environmental approvals and confirmation of water and sewer servicing. It is a reality that all roads, services and subdivision will have to meet all provincial and federal regulation and be designed and constructed in accordance with the most recent version of the Electoral Area D subdivision and Development Servicing (Planned Communities) Bylaw No. 741, 2002.

This Master Plan will provide a review of the existing sanitary sewer infrastructure capacity. It will also define any special design requirements / significant offsite upgrades required to service the proposed development.

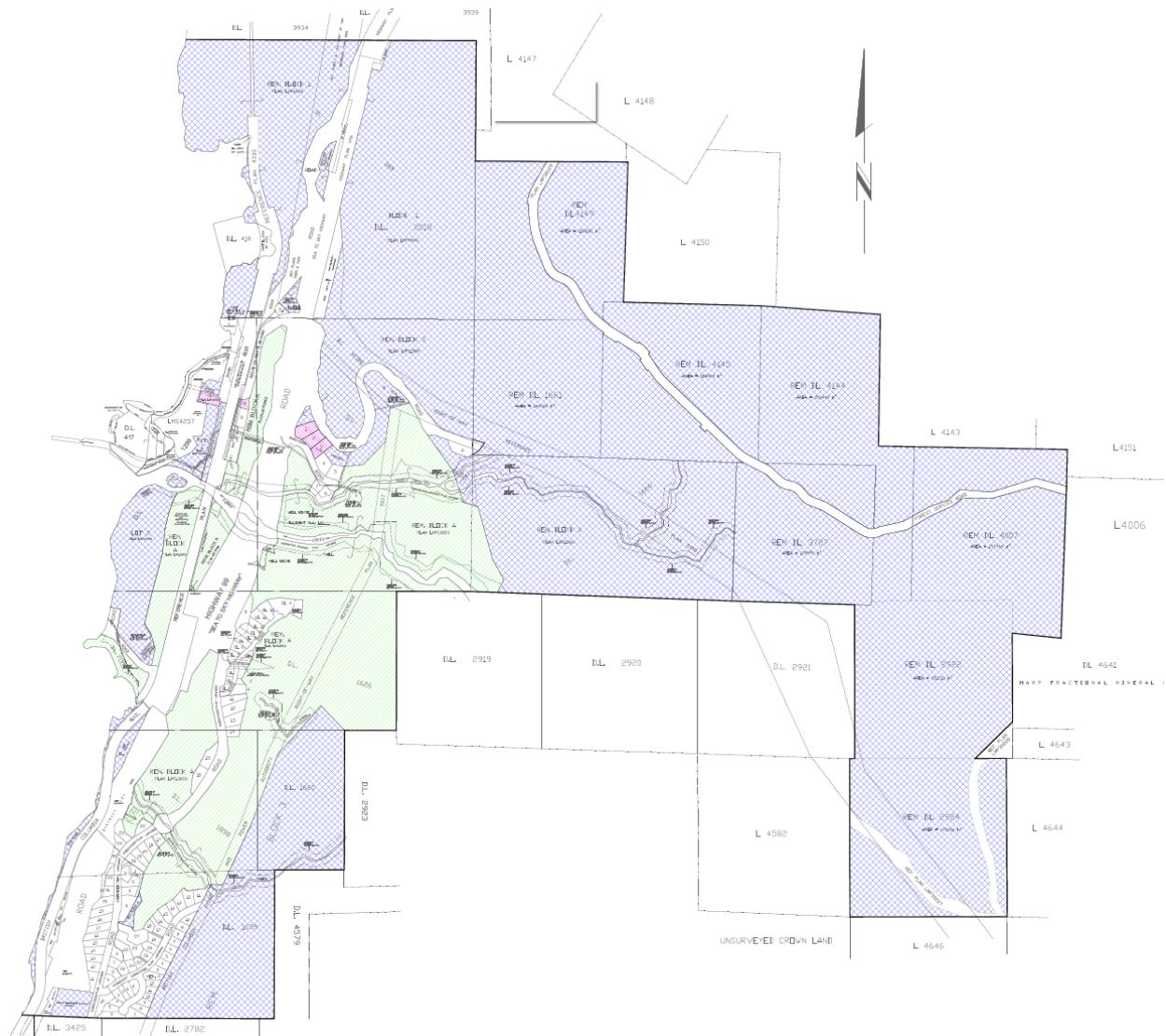


Figure 1: Context Legal plan from Bennett

## **2. SANITARY SEWER EXISTING CONDITIONS**

### **2.1. COLLECTION SYSTEM**

A gravity piped sanitary sewage collection system has been constructed to serve the first neighbourhoods constructed from 1993 to the Salal Court Subdivision in 1997. The Wastewater Treatment Plant (WWTP) was also installed in 1993. An upgrade was designed by Associated Engineering (AE) and installed in 2005. A copy of the current plant design is included as Associated Engineering Plan 032488-1-103 in Appendix 14: An outfall was installed in 1993 and runs from the WWTP to Howe Sound and is contained in SRW Plan LMP15937. The approval was updated under the Municipal Sewage Regulations in Dec 2004 under file # RE-10931 in the name of the SLRD allowing a maximum discharge of 1,900 m<sup>3</sup>/day of secondary disinfected sewage effluent. The approval outlines staged upgrades to the treatment plant based on measured flow. The WWTP is located on Lot 1 of Block 3 which is between the 17<sup>th</sup> fairway and CN rail line opposite Oliver's Landing and is accessed via Waterfront Drive. The lot is owned by the SLRD and has a total area of 0.376 ha as identified in legal plan LMP16073.

The current collection system is summarized as follows and is distinguished as three key mains entering into the WWTP. Entering the WWTP directly from the east is a 300mm gravity main which runs under the highway and fairway 17. This collects from the current 200 mm line within the Country Club Road which services the single family lots on that road and the clubhouse. A dead-end cap has been provided for future Collector and Uplands developments. Entering the WWTP directly from the south is the existing Benchlands lots on Furry Creek Drive, Ocean Crest, Stonegate Drive and Salal court which are collected in a 250mm gravity line that runs to the intersection of Furry Creek Drive and the southern highway access. From there it crosses under the highway and runs to Sewage Lift Station (SLS-1) located at 16<sup>th</sup> tee. This station pumps through a 200mm forcemain passing through the 16<sup>th</sup> and 17<sup>th</sup> fairway and is reduced to a 150mm forcemain at the cart path bridge crossing and back to a 200mm forcemain to the north side of Furry Creek before entering the WWTP. The pump station and forcemain are given tenure by a SROW registered as LMP31371. Entering the WWTP from the west is the Oliver's Landing subdivision which is a townhouse development to the west of the CN rail tracks. There is a 200mm collection system which runs to SLRD owned lift station (SLS-2) located in SROW Plan LMP42746. This pumps via a 100mm forcemain heading north part-way along Waterfront Drive (incorrectly labelled as Beach Drive on google maps) where it crosses east and connects into a 200mm gravity main in Howe Sound Drive (labelled as Waterfront Drive on google) which continues south and outlets into the WWTP. This 200mm gravity main runs north parallel to HWY 99, it continues north past the Sea View Drive interchange and along Howe Sound Drive where two dead-end caps are provided for the future developments in the Northeast and Northwest.

The SLRD currently operates the plant and sanitary sewer system under contract to Corex. The costs are paid for by taxes paid in the Furry Creek Local Service Area D under bylaw 741, 2002.

## 2.2. TREATMENT SYSTEM

As indicated above the WWTP was installed and turned over to the SLRD. Upgrades were performed by the Developer in 2005 as per approved design outlined in the Associated Engineering (AE) Reports "Upgrading and Expansion Plan, dated 2004, and Technical Memorandum No.1, dated 2008 "Furry Creek Wastewater Treatment Plant Ultimate Expansion Conceptual Options". In general, the SLRD accepted design criteria from the AE reports in the approval of WWTP upgrade and these criteria have been used in the WWTP analysis and will be discussed in further detail in the following sections. The AE reports are included in Appendix 10:

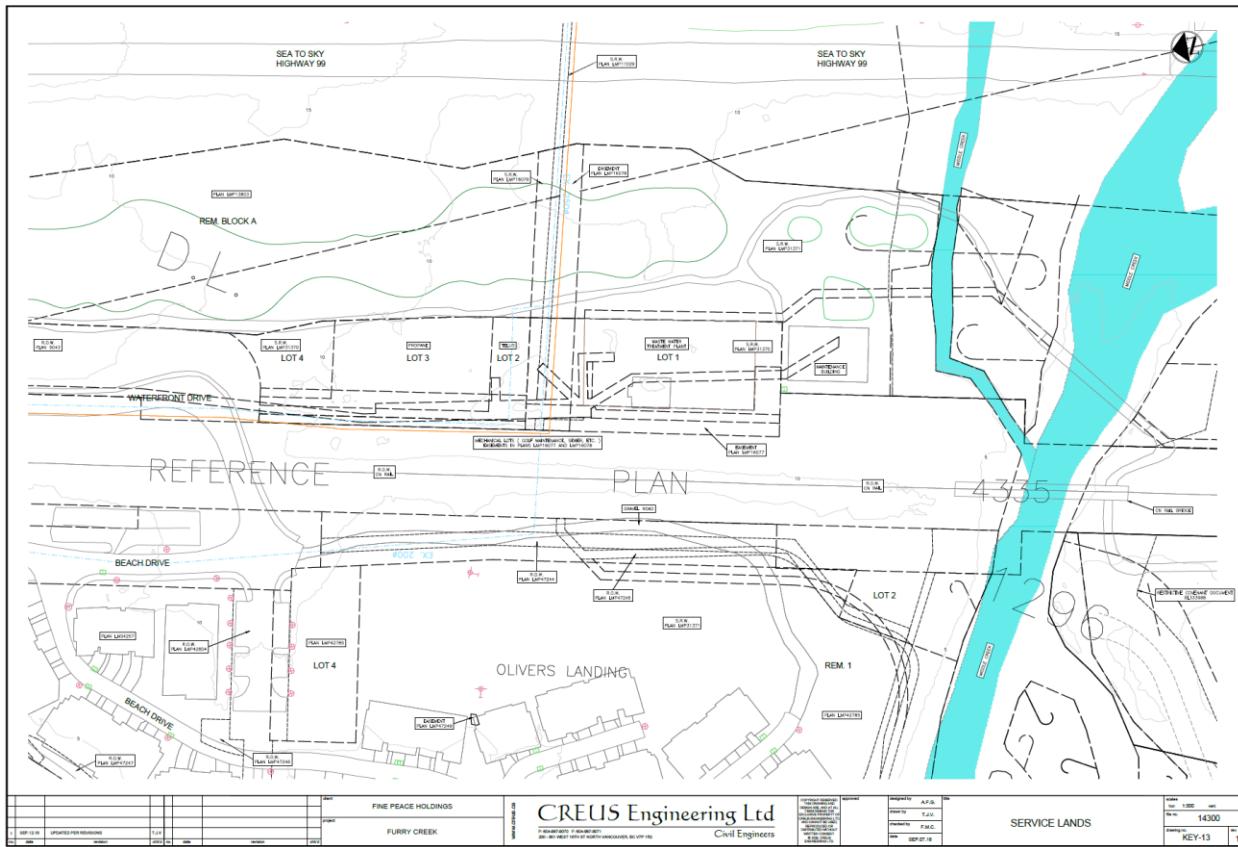


Figure 2: Service Area

The current plant is sized to accommodate up to 530 residential units and the golf course which is an Average Day Flow (ADF) of 600m<sup>3</sup>/d and a Peak Day Flow (PDF) of 1600m<sup>3</sup>/d.

Development beyond those flow limits will trigger a further upgrade. The current approval under the Municipal Sewage Regulation File #Re-10931 is for a maximum of 1,900m<sup>3</sup>/d. The WWTP is located on Lot 1 of Block 3 which is 0.376 ha in site and was sized to accommodate the expected ultimate development demands at the time of subdivision and was confirmed to have excess physical space in the AE report in 2008. The Option B ultimate expansion plant design by AE is more efficient use of the site and shows there is excess buildable land of 700 m<sup>2</sup> at the south-west and 350m<sup>2</sup> to the north. This does not use the land in the panhandle or in the 6.0 m access to the maintenance yard to the south. It does allow for partial use of the area to the north (approximately 50%) which contains services but ones that could be reconfigured as part of the overall design update, refer to Figure 7.

### 3. DESIGN CRITERIA

In review with SLRD, they have acknowledged the use of more real-world flow criteria used by AE in sizing the WWTP and designing the stage 2 and ultimate expansion plants as well as in the water supply criteria on domestic water under AE and Hunter Laird (HL). SLRD requested that Creus obtain more recent data for analysis as AE is based on data of 2003 and earlier. To date a lack of data has been made available to Creus between the period of 2003 to 2017 and have only received effluent data of the WWTP for 2018, 2019 and partial 2020. It was noted that Creus would obtain on-going data and it is recommended that a water meter be installed at the

clubhouse and the maintenance building to more accurately measure golf course flow to be able to track domestic flow. As well, the WWTP should have the effluent meter recalibrated to check accuracy and influent measurements made which was last done in 2008. SLRD have however requested that the current Wastewater Master Plan check the capacity of the existing pipe network and lift stations to meet current Bylaw 741 requirements with exception of allowing a variance of 2.6 capita/household and a peaking factor of 3 for collection and WWTP sizing, note that Creus Engineers have used a more conservative peaking factor of 3.5 for collection calculations. The flow for the WWTP remained at the more conservative value based on records and is further discussed in section 3.2 below. AE reports to date have demonstrated that those are conservative numbers. WSP has indicated that the SLRD specifically allows for review of data to update design standards and have done the same in other surrounding communities such as Porteau and Britannia. Due to current gaps in actual flow information made available to Creus, and the fact that there is sufficient capacity in the existing system for a significant number of additional units before the next upgrade the above variance criteria is deemed suitable for zoning and to allow for more data collection. The data is to be updated and collected over the coming years and used to demonstrate what a reasonable actual flow is given the results of the data collection and a variance would then be applied for at the next design submittal for the plant.

There was also discussion that Creus is showing a higher number of units in the collection sizing than in the WWTP sizing. This difference is to reflect that while the total number of units in the community is fixed by the zoning, where the dwellings occur on the site may have some flexibility.

### **3.1. DESIGN CRITERIA FOR COLLECTION**

The SLRD has Bylaw 741 which sets out standards for Area D of the Regional District. The Regional District has provided variances to that on surrounding communities and has acknowledged the reasonable changes to the bylaw regarding Furry Creek as further demonstrated in accepting previous reports from Hunter Laird and AE. While Creus recommend using actual flows, following a review, the report has been updated with calculations based on Bylaw 741 with the exception of capita recommendations and peaking factor. A residential flow of 350 l/cap/d and commercial of 40,000 l/cap/d, infiltration and inflow of 11,200 l/day/ha, peaking factor of 3.5 have been used. However, it was agreed that 2.6 capita/unit is to be used in the Master Plan until such time as other variances are formally documented.

### **3.2. DESIGN FLOW, INFILTRATION & INFLOW FOR WASTEWATER TREATMENT**

Within the Associated Engineering Technical Memorandum No.1 dated 2008, an estimated residential per capita flow (including infiltration and inflow) of 440 l/cap/d was estimated and accepted by SLRD. This was based on a population of 250 people and a measured average daily flow (ADF) from November 1999 to February 2001 of 111m<sup>3</sup>/d. Creus Engineering did a more recent analysis based on a population of 306 people which included 79 built single-family units, 1 duplex and 56 townhouse units and the golf course. This gave an average day flow (ADF) of 137.4m<sup>3</sup>/d for the year of 2018 and a ADF 111m<sup>3</sup>/d for 2019. This indicated an average flow of 449 l/cap/d for 2018 and 362 l/cap/d for the year of 2019. For this report we have used the calculations from 2018 of 449l/cap/d as it is more conservative than the AE design approach of 440 l/cap/d. It is understood that the use of actual data more accurately

represents the WWTP ultimate expansion needs. It is expected that as the WWTP continues to operate that updated flow data will be used to better model conditions and required treatment sizing. Creus is working to obtain more data and this would be used at the time of actual design to correlate the model with actual flows. Following a review, it was requested that additional data be collected. The only data that has been made available to Creus to date is the effluent data for 2018, 2019 and partial 2020. The data from 2019 reflected a significantly lower flow as discussed above and this is due to renovations that were taking place at the golf course during this time which lowered the golf course flows. The estimated flow from 2018 data and AE criteria is fairly consistent and the more recent and conservative of flow of 449 l/cap/d has been used. It is understood that as the development progresses and more accurate and relevant data is collected, a more precise capita flow can be determined. As per WSP review, the treatment calculations were updated to reflect a change of capita and peaking factor as previously discussed. The flow calculations have remained based on actual data and will also be subject to more recent data at the time of future upgrade.

### **3.3. POPULATION FOR TREATMENT & COLLECTION**

The service population per capita was reviewed by Associated Engineering (AE) and Hunter Laird (HL) in their work with SLRD. Within the AE report an average population density of 2.25 people per residential unit was assumed, compared to the projections in the SLRD Bylaw No. 741, dated March 2015 (for waterworks systems) of about three to four people per residential unit. The HL report for the SLRD on Master Waterworks, dated April 2012, suggests 3.0 capita per single family (SF) and 2.1 per multi-family (MF), however an overall ratio to be no less than 2.6 per unit is recommended to be used at that time. This relied in part on the existing census data for Area D showing an occupancy of 1.5 capita/unit. The current mix of use proposed is approximately 198 SF and 962 MF which includes the 120 resort units. A significant element of the MF is now apartment style condominium. This would result in a capita average of 2.25. Creus originally adopted AE per capita average of 2.25 as it was deemed more appropriate given the Hunter Laird is a recommendation for water supply demands. Following reviews with SLRD, the capita to be used for sizing the WWTP was confirmed to be updated to 2.6 units per capita. This would be consistent with variance for Britannia and Porteau Cove.

WSP has indicated that a variance from design flows can be submitted but recommended that data from forthcoming years of use be used to apply for the variance at the time of the WWTP upgrade design. This reflects the fact that available records in the last few years were limited. This will also better document the impacts on flow as the expected use moves towards more stacked MF from ground orientated housing to date.

### **3.4. PEAKING FACTOR FOR TREATMENT**

A peaking factor was calculated based on the Technical Memorandum No.1 completed by AE on each of the WWTP upgrading phases from initial to ultimate expansion, these were 2.38, 2.67 & 2.70 respectively as they relate to the upgrade phases. Further analysis was completed by Creus Engineers of the flow data from 2018 and 2019 and an average peaking Factor of 1.83 and 1.99 was calculated respectively, refer Figure 4. Creus reviewed the data and had adopted the AE design approach peaking factor of 2.70, as this was the worst case of the data proposed by AE and more conservative than Creus calculations based on recent available data. It is expected that the use of actual data more accurately represents the WWTP expansion needs. It is acknowledged that the inflow and infiltration (I&I) data of the last few years shows some troubling peaks. It is recommended that an initial analysis be done once flow meters are

installed in the two existing Sewage Lift Stations (SLS) and that this will be updated once more data is available which is expected to lower the flows. WSP has now indicated that a variance from design flows can be submitted but recommended that data from forthcoming years of use be used to apply for the variance at the time of the WWTP upgrade design or earlier if required and justified by available data. However, until this data has been presented it has been accepted that the peaking factor in this Master Plan has been set at 3.0, as discussed in the opening paragraph of section 3, there will be flexibility for this to adjust in the future once more data has been collected.

### 3.5. GOLF COURSE CLUBHOUSE

The Golf Course Clubhouse is expected to contribute a significant portion to the total amount of wastewater flow. Previous investigations from AE and Reid Crowther have made assumptions as to the contributing flow. In 1992 Reid Crowther assumed that there would ultimately be approximately 150 people per day using the facility whereas AE reviewed this based on more recent data at the time (1999 – 2003) and suggested that there may be as many as 300 people per day based on a typical flow of 380l/cap/d which was taken from Metcalf & Eddy 2003. The assumptions were derived from the seasonal fluctuation of data. As the golf course is typically in-use during the summer months of March to October resulting in higher use, and the off-season winter flows of November to February were lower, refer Figure 6. Creus reviewed recent data and it appears this is not consistent with actual data. There is a November to January peak and a July August peak. As seen below in Figure 3 during the summer months the ADF decreased which is contrary to the methodology mentioned in the AE report. It is likely that the increase is due to infiltration and inflow which can be inferred from the overlay of precipitation data as seen in Figure 5. Due to the lack of available data and inconsistencies, as suggested previously, a water meter will be installed at the clubhouse to attain accurate data going forward. For the purposes of this report Creus has maintained the previously approved design approach outlined by AE, and so a 380l/cap/d for an estimated 300 people will be used. Based on the estimated golf course flows as seen in Figure 6, the sum average calculated peaking factor is 1.84. As per WSP review the peaking factor has been updated to 3.0 however the flow of 380l/cap/d remains. As discussed in the opening paragraph of section 3, it is acknowledged and agreed upon that there will be flexibility to allow a variance for the flow data and peaking factor criteria based on actual flow data.

Nov - Feb	Av. Day Flow m3/d	Max. Month Flow (m3/d)	Max. Day Flow (m3/d)
2018	163.2	182.8	336.5
2019	112.3	121.9	293.0
Mar-Oct			
2018	124.5	160.9	209.2
2019	110.2	130.7	185.1

Figure 3: Seasonal Wastewater Flow Fluctuations summarized from figure 5

	2018 Effluent Volume report (m3)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
Min	92	78	46	49	56	120	106	114	115	72	86	86	85.0
Av.	182.8	120.6	86.6	61.6	105	147	150	136.7	161	149	181.9	168	137.4
Max	344	181	112	85	276	276	196	181	301	246	555	266	251.6
Calc. PF	1.9	1.5	1.3	1.4	2.6	1.9	1.3	1.3	1.9	1.7	3.1	1.6	1.83

	2019 Effluent Volume report (m3)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
Min	70	76.5	65	78.5	75	63	85	58	55	70	59	83	69.8
Av.	121.9	98.2	88	109.6	131	110	103	107.2	116	116	109.9	119	110.9
Max	477	134	121	151	356	157	136	143	167	250	231	330	221.0
Calc. PF	3.9	1.4	1.4	1.4	2.7	1.4	1.3	1.3	1.4	2.1	2.1	2.8	1.99

Figure 4: Tabulated WWTP Effluent data as provided by Corex

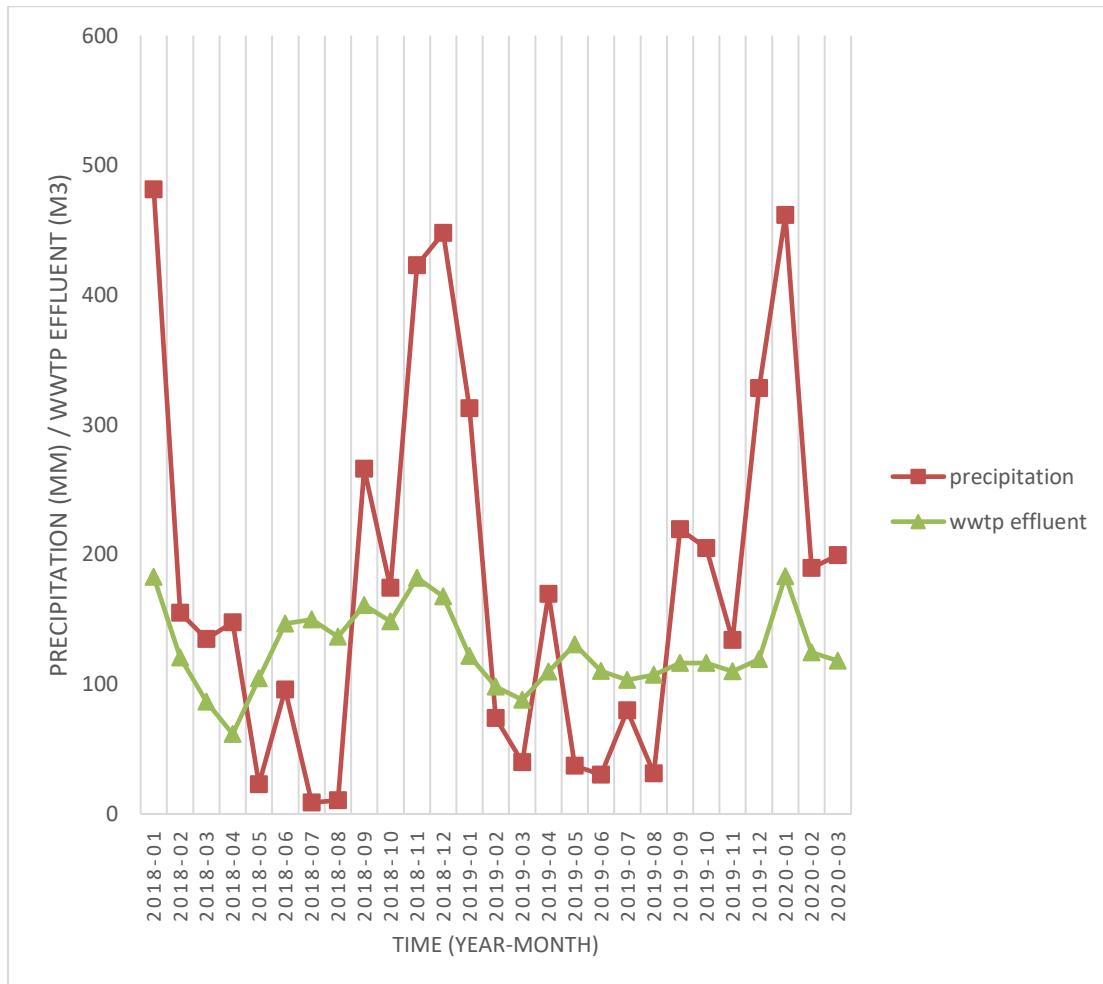


Figure 5: Comparison of precipitation and average WWTP monthly effluent data

WSP and Creus reviewed the data and agreed that Figure 5 indicates high inflow and infiltration (I&I). Fine Peace Holdings will undertake an investigation to determine the reason for the high I&I once flow meters are installed in the existing Sewage Lift Stations (SLS). Initial manhole inspection and visual analysis of flow may isolate the issue, however if no visual indicators isolate the flow, further sewer flushing and CCTV inspection of the collection sewers may be required.

**Table 4-1**  
**Summary of Historic Flow Data**

Period	Average Day Flow (m <sup>3</sup> /d)	Maximum Month Flow (m <sup>3</sup> /d)	Maximum Day Flow (m <sup>3</sup> /d)
Winter Flow or Residential Wastewater Flow - November to February <sup>1</sup>			
2000/2001	43	50	95
2001/2002	74	93	140
2002/2003	<b>111</b>	<b>146</b>	<b>308</b>
Total Flow - March to October			
2001	135	178	242
2002	186	299	366
2003	208	251	495
Estimated Golf Course Flows - March to October <sup>2</sup>			
2001	92	128	147
2002	<b>113</b>	<b>206</b>	<b>226</b>
2003	97	105	187
Notes:			
Values shown in bold were used to develop the design flow criteria for the Furry Creek WWTP.			
1. The Furry Creek Golf Course is typically non-operational during this period.			
2. The golf course wastewater flows were estimated by subtracting the estimated residential flows from the total summer flows.			

Figure 6: Excerpt from Furry Creek WWTP Upgrading and Expansion Plan by AE 2008

### 3.6. WWTP ULTIMATE EXPANSION AND LAND AVAILABILITY

The WWTP lot was sized based on the 1991 design by Reid Crowther for 920 mostly single-family lots, golf course, commercial, 300-unit resort and Marina. In 1992 there was an alternate design completed by Sanitherm Inc. In around 2000 the WWTP was updated and the meter calibrated at that time. In 2004 Associated Engineering (AE) did a plan for ultimate build-out on the lot. In 2008/2009 AE updated that plan with different layout options for ultimate build-out which is further discussed in section 3.6. The 08/09 AE designs did not accommodate non-market housing or a resort. As well WSP requested that more stringent design criteria be used until actual data is attained. As such, the more stringent criteria resulted in an estimated design flow increase of 59% higher than the AE designs.

Creus has been in contact with AE in regard to the capacity of the ultimate expansion design options proposed in 2008 and the expected change in flow due to updated population densities of 2020 and design criteria. AE has indicated there are various options to meet the revised ultimate expansion demands. It is understood that there is more recent technology that can be implemented to increase the capacity without the need for more land than originally allowed for

in the ultimate expansion design on existing Lot 1. WSP acknowledges via email dated June 6<sup>th</sup>, 2020 and references the email sent from Creus on April 21<sup>st</sup>, 2020 detailing the reluctance to engage AE for another detailed WWTP expansion option at this time. It is therefore accepted that when the time of the next WWTP upgrade occurs, an Engineer will be engaged to detail the required design and obtain approvals from the relevant authorities to meet the required standards and flows.

The current plant is in good standing for up to approximately 540 units depending on the type and size of units. The need for an upgrade will likely not occur for some time. When the time does arise and an upgrade is required, there is in fact additional land available on the current Lot 1. As seen in Figure 7 below of the current AE ultimate expansion design option B: There is approximately 700m<sup>2</sup> to the south and west and 350m<sup>2</sup> to the north of existing plant. It is reasonable to deduce that Lot 1 will have sufficient land for future needs.

WWTP Lot 1, Plan LMP16073 is 0.376 ha, however it accommodates service SROW and access easement to the golf maintenance building. The total buildable area is approximately 2,693 m<sup>2</sup>. The 2008/09 AE buildout design uses 1,532m<sup>2</sup>. This provides 39% additional area to expand the plant within. There is also potential for expanding the underground tanks in the access easement. These figures exclude a 120m<sup>2</sup> staging area which could be repositioned to the area of the service SROW. AE have verbally indicated that the site area would be adequate to provide for the increase in flow likely within the original expected footprint due to advances in technology.

It is acknowledged that the existing Lot 1 is likely to have sufficient lands to accommodate expansion needs for the ultimate WWTP. However, it is noted within email communications dated August 6, 2020 that the placement of restricted covenants on additional lots would provide security in the case the Lot 1 proved to be insufficient for the ultimate buildout. WSP indicated that the placement of covenant would satisfy requirements for zoning and that the unused lands can be released from covenant if not required. Fine Peace owns the adjoining golf course lands including the maintenance yard immediately to the south of the WWTP. It also owns Lot 3 and Lot 4 to the north of the WWTP. Lot 3 (1800m<sup>2</sup>) is currently used as a propane farm and is sized to service all of the Furry Creek lands. There are excess lands of approximately 240m<sup>2</sup> available for use. Fine Peace has agreed to hold the respective lands aside and place a covenant until such time as the WWTP final design is completed. If the lands are not required for the buildout design, they will be released for use to Fine Peace. The following lots are agreed to be covenanted to restrict development until full-build out of WWTP is confirmed: The golf maintenance building on Block A LMP 13803, Lot 4 LMP16073 (681m<sup>2</sup>) and approximately 240m<sup>2</sup> of excess lands on lot 3 LMP16073.

It is acknowledged that each subdivision requires sign off from Waste Management Branch to confirm the permit is in good standing and requires approval from the SLRD and as such it will be the developer's responsibility to address WWTP expansion. It is expected an updated WWTP design will be instigated as the current WWTP approaches its design flow limits. When this upgrade occurs, the design will reflect actual flow data and the most current technologies. The expectation is that it will be an expansion of the existing plant within the current lot. All designs to date have raised the issue of odour control and have systems identified to address those concerns. It is also understood that an amendment to the existing Waste Discharge File (PE-10931) which allows discharge of 1,900 m<sup>3</sup>/day is required. It is expected that it will be filed and registered under the more recent Municipal Wastewater Regulation (MWR) or other standards that may be applicable at that time.

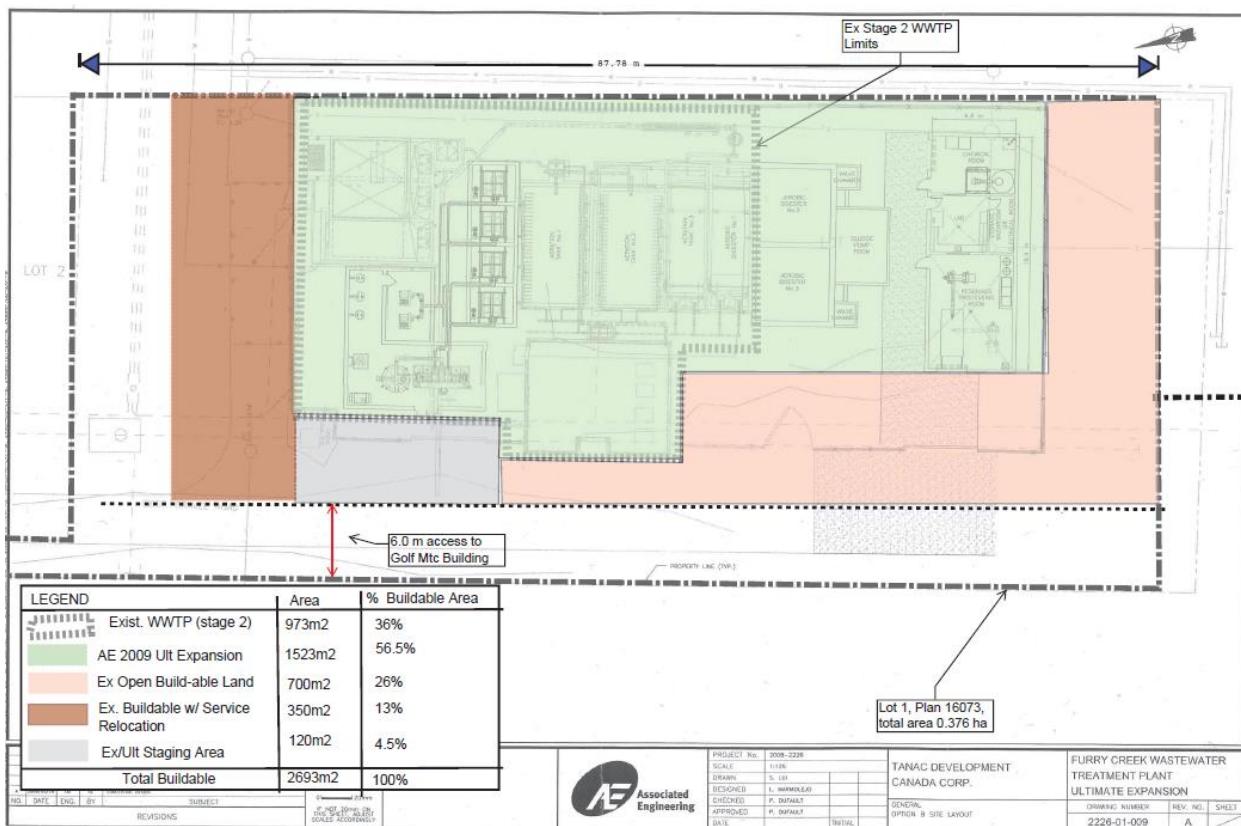


Figure 7: AE 2008 Expansion Plan identifying excess lands system upgrades

## 4. SYSTEM UPGRADES

### 4.1. COMMUNITY BUILD-OUT

The proposed rezoning is projected to have a build-out of 920 market housing units, 120 non-market housing units, a 120-unit resort, small resident marina, commercial and community amnesty plus the golf course. The new zoning contemplates a significantly higher percentage of multi-family (MF) homes which would generally have a lower capita per unit rate and thus a lower ADF per unit. WSP has now indicated that a variance from design flows can be submitted but recommended that data from forthcoming years of use be used to apply for the variance at the time of the WWTP upgrade design. This reflects the fact that available records in the last few years were limited. This will also better document the impacts on flow as the expected use moves towards more stacked multifamily from ground orientated housing to date. As such Creus has updated the Master Plan per the criteria in Bylaw 741 with the exception of adopting a capita of 2.6 for both collection and WWTP sizing and a peaking factor of 3.5 for collection and 3.0 for WWTP sizing until further data is available to formally justify application for a variance from bylaw 741. The previous submissions Rev 2 and prior had calculated an increase of 240 dwellings to have a population increase of 25% from original projections, when maintaining a 2.25 capita. As per WSP review this updated capita and peaking factor reflects a population increase of 45%. Based on the proposed zoning densities Creus Engineering estimates that the WWTP ultimate expansion will require upgrades based on an ADF of 1477m<sup>3</sup>/d and a PDF of 4432m<sup>3</sup>/d which amounts to an approximate increase of 59.0%. The actual trigger for upgrade of the WWTP will be actual flow and operation.

## 4.2. COLLECTION

The collection system will be expanded via a series of phased expansion as each neighbourhood is constructed. These will generally be serviced by gravity mains, though lift stations are required in certain areas as detailed below. Sewage Lift Stations servicing one strata will remain within the strata ownership and have been designated SSLS in this report. Pump stations servicing multiple developments will be turned over to the SLRD. Individual Buildings may require individual pumps for lower floors, however that would be dealt with under an individual Building Permit process

The proposed and existing network will be analysed and designed in accordance with the current SLRD Bylaw No. 741, 2002 as clarified below. Creus has reviewed the existing system and future demands and has determined that existing sanitary pipes have sufficient capacity to accommodate for the future development demands.

There will be small lift stations in the lower area of the Northwest development which is expected to be strata owned. The Northeast neighbourhood may require an SLRD owned pump station, however a directional drilled line under the highway was considered during the highway interchange construction which may be possible which would eliminate the need for a pump station if this is acceptable to MOTI. The remaining areas will largely be gravity services, though individual houses and buildings may require individual pump stations to tie into the mains. The gravity lines may run in public open space or in SROWs over private lands to avoid pump stations where required. RCPL addressed the preliminary Sewage collection and pumping in their 1992 study "Preliminary Design Report, dated 1992". The preliminary concept would be updated as each phase moves forward and details of future phases is further defined. A general description of each phase is further detailed below.

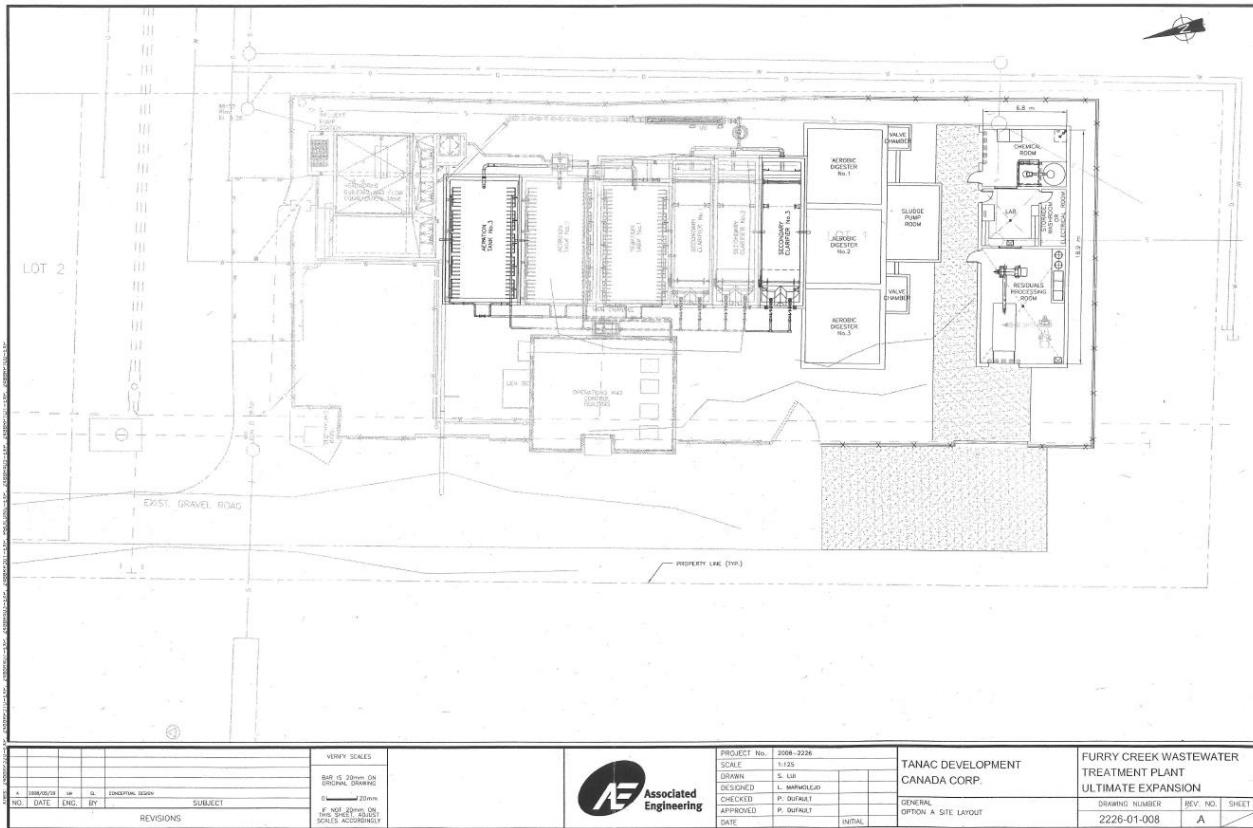
## 4.3. TREATMENT

As indicated above the WWTP was installed and turned over to the SLRD. Upgrades were performed by the Developer in 2005 as per approved design outlined in the Associated Engineering (AE) Reports "Upgrading and Expansion Plan, dated 2004, and Technical Memorandum No.1, dated 2008 "Furry Creek Wastewater Treatment Plant Ultimate Expansion Conceptual Options".

The WWTP is located on Lot 1 of Block 3 which is 0.376 ha in site and was sized to accommodate the expected ultimate development demands at the time of the report in 2008 with excess land remaining. AE provided conceptual design options under Drawings 2226-01-008 and 2226-01-009 dated 2008 which are seen in Figure 8 & Figure 9 below and are contained in Appendix 14: AE had established the design for the ultimate build-out to meet the 920 units plus the golf course based on an ADF of 1030m<sup>3</sup>/d and a PDF of 2780m<sup>3</sup>/d.

In general, the SLRD accepted design criteria from the Associated Engineering (AE) reports have been used and will be discussed in further detail in the following sections. A summary of Creus review of AE design indicates the ultimate expansion design completed by AE allowed for an Average Day Flow (ADF) of 1,030m<sup>3</sup>/d and a Peak Day Flow (PDF) of 2,780m<sup>3</sup>/d. Creus updated flow calculations based on the proposed zoning densities, as reflected in Figure 10 which indicates that the WWTP requires an approximate ADF of 1477 m<sup>3</sup>/d and a PDF of 4432

m3/d. This is an approximate increase of 59.0%, however that is largely due to changes in design criteria from the originally accepted AE rates as discussed in section 3



*Figure 8- WWTP Ultimate Expansion – Option A*

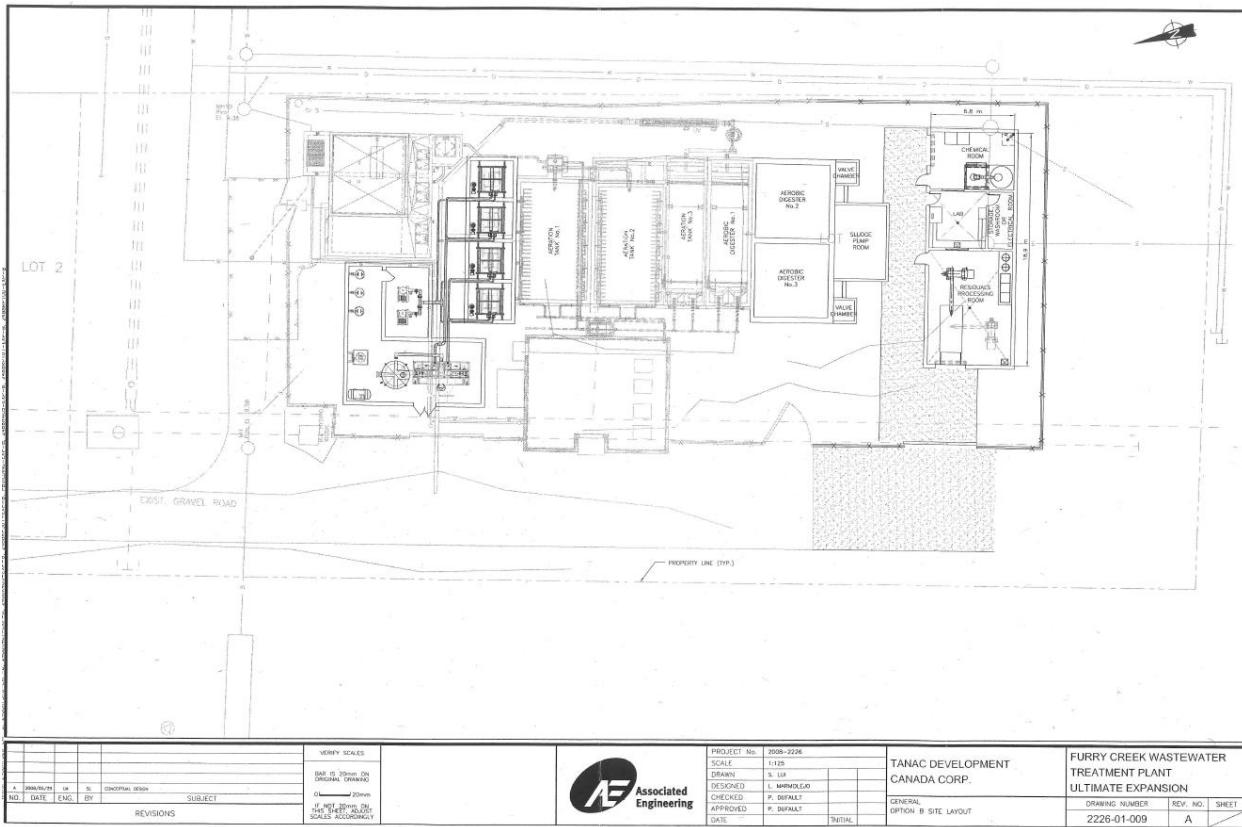


Figure 9: WWTP Ultimate Expansion - Option B

Average Annual and Max Day Demand Flow (for WWTP)							
Use	Description	Units	Capita	I/c/d	Development Demands		Peaking Factor
					Av. m3/day	Max m3/d	
Residential	SF	198	2.6	449	231.1	693.4	3.0
Residential	MF	722	2.6	449	842.9	2528.6	3.0
Non-Market Housing	Small MF	120	2.6	449	140.1	420.3	3.0
Clubhouse	300 People per day			380	114	342	3.0
	*clubhouse data based on flow data as mentioned in AE report, dated 2004.						
Golf Maintenance Building	Limited use of washroom and washdown, actually included in the number above Included in overall golf course						
Oliver's Landing Community Building	Limited use actually included in the Clubhouse numbers from Hunter Lairds Calculation						
Resort Hotel	Units	120	2.6	449	140.1	420.3	3.0
		<b>Building (sq. ft)</b>	<b>Lot (ha)</b>	<b>I/d/ha</b>			
Commercial		20,000	0.18	40,000	7.43	22.3	3.0
Community Centre		5,000	0.05	40,000	1.86	5.58	3.0
Marina	Very minimal with no services allowed 1/10th of a residential unit				0.01	0.03	3.0
<b>Total Demand at Ultimate Expansion</b>					<b>1477</b>	<b>4432</b>	

Figure 10: Design Flow WWTP Build-out

As per WSP review, the calculations above have been updated to reflect a 2.6 capita and a peaking factor of 3.0. These values are considered conservative and it is generally agreed that design criteria based on actual data is preferable. Ultimately the WWTP will be sized based on actual data as mentioned in section 3. Additional metering will be placed on existing infrastructure going forward. A variance application will be made based on actual operating conditions.

Peak Wet Weather Flow (for Collection)								
Zone	Single Family (SF)	Multi-Family (MF)	Capita	I/c/d	Area (ha)	Infiltration & Inflow (l/s)	Development Demands PWWF (l/s)	Peaking Factor
A	90	8	2.6	350	15.0	1.9	5.6	3.5
B	11	187	2.6	350	5.1	0.7	8.0	3.5
C	2	141	2.6	350	3.1	0.4	5.7	3.5
D	0	48	2.6	350	0.7	0.1	1.9	3.5
E	21	450	2.6	350	21.0	2.7	20.1	3.5
F	0	220	2.6	350	3.5	0.5	8.6	3.5
G	30	130	2.6	350	8.5	1.1	7.4	3.5
H	0	104	2.6	350	5.0	0.6	4.5	3.5
I	0	120	2.6	350	3.0	0.4	8.8	3.5

Note:

- 1- Demands are based on maximum possible build-out in each zone.
- 2- Zone G includes Commercial & Community demands, refer figure 6 for calcs.
- 3- Zone I includes Golf Course Clubhouse, refer figure 6.
- 4- Refer MSP-1 and Section 6 of this report for breakdown of zones.

Figure 11: Design Flow Distribution calcs for maximum build-out

## 5. EXISTING CAPACITY ANALYSIS

### 5.1. WWTP

The community total of 920 + 120 non-market + 120 resort was used for the WWTP which is consistent with the maximum allowable for the overall Furry Creek Community as per zoning and is what is reflected in Figure 10. The existing plant is sized to accommodate up to 530 residential units and the golf course.

### 5.2. PIPE NETWORK

An analysis of the existing pipe network was completed to confirm that no upgrades are expected to be required. This is based on the most recent architectural layout and reflects an overall unit count of approximately 1600 dwellings, refer Figure 11. This unit count is in excess of max allowed units per zoning but allows for units to be redistributed between neighbourhoods as well as potential future infill that might result from future zoning changes. The current expectation is that the total number of units is fixed at 920 market plus 120 non market along with resort, golf and commercial, the actual distribution between neighbourhoods may adjust over time and this has been allowed for in the conservative design approach. It is understood that each phase will require passing through a process of Development Permit, Subdivision and Building Permit. This will required sign off from VCH, SLRD and Waste Management Branch. Each unit will have to go through a process to prove out there is adequate servicing and that the lands are safe for their intended purpose.

It was found that all existing pipes had sufficient capacity to accommodate future development demands and were below the maximum allowable capacity of 75% of the depth of the pipe as stated in bylaw requirements. It has been noted on MSP-1 the three worst-case situations. These locations are north of the WWTP, which is expected to take development catchments Northwest, Northeast, Marina and Oliver's Landing which are called up as zones B, C, D & H respectively. East of the WWTP taking catchments from Mountain, Uplands South, Uplands

North, Collector, Resort and existing golf clubhouse which are labelled as zones E & I. And south of the WWTP near to Ocean Crest Drive which take combined catchments Upper Benchlands, Bluff Lots, and existing development at Stonegate Drive, along Furry Creek Drive south of South Creek and Ocean Crest Drive which are named zones A & G. It is noted that there was insufficient as-builts to confirm the grade of the pipe from the WWTP heading north to the interchange of Sea View Drive. Based on available data of the nearest dead-end cap invert at the Sea View Drive Interchange directly north of the WWTP and the invert going into the WWTP, a conservative grade of 2.5% was assumed.

### 5.3. PUMP STATIONS

There are currently two existing sanitary lift stations (SLS) at Furry Creek owned and maintained by SLRD, denoted on Master Sanitary Plan “MSP-1” as SLS-1 and SLS-2. It is understood that the existing lift stations were initially designed to have adequate capacity to accommodate for the future development demands known at that time. It is noted that both existing lift stations have duplex pump systems setup for two pumps running in parallel, the design criteria is for a scenario of one pump on and the other pump in failure mode as per current bylaw 741 requirements, section 3.5.2.3.

Existing lift station SLS-1 is located off HWY 99, south of Furry Creek and was designed for Benchlands and Upper Benchlands as well as the Waterfront South Lands at the time as per the RCPL report. Creus has completed calculations and analyzed the adequacy of the lift station and is further discussed within section 6.2. Currently SLS-1 is estimated to have an existing contributing flow of 5.6l/s PWWF from the developed lands south of South Creek along Furry Creek Drive, Ocean Crest Drive and Stonegate Drive. The station is calculated to have a capacity of 41.5 l/s (in parallel) and 33.0l/s with one pump in failure mode.

Existing lift station SLS-2 is located in the existing Oliver's Landing development and was designed to accommodate for the build-out of Oliver's Landing, Waterfront South and Marina neighborhoods at the time of submission. This was to include up to 225 townhouses on the Waterfront South portion. This was based on the AE and Hunter Laird design flows. Currently SLS-2 is estimated to have contributing flows of 2.4l/s PWWF from the current townhouses within Oliver's Landing. The station is calculated to have a capacity of 11.2 l/s (running in parallel) and 9.6 l/s with one pump in failure mode. Based on the WWTP and water system flows, the pump stations are not experiencing the estimated design flows. This will be further documented once flow meters are installed.

## 6. NEIGHBOURHOOD INFRASTRUCTURE

### 6.1. OLIVER'S LANDING (ZONE H) / MARINA NEIGHBOURHOOD (ZONE D)

The existing 56 townhouse (TH) dwellings within Oliver's Landing are serviced by an SLRD owned and operated sewage lift station SLS-2. The Marina Neighbourhood is immediately to the north of Oliver's Landing and both are accessed by the public road Waterfront Drive (incorrectly labelled as Beach Drive on Google Maps) that crosses the railway. The area has elevations from 5-20 metres. The existing station has two pumps running in parallel (5hp 208v/3P/60hz) and at present connects 56 TH plus an 8000 ft<sup>2</sup> community building for that strata. It was designed to accommodate 18 additional units, a 4-storey building on lot 4, 32 units on the Marina Lands and approximately 259 units on the Waterfront south based on the design criteria of the day. There is an existing sanitary forcemain dead-end cap provided for potential future

connection of the Waterfront South development. The current pump station does not have a flow meter or hour meter based on the shop drawings and it is recommended that this be added going forward.

The current expectation is that the total number of units is fixed, however the actual distribution between neighbourhoods may adjust over time as well as the building size and type. It is understood that each phase will require passing through a process of Development Permit, Subdivision and Building Permit. At this time, it will be a requirement to prove out the adequacy of servicing and ensure the lands are safe for their intended purpose. The following criteria is based on the maximum possible build-out of the developments neighbourhoods. This ensures worst-case condition and confirms that the pump stations have adequate capacity to satisfy the bylaw criteria. It is understood that a variance will be applied for once further more detailed actual flows are detailed and that approved variance would be used moving forward from that point. Until that occurs all collection flows are based on the Bylaw with the current approved variance of capita being 2.6 and peaking factor being 3.5.

The current flows from Oliver's Landing are calculated to be +/- 2.4l/s based on the already built 56 townhouses, and expected to contribute a total of 4.5l/s once built-out. Future demands from Marina Lands are calculated to have an additional flow of +/- 1.9l/s. The Waterfront South catchment is calculated to have an additional +/- 8.6l/s. The following options were reviewed to address the existing pump stations capacities:

Option 1 would be connecting Marina and Oliver's Landing to SLS-2 and having Waterfront run independently to the WWTP. Creus completed updated calculations and determined the SLS-2 lift station would be running at approximately 66% capacity with the maximum build-out of Oliver's Landing and Marina contributions.

Option 2 was investigated of pumping Waterfront South to SLS-2 per the original design assumptions. If the Waterfront South area were to be connect to SLS-2, the lift station would be running at approximately 156% capacity. based on the new design Criteria. This option is not viable under the conservative design criteria and has been abandoned.

## **6.2. BENCHLANDS (ZONE A) / WATERFRONT SOUTH (ZONE F) / COMMUNITY CENTRE, PORTEAU BLUFF LANDS AND UPPER BENCHLANDS (ZONE G)**

The Upper Benchlands are located immediately east of the BC Hydro ROW and east of the existing Stonegate Neighbourhood with lands both north and south of South Creek. It is accessed by an extension of Stonegate Drive. There is an existing 200mm main that was designed to be extended to service those properties. The Porteau Bluff Lands and Community centre will both be tying into the existing main. These combined catchment areas (zone G) are calculated to have a contributing flow of 7.4 l/s.

The existing Benchlands include lots on Ocean Crest, Furry Creek Drive, Stonegate Drive and Salal Court all tie into an existing gravity sanitary that runs under the highway to SLRD owned and operated SLS-1 by Sixteen tees. The current existing catchment contributes 5.6 l/s based on bylaw design criteria requirements and a 2.6 capita. The unit was designed to have adequate capacity to accommodate the future Waterfront South, Community Centre, Porteau Bluff Lands and Upper Benchlands based on proposed development when it was first installed. Creus Engineering calculated that SLS-1 has a capacity of 33.0 l/s with one pump in failure mode.

Waterfront South will be a strata collection of medium rise condominiums. A central lift station will be required and is identified as SSLS-7. As this will be a number of strata's feeding one lift station it is envisioned that it should be SLRD or Strata owned and maintained. Three options for tying this lift station in to the system were reviewed. The first would require a service line under the rail to existing lift station SLS-1. The second would tie into the existing forcemain within Oliver's Landing which would tie into SLS-2. The third option would be to tie into the existing 200 mm forcemain that connects SLS-1 to the WWTP near the existing cart bridge.

Option 1 would require approval from regulatory authorities CN rail for the line under the rail tying into SLS-1. This option would lead to the effluent being pumped twice. The Waterfront South catchment is expected to have a contributing flow of 8.6 l/s. The existing lift station SLS-1 is calculated to be running at 65% capacity with one pump in failure mode with the addition of Waterfront to the Benchlands and the Community Centre and therefore has sufficient capacity to accommodate this option.

Option 2 would require running the forcemain over the future Furry Creek bridge and tie into the existing forcemain which runs to SLS-2. This would require pumping twice. As discussed above, this would lead to SLS-2 running at 156% capacity. This is not a viable option under the revised criteria.

Option 3 is to tie into the exiting forcemain that runs between SLS-1 and the WWTP. The routing would be from the south end of the development along a cart path under the existing CN rail bridge. This would require a SROW over the golf course and through the CN ROW where the existing cart path and irrigation line run. This would require the installation of check valves to ensure the SLS-6 and SLS-1 did not back feed each other. The controls could be linked to ensure run times are offset. On initial review this appears to be the preferred option.

### **6.3. NORTHWEST (ZONE B)**

The Northwest neighbourhood is in the Northwest Corner of the site west of the Highway. It will have access off of Howe Sound Drive and there was an intersection roughed in at the time of the Interchange construction. This will be a combination of uses with the potential for duplex, resort, townhouse, low rise and mid-rise apartments. The elevations for development range from 35 metres to 150 m. Use of two strata owned and maintained pump stations SSLS-1 and SSLS-2 will be required to allow lower lying areas to tie into the existing 200mm gravity main that runs along Howe Sound Drive to the WWTP.

### **6.4. NORTHEAST (ZONE C)**

The Northeast (NE) lands are across the highway from the Northwest (NW) and immediately below the Mountain neighbourhood. The lands were shown as being accessed from the Mountain neighbourhood area in previous planning exercise. Creus has met with MOTI to discuss the potential for a bridge crossing Highway 99 from the NW lands. It is viewed that this is more efficient from an access and servicing perspective and results in less clearing and earthworks. MOTI indicated they did not see an obvious reason to not consider this option and have requested that further design work be done. There was a 200mm line stubbed off during the interchange construction to give an option for a directional drilled gravity line under Highway 99 to service the NE lands. If this option is viable and approved by MOTI, an additional SLRD owned pump station, SLS-3 will be not be required. Alternatively, a SLRD owned and operated

pump station SLS-3 would be located at the bottom of NE and pumped over the bridge over the highway and into Howe Sound Drive gravity main.

## 6.5. RESORT/CLUBHOUSE

The final location and massing of the resort is still to be resolved. It is expected to be located east of the existing golf clubhouse and accessed via an extension to the existing Country Club Road. It is expected that the resort will be serviced via extension to the existing 200mm gravity within Country Club Road. The size of the resort can be accommodated by the existing 200 mm main as will the 300mm main under fairway 17.

## 6.6. COLLECTOR / UPLANDS SOUTH / UPLANDS NORTH / MOUNTAIN (ZONE E)

The Collector, Uplands and Mountain Neighbourhoods are all generally elevated above the currently dedicated Sea View Drive. These neighbourhoods are proposed for a mix of uses including townhouse, low and mid-rise apartments and a community space and fire hall near Collector lands. As these areas are located in terrain with elevations generally above that of the proposed gravity main within in Sea View Drive, it is expected minimal to no pump stations will be required. The Uplands North (UN) neighbourhood will likely have sewer main in the public open space to avoid pumps. A strata owned pump station is likely required for the easterly portion of UN lands unless a creek crossing is permitted. There is a strata pump that will be required in the US development immediately above the golf course. Following detailed design analysis there may be other areas that require private strata owned pump stations.

## 6.7. FUTURE STUDY AREAS

The original PLA indicated development in the Highlands area at the east end of the property between Phyliss and Furry Creek. It would have gravity flow to the rest of the development, however, due to the distances involved may trigger a separate WWTP. There is another potential area of development opposite the Mountain neighbourhood which would tie into the Upland North network. This would be reviewed at the time if this area was brought forward for rezoning in the future.

## 7. CONCLUSION

The proposed zoning of the lands is largely consistent with the original plans, engineering and Preliminary Layout Approval. The development zones have not changed. The original vision for the community was 920 residential units in single and multi-family format, golf course, resort, commercial amenities and a commercial marina. This has evolved to 920 residential market units, 120 additional non-market units, a commercial village centre and resort facilities.

Creus has reviewed the existing sanitary reports and drawings. The proposed rezoning will not require any works that are beyond normal works required for development. None of the existing infrastructure requires upgrade other than the WWTP which was previously identified. The existing lot for the WWTP is adequate to accommodate the ultimate buildout. The current WWTP permit (PE-10931) allowing 1900m<sup>3</sup>/d is adequate based on current demands. As the development grows this permit will need to be amended to meet the revised ultimate expansion build-out. This is not expected to be required for years to come. This will be done under MWR, or other more current legislation that may be in force at that time.

The Furry Creek development is consistent with the SLRD Official Community Plan (OCP) and Regional Growth Strategy. As per the OCP, "The objective for the Furry Creek neighborhood is to continue to recognize the Planned Community designation and encourages adequate provision of community facilities and public open space as development proceeds." The proposed development fits well within in this objective. The proposed development zones are consistent with the original planning and have the support of the environmental, geotechnical, traffic management, landscaping and Civil infrastructure consultants in confirming they are suitable for their intended use.

Creus is recommending upgrades to the flow monitoring of the system. This will include more detailed tracking of well data, installation of a meter for domestic flows at the clubhouse, flow/hour meters on the sewage lift stations and calibrating and upgrading flow measurement systems at the WWTP. Creus is also recommending an initial I&I study be done on the collection system once the flow meters are installed on the existing pump stations.

The flow meter requirements set out in the Master Plan to be installed immediately following Furry Creek re-zoning approval. The flow meter requirements include the two existing pump stations, re-calibration of the existing effluent flow meter and a water meter in the Golf Course Clubhouse. A minimum of 5 years of water consumption and sewage flows are required to support a future variance to Bylaw 741 for treatment plant design. Inflow and Infiltration study work set out in the Master Plan start immediately following Furry Creek re-zoning approval and be completed within a two year period.

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WSP has recommend influent sewage quality be analyzed. This is a general requirement of standard operating procedures. Fine Peace to work with SLRD operator, and supplement where required, testing to ensure quarterly sampling for a minimum period of five years. Parameters shall include BOD, TSS, Nitrogen, Phosphorus and Fecal Coliform. This will supplement effluent quality data required under the existing Permit.

The development as shown is viable and can be designed and constructed using standard engineering design and construction standards.

Prepared By:

**CREUS** Engineering Ltd

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Permit to Practice #1001543

## **8. APPENDICES**

Appendix 1: CONTEXT PLAN

Appendix 9: REZONING PLANS

Appendix 10: INFRASTRUCTURE AND ROAD PLANS

Appendix 14: WASTEWATER REPORTS AND DRAWINGS

Appendix 21: HISTORICAL SUMMARY OF LANDS

Appendix 24: WSP REVIEW AND RESPONSES