WHISTLER

REPORT | ADMINISTRATIVE REPORT TO COUNCIL

PRESENTED:	October 3, 2017	**REPORT:**	17-105
FROM:	Infrastructure Services	**FILE:**	420.2
SUBJECT:	Cheakamus Crossing DES Recommendations		

COMMENT/RECOMMENDATION FROM THE CHIEF ADMINISTRATIVE OFFICER

That the recommendation of the General Manager of Infrastructure Services be endorsed.

RECOMMENDATION

That Council direct Whistler2020 Development Corporation to extend Phase 2 of the District Energy System Upgrade and Maintenance Program to a final end date of March 31, 2018;

That Council request Whistler2020 Development Corporation to facilitate a discussion of bulk pricing for annual maintenance of the home heating systems in the 174 townhomes constructed by Whistler2020 Development Corporation;

That Council direct staff to create a process that would conditionally allow owners of the 174 Whistler2020 Development Corporation constructed townhomes the option to disconnect from the District Energy System after March 31, 2018 if they are still dissatisfied with the operation of their home heating systems; and

That Council direct staff to explore the potential sale of the District Energy System to a private company to allow private management and regulation as a utility under the BC Utilities Commission.

REFERENCES

Appendix “A” - Cheakamus Crossing DES Summary Report – September 2017.

Appendix “B” - Cheakamus Crossing DES Recommendations – September 2017.

PURPOSE OF REPORT

The purpose of this report is to provide direction to Whistler2020 Development Corporation (WDC) and RMOW staff with respect to the home heating systems in the WDC constructed homes in Cheakamus Crossing and the Cheakamus Crossing District Energy System (DES) utility.

DISCUSSION

WDC were the developers responsible for delivering the Cheakamus Crossing neighbourhood. In response to many owner concerns about their home heating systems, WDC commissioned a report in late 2015, which was completed in the spring 2016. The report identified several deficiencies and possible upgrades in the home heating systems, and the program presented by WDC was undertaken to complete one-time specified repairs and maintenance.

Following a two-phase repair and maintenance program in 2016 and 2017 by qualified contractors, the expert opinion of Integral Group (the professional engineering firm selected by WDC and the Cheakamus Crossing DES Volunteer Committee) is that the work undertaken to date in these programs has corrected the majority of the identified deficiencies. In addition to fixing deficiencies, upgrades were made to make the systems easier to properly maintain. The review identified that there were no systemic failures associated with either the design or installation of the DES.

It is noted that as the systems approach a decade of operation, they will require parts replacement over time (such as domestic hot water and buffer tanks which are expected to have an 8 to 10 - year lifespan).

The consulting engineering firm and the maintenance contractors have strongly recommended that owners take on the initiative to arrange bulk pricing from qualified contractors for an annual heating system maintenance program. This will allow for cost effective, stable and consistent servicing, and will help maintain the base line operating level that has been established. WDC has offered to facilitate bulk pricing quotations from qualified maintenance contractors.

With Council's approval, an option to disconnect from the DES system will be offered to individual homeowners in the spring 2018 if they are still dissatisfied with the operation of their home heating systems. A process will be established to ensure homeowners wishing to disconnect understand both the costs and benefits of making this change.

With the goal of providing further assurance to homeowners, RMOW staff will investigate the potential for selling the DES to a private utility operator. A private utility would be regulated by the BC Utilities Commission, and may include the maintenance of home heating systems as part of the operation of the utility. The potential costs and benefits of this idea will be explored and results will be reported to Council.

WHISTLER 2020 ANALYSIS

W2020 Strategy	TOWARD Descriptions of success that resolution moves us toward	Comments
Built Environment	The new and renovated built environment has transitioned towards sustainable management of energy and materials.	Continuing to utilize the Cheakamus Crossing DES provides an environmentally sustainable source of heat energy to one of Whistler's newest neighbourhoods.
Energy	Whistler's energy system is supplied by a mix of sources that are local and regional wherever possible.	The Cheakamus Crossing DES adds to the mixture of energy options available in Whistler.
Energy	Community energy needs are met equitably.	The utility fees associated with the Cheakamus Crossing DES are set to provide an equitable cost for the heat provided.

W2020 Strategy	AWAY FROM Descriptions of success that resolution moves away from	Mitigation Strategies and Comments
None.		

OTHER POLICY CONSIDERATIONS

None.

BUDGET CONSIDERATIONS

The RMOW has provided funds to WDC to carry out Phase 1 and Phase 2 of the DES Upgrade and Maintenance Program. To date, WDC has spent $271,500 on implementing Phase 1 and Phase 2 of this program.

COMMUNITY ENGAGEMENT AND CONSULTATION

WDC, with assistance from the RMOW, met several times with a representative of the Cheakamus Crossing DES Volunteer Committee. Updates on the progress of Phase 1 and Phase 2 of the DES Upgrade and Maintenance program were provided on WDC's website.

SUMMARY

With Council's direction, WDC will continue Phase 2 of the DES Upgrade and Maintenance Program and will help facilitate bulk pricing for ongoing annual maintenance of the home heating systems. RMOW staff will work with owners of the 174 WDC constructed townhomes to allow them to initiate a process to disconnect from the DES system after March 31, 2018 if owners are still dissatisfied with the operation of their home heating systems. RMOW staff will also explore the potential to give the owners more assurance for the maintenance of their systems through the sale of the DES system to a third-party utility company.

Respectfully submitted,

James Hallisey
GENERAL MANAGER OF INFRASTRUCTURE SERVICES

Cheakamus Crossing
Whistler 2020 Development Corporation

District Energy System Summary Report

September 22, 2017

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1.0 Cheakamus Crossing Neighbourhood

1.1 Introduction and history

Since 1988, Whistler has had in place a Resident Employee Accommodation Policy. In 1997/ 1998 the municipality engaged community members to help chart a vision for the future by creating "Whistler 2002" a plan that outlined five community priorities which included, building a stronger resort community, enhancing the Whistler experience, moving toward environmental sustainability, achieving financial stability and contributing to the success of the region.

At that time, Whistler was considering a bid with the City of Vancouver for the 2010 Olympic and Paralympic Games and "guiding principles" were created to help guide Whistler's involvement in the bid to support and advance the community's priorities. To foster community character, diversity, volunteerism, pride and investment where one lives, the community set an overall goal to maintain 75-percent of Whistler's employees as residents within Whistler.

Leading up to the 2010 Olympic and Paralympic Games, Whistler faced a significant affordable housing challenge. Rates for market housing had risen significantly, from $335,331 in 1994 to $957,834 in 2001 for a single-family home. In 2005, the Whistler Housing Authority reported 535 families on the wait list to purchase resident-restricted housing, with a preference for two to three bedroom townhomes. 55-percent of the families on the waitlist wanted three or four bedroom townhomes. In 2007, the waitlist had ballooned to over 700 families which included families in need of affordable housing and families in WHA housing in need of larger homes.

The opportunity to create a significant amount of affordable housing for the community arose when the Province of British Columbia committed during the bid phase of the 2010 Olympic and Paralympic Games to construct temporary housing in Whistler for use during the Games. The concept emerged for the development of an Athlete's Village that could then be converted to permanent resident-restricted housing as a legacy for Whistler following the Games.

With $31 million in capital funding from the Vancouver Olympic Committee (VANOC) through the provincial and federal government and land from a Land Bank provided by the Province of British Columbia, the RMOW agreed to develop an Athlete's Village for the 2010 Games that would then transition to resident-restricted housing. This new development would add 276 affordable housing units as well as a 55-room hostel and 20 market-priced townhomes.

In 2004, the RMOW created an independent organization, incorporated as a business with the RMOW as the sole shareholder. The name, "Whistler 2020 Development Corporation" (WDC) was chosen to reflect the community's goal of creating a new, sustainable neighbourhood for full-time Whistler residents, known as the "Legacy Neighbourhood". WDC managed the design and approval process for the new neighbourhood and developments in a similar manner to a

conventional developer with a focus on the delivery of the Athlete's Village and subsequent Legacy Neighbourhood. WDC Board members were appointed by Council with a strong focus on extensive expertise in the development and construction business and a commitment to the Community. A number of the original Board members from 2004 continue to volunteer today and have devoted thousands of hours of their time to WDC.

Drawing on their collective expertise, WDC ensured all facets of the project development met industry standards. WDC retained planning consultants to create development concepts at the start of the project and engage the community on the initial ideas for the neighbourhood. WDC developed plans for the initial phase of the neighbourhood which transitioned into a series of building projects and the accompanying infrastructure, including utilities.

WDC maintained responsibility for developing the Legacy Neighbourhood master plan for RMOW Council approval, developing a business and construction plan, preparing village development requests for proposals, executed contracts, monitored and oversaw construction activities and ensured project completion. WDC also managed the sales and occupancy process for Whistler Housing Authority pre-qualified Whistler residents.

The development of the Athlete's Village was shaped by four principle objectives;

1. **Establish a land bank:** The Community Land Bank agreement between the RMOW and Province provided a Crown grant of 300 acres to the RMOW to support resident-restricted housing. The initial Legacy Neighbourhood/ Cheakamus Crossing occupied 35 acres, leaving the balance available for future development, provided that development is for the purpose of creating resident-restricted housing and approved ancillary uses.
2. **Minimize financial risk to Whistler taxpayers**: The goal of the development was to break even, minimizing one time and on-going financial risk to the municipality.
3. **Complete International Olympic Committee/VANOC housing requirements for November 2009 handover**: Under the Venue Agreement, VANOC was to take possession November 1, 2009 to May 31, 2010. All buildings and improvements were to be completed on time to meet VANOC requirements and IOC standards.
4. **Retrofit and refurbish housing to turnover to purchasers by fall 2010**: To minimize financial risk to Whistler taxpayers, the housing needed to meet IOC standards but also be saleable to Whistler-based employees at affordable pricing.

Throughout the planning, building and retrofit phases, the WHA and WDC conducted an extensive community engagement process to ensure potential buyers were kept fully apprised on the progress of the developments. This included email updates to approximately 1,000 applicants on the waitlist and advertising in local publications. A rigorous planning process and attention to detail on all aspects of the infrastructure development, landscaping, building design and engineering resulted in a final mix of housing and accompanying finishes that met the identified housing needs of the residents on the purchase waitlist within their preferred price range of $200,000 to $300,000.

1.2 Environmental Considerations

Along with its reputation as a leader in the provision of residential housing, Whistler has also pursued excellence in climate change and environmental protection. Accordingly, each of the housing projects for the Athlete's Village/ Cheakamus Crossing development were designed with the Whistler Green Building Program in mind. This community-driven program is intended to encourage sustainable and environmentally friendly design and building practices at a grassroots level. In the design process, project objectives for the Legacy neighbourhood included optimizing site density to lower the overall footprint of the neighbourhood, ecologically sound and drought-resistant landscaping, walking paths and sidewalks to connect to transit routes, adding a new transit route to the neighbourhood as well as direct access to Whistler's Valley Trail.

As part of the goal of building a sustainable community and reducing the community's environmental footprint, a District Energy System (DES) was designed to service the neighbourhood and provide the majority of the energy requirements needed for heating and domestic hot water use, traditionally the largest contributor of a home's carbon footprint. Each residential unit was designed to be heated by a radiant hot water system, with the temperature of the water supplied by Whistler's Wastewater treatment plant boosted by heat pumps in each unit.

Leadership in Energy and Environmental Design (LEED) Neighbourhood Development provided instructive considerations through each step of the planning process. The Athlete's Village/ Legacy Neighbourhood was one of twenty pilot projects assessed by the U.S. Green Building Council under a new rating system.

1.3 Marketing and sales of WHA Cheakamus Crossing units

WHA worked with WDC to market and manage the pre-sales of the housing in the Legacy Neighbourhood which was marketed as "Cheakamus Crossing". Whistler Real Estate Company was retained to complete the sales contracts with the buyers. The resident-restricted housing units were price-capped at purchase and any re-sales tied to a maximum appreciation rate tied to the Core Consumer Price Index as with other WHA properties.

Marketing and sales contracts for the Cheakamus Crossing properties managed by the WHA were executed by the Whistler Real Estate Company.

Disclosure statements by the Whistler Real Estate Company included a comprehensive section on the Home Warranty Information for each Cheakamus Crossing strata property.

A “Features Sheet” for the Cheakamus Crossing properties highlighted;

Neighborhood Features:

- Master Planned community designed with sustainability in mind–compact pedestrian-focused neighbourhood offering privacy, green space and a variety of housing types.
- LEED-ND – Cheakamus Crossing is one of only 20 Canadian developments designated as a pilot project for LEED-ND (Neighbourhood Development). The LEED-ND program currently sets the highest standards in green neighborhood design practices
- District Energy System (DES) – decreases the use of conventional energy sources for hot water and heating
- Mountain views and sunny location
- Amenities:
  - Children’s play area
  - High Performance Training facility
  - Athletic fields and park areas
  - Retail and commercial convenience centre
  - Abundant recreation within walking distance
  - Transit service

The disclosure statement provided by Whistler Real Estate that was signed by each purchaser, in relation to maintenance responsibilities of owners stated the following furnishings and equipment were included in the purchase price of each Strata Lot unless otherwise indicated:

- refrigerator;
- electric stove;
- dishwasher;
- microwave hood/fan;
- window blinds;
- washer/dryer;
- heat pump with two tanks (one for hot water and one for space heating);
- in-floor radiant heating on ground floor and second floor; and
- hydronic baseboard heaters on the third floor.

The Developer may, in its sole discretion, offer additional furnishings and equipment to purchasers of Strata Lots at an additional cost.”

In relation to utilities services;

1.1 Utilities and Services

(a) Utilities

The Development will be serviced by the district energy (thermal) system (the "DES"), a water system, electric power, sewage, fire protection, telephone, cablevision and road access.

The DES is a municipal service, which will provide thermal energy for space heating and domestic hot water purposes. The DES will capture heat from the nearby wastewater treatment plant and transfer this energy to clean water which will be circulated around Cheakamus Crossing in a network of pipes. This warmed water will be used by heat pumps within the Development to provide space heating to the Strata Lots and to provide a portion of the energy used to heat the domestic hot water.

The Municipality will own and operate the DES, and will charge owners of the Strata Lots fees and charges in respect of:

(i) the costs of operating, repairing and maintaining the DES; and

(ii) a contribution to a replacement reserve fund for the components of the DES including, without limitation, the pipes, heat exchangers, boilers and pumps.

It is intended that the Municipality will enact bylaws to establish the fees and charges payable by owners. As the DES is to be owned and operated by the Municipality, it will not be governed by the Utilities Commission Act (British Columbia) so such fees and charges will be at the discretion of the Municipality, much like the existing municipal water and sewer services. The charges anticipated by the Municipality for the DES, when added to the electricity bill, will be comparable to the cost of electricity and gas for other traditional forms of heating and the supply of domestic hot water. The Developer anticipates that the fees and charges will be proportional to the Unit Entitlement of the Strata Lots.

Additionally, each disclosure included warranty information language as follows:

"Exhibit 1
The following coverage will be provided in respect of any defects in workmanship and materials for the construction and finishing of the buildings and common facilities:

Two Year Materials and Labour Warranty:

1. The coverage for the two-year materials and labour warranty is as follows:

    (a) in the first twenty-four months:

        (i) coverage for any defect in materials and labour supplied for the electrical, plumbing, heating, ventilation and air conditioning delivery and distribution systems; “

1.4 Home ownership and historic sales of WHA Cheakamus Crossing Units

The initial overall housing mix at Cheakamus Crossing consisted of 154 employee-restricted townhomes, 20 market townhomes (total of 174 units constructed by WDC), and 67 employee-restricted condos, as well as 55 rental apartments for WHA and 55 rental units for Hostelling Canada.

Home ownership and sales for approximately 90-percent of Cheakamus Crossing housing is managed by the Whistler Housing Authority.

The Whistler Housing Authority is widely recognized as an innovator and leader in the provision of residential housing. It operates on the mandate that it is essential for the majority of Whistler employees to live in the community in which they work. To achieve this objective, the WHA partners with the community to provide and sustain a range of housing options both rental and home ownership for those who live and work in Whistler. Creating an inventory of price controlled units that are only available to resident employees has proven to be the best means of reducing the impact of market forces, which for the last 20 years have driven the price of market housing out of reach for many locals.

In Cheakamus Crossing, WHA development for ownership include;

- The Falls – condo units
- The Lofts – condo units
- The Heights – townhouses constructed by WDC
- The Rise - townhouses constructed by WDC
- The Springs - townhouses constructed by WDC
- The Terrace - townhouses constructed by WDC
- Whitewater - townhouses constructed by WDC

Riverbend, a market-priced townhouse development, was built by WDC as a means to recoup Whistler tax-payer funded capital costs incurred in the Cheakamus Crossing development.

The Chiyamesh is the 55-unit rental housing building managed by the WHA. Rents currently range from $817 to $1,020 including utilities. In 2010 rents were between $775 and $975.

All WHA homes in Cheakamus Crossing are price-restricted and resale value is limited to changes in the Core Consumer Price Index (CCPI) for Canada as reported by the Bank of Canada.

A positive increase to the CCPI from the CCPI at the date of the previous sale results in an increase in the value of a WHA price-restricted home at the time a new sales contract is executed.

A drop in the CCPI from the date of the previous sale and the execution of a new sales contract results in a decrease in the value of the home.

Cheakamus Crossing owners were permitted to start calculating the change in CCPI per the date of their signed Contract of Purchase and Sale as opposed to the date of their sales completion.

The WHA reported resale prices of $260 to $276 per square foot for WHA Cheakamus Crossing developments in 2011.

In 2016 and 2017 to date there have been 10 sales in Cheakamus Crossing with the price per square foot ranging from $271 to $296. The average WHA waitlist time for purchasers was 70 months or 5.8 years.

In comparison, market-priced employee-restricted housing sales in Whistler (Eaglecrest development, Bayshores and Suncrest Development, Brio) averaged approximately $600 per square foot in 2016/17. Market price non-restricted housing price per square foot varies in Whistler but for townhouse developments in 2017 have ranged from $700 per square foot to + $1,000 per square foot. (Source: BC Assessment eValue)

In September 2017, a 3 bedroom, 3 bathroom 1,765 square foot unit at Riverbend, the market-priced housing in Cheakamus Crossing, was listed for $1,499,000, $849 per square foot.

1.5 Warranty information on WDC-built Cheakamus Crossing residences

Each owner of a resident restricted or market dwelling unit built by WDC in Cheakamus Crossing, received the benefit of various warranties as part of the purchase of their new home. There were three (3) separate warranties provided as follows:

1) New home warranty under the provisions of the provincially legislated Homeowner Protection Act which was underwritten by either Travelers or National Home Warranty and provided:
    a) a 12-month warranty for any claims related to interior finishing, plumbing, mechanical, and electrical, among other issues
    b) a 5-year warranty for building envelope deficiencies

c) a 10-year warranty for structural defects

2) Contractual warranties from third party contractors (windows, appliances, flooring, plumbing, electrical, mechanical. etc) who were contracted by WDC to construct components of each home in each of the individual developments

3) A warranty from WDC pursuant to the provisions of the Purchase and Sale Agreement (PSA) for each home

Prior to the expiration of each individual warranty as specified in 1(a), (b), and (c) and 2) and 3) above, WDC administered the warranty programs as required by responding to owner requests for warranty service. Items related to many components of the homes were submitted and addressed where legitimate during the applicable warranty periods, including numerous service requests related to the DES system and components within the home.

WDC kept individual warranty files for each new home and the warranty companies registered each individual new home owner and provided warranty documentation at occupancy and also maintained warranty files for each home. The number and type of deficiencies addressed under the warranties were not noted as anomalies in the development sector for a project of this nature and size.

2.0 Cheakamus Crossing District Energy System

2.1 History of Cheakamus Crossing and the District Energy System (DES)

A District Energy System(DES) was built and connected to all the units of Cheakamus Crossing when the neighbourhood was built for the 2010 Winter Games as the Whistler Athletes' Village.

In Whistler, the DES refers to the energy system that is in place from the Wastewater Treatment Plant to the exterior wall of properties connected to the DES. Multi-unit properties connect to the DES through a centralized mechanical room while individual homes/ townhouses each have their own privately-owned and operated heating system within their home that is connected to the DES. The properties themselves do not have a DES but are connected to the DES.

As outlined previously, one of the mandates for the Whistler Athlete's Village/ Cheakamus Crossing neighbourhood was to build a sustainable community that met the goals of 'Whistler2020' Whistler's integrated community sustainability plan and highest-level policy document.

WDC worked with consulting engineers Kerr Wood Leidel and mechanical engineers DEC Engineering to develop a District Energy System for the Whistler Athlete's Village/ Cheakamus Crossing neighbourhood that would meet the community's goal of reducing overall energy use.

The system was designed to use low-temperature ambient heat from treated sewage effluent from the nearby Whistler wastewater treatment plant. The engineers designed the DES to use treated wastewater effluent instead of natural gas in order to reduce greenhouse gas emissions by over 95-percent.

The Cheakamus Crossing DES makes use of energy from the wastewater process that would otherwise go to waste. The high efficiency of the DES provides a significant amount of heating to a large number of residences while using less energy overall as compared to individual heating units and units heated individually by natural gas.

2.2 Costs

The DE system cost of $4.1 million was absorbed into the $144 million total building costs for the affordable housing units in Cheakamus Crossing, which were shared among the Province (land and land remediation), the Vancouver Olympic Committee (VANOC) ($35 million), RMOW ($8 million) and the Municipal Finance Authority (MFA) ($100 million loan). The RMOW received a two-year extension from the MFA to repay a $13 million outstanding balance.

The RMOW does not include capital cost recovery or return on invested capital in its revenue requirements as the capital cost has been paid. Rates are set annually by Council based on staff reviews of operating costs. The amount to be received from DES ratepayers in 2011 was $195,000, consisting of:

- $125,000 in operating costs (including $40,000 for electricity and $50,000 for natural gas); and
- $70,000 to a replacement reserve fund (to provide half of the estimated future capital replacement costs).

The RMOW's Bylaw 1951 sets a unit rate of $4.58/m2 per year to recover $195,000 from owners of 42,600 m2 of floor area.

2.3 DES Fees

To manage the ongoing maintenance and depreciation costs of the DES, the RMOW collects a quarterly DES fee from homeowners connected to the DES.

The fee is collected on April 1, July 1, September 1, and December 31 of every calendar year.

The unit area rate of $4.58 / m^2 /year goes towards the costs of operation and maintenance of the municipal components of the DES (heat transfer and pumping equipment at the wastewater treatment plant and the DES piping through the neighbourhood).

2.4 Background on District Energy Systems

A District Energy System (DES) centralizes the production of heating or cooling for a residential or commercial development, neighbourhood or community. The concept and use of energy systems for multiple residences and commercial units is not new. Examples of steam-driven and other centralized heating units have been in use across North America for more than a century.

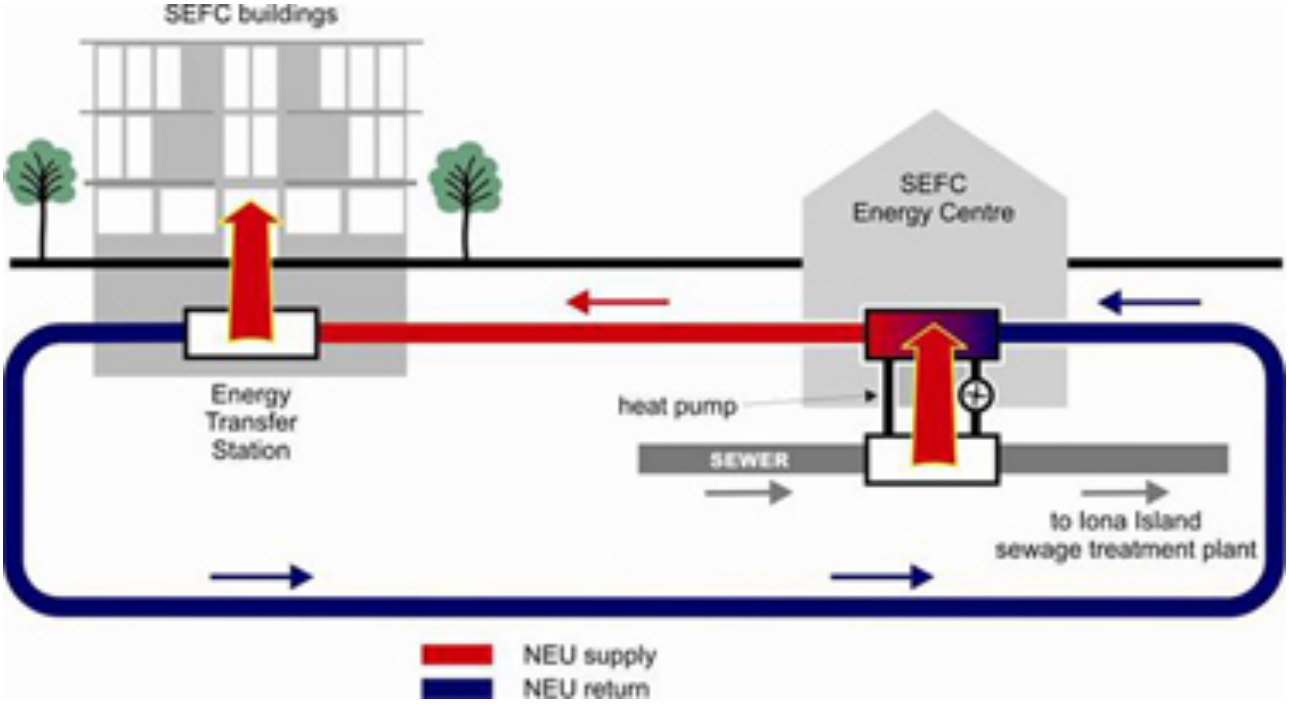

Image 1: Vancouver's Neighbourhood Energy Utility in Southeast False Creek. Source: City of Vancouver/ BC Climate Action Toolkit resources

District energy systems generate heat at a central plant, or extract heat from other sources. The heat is transferred to a fluid and distributed through underground pipes to buildings where it is used for space and water heating. The fluid is then returned to the source to be reheated and recirculated. Some systems also provide space cooling in a similar way. They may deliver energy services with greater efficiencies and lower emissions than individual furnaces, boilers, electric baseboards, and water heaters fueled by oil, natural gas, propane, or electricity. (Source: BC Climate Action Toolkit)

In British Columbia, examples of other District Energy Systems in use include;

- City of Vancouver's Southeast False Creek Neighbourhood Energy Utility which uses waste thermal energy captured from sewage to provide space heating and hot water to buildings in Southeast False Creek. Creative Energy is a private district energy system company that provides steam heat from natural gas in downtown Vancouver.
- Corix is a private company that manages geothermal distribution at Simon Fraser University's sustainable community, UniverCity including the sustainable and affordable housing development, Verdant.
- Corix systems are also in operation in strata developments across the lower mainland of B.C. including Will's Creek townhomes in South Surrey, The Rise Resort in Vernon.
- Dockside Green Energy in Victoria operates a central energy plant that produces hot water through a natural gas boiler and works in conjunction with a gasification process that uses waste wood. The heated water is transported to the Dockside Green community through a District Energy System.
- The Town of Gibsons, B.C. worked with developers and builders to construct an ambient-temperature district system for a 750-home development. A large ground heat exchanger (GHX) was built in the Parkland area.
- Revelstoke's Community Energy System uses sawdust and hog fuel from the Downie sawmill to fuel a 1.5 MW biomass boiler. The boiler provides heat to several downtown buildings through a district hot oil loop, as well as steam to Downie's drying kilns. The system provides energy rate stability to customers, improves air quality, and reduces greenhouse gas emissions.
- Richmond, B.C. manages the Alexandra District Energy Utility (ADEU), which increases heating and cooling efficiency by matching energy supply with energy demand.

2.5 Cheakamus Crossing District Energy System

The Cheakamus Crossing District Energy System (DES) uses treated wastewater at the Resort Municipality of Whistler's Wastewater Treatment Plant to provide a heat source for space and domestic water heating for buildings in the Cheakamus Crossing neighbourhood.

The RMOW operates and maintains the DES plant located within the municipal wastewater treatment plant, as well as DES piping in the neighbourhood up to the property lines. Strata properties are responsible for the piping on common property, and individual homeowners are responsible for all equipment within their homes.

The Cheakamus Crossing DES plant provides low temperature (10 to 12C) water through a five kilometre loop of pipe with associated valves and controls, to service connections across the neighbourhood. The plant extracts heat from treated effluent water and transfers it to the heat transfer fluid in the loop. The distribution piping and controls are partly on public land and partly on private land. The plant and distribution system are the property of the RMOW.

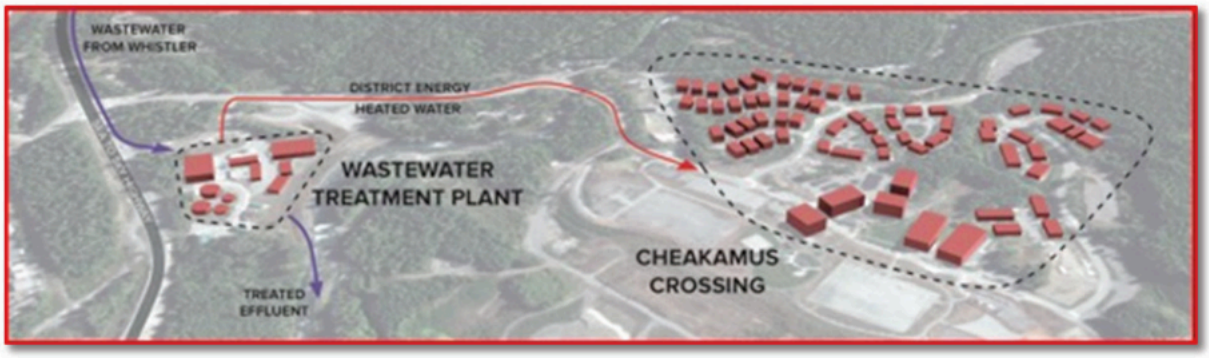

Image 2: Cheakamus Crossing Neighbourhood DES Overview
Source: DEC Engineering, Homeowners Quick Reference Guide)

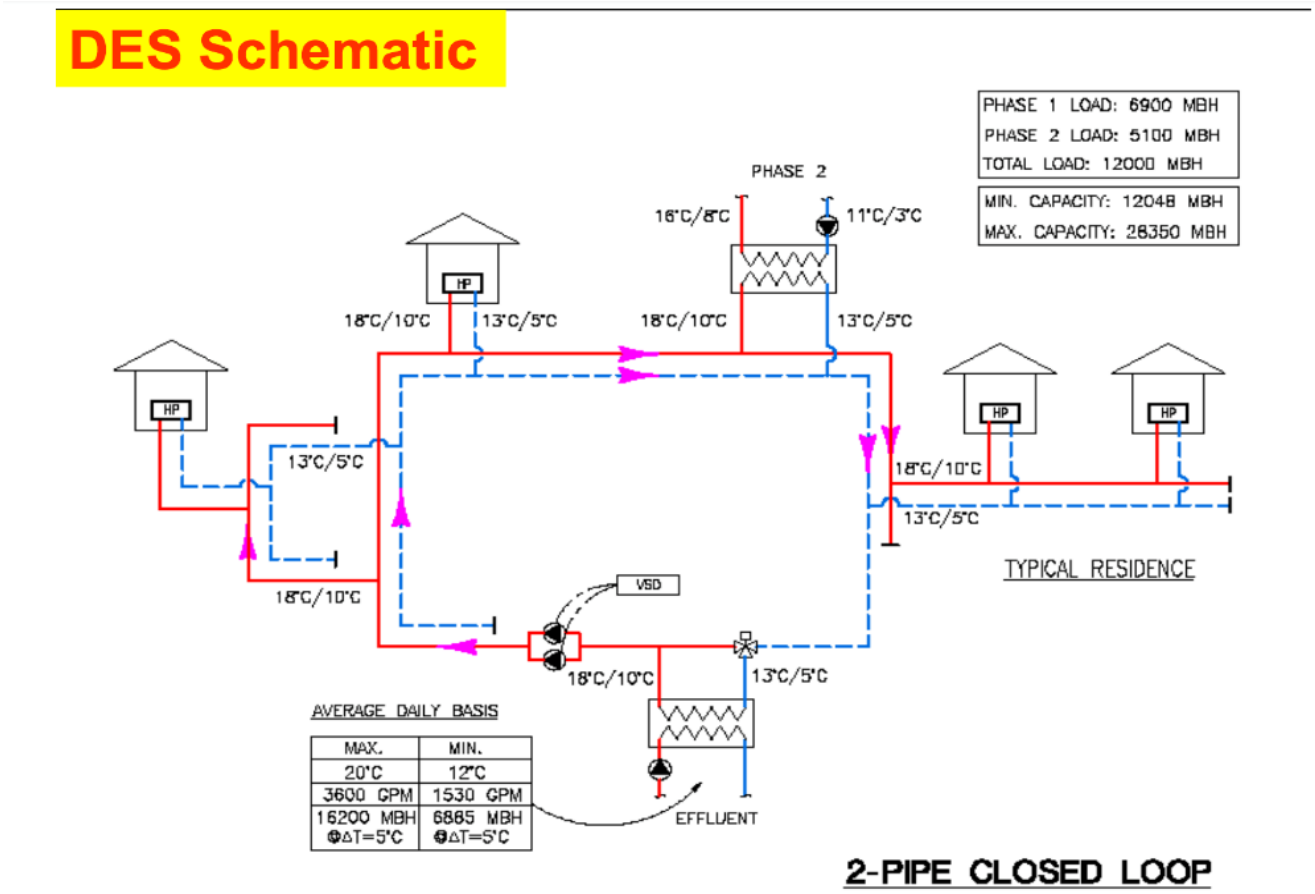

Image 3: DES Schematic
Source: Kerr Wood Leidal Consulting Engineers (hard to read illustration – can it be enlarged)

Within homes, the residential heat pump system includes an electric heat backup circuit (for home heat) and a backup electric hot water heating circuit (for domestic hot water). In the event of a failure of loop flow or temperature, the heat pump will switch to backup electric heating automatically, then attempt to go back to heat pump mode. If the system is unable to reset the heat pump, the heat pump will eventually shut down entirely, requiring the home owner to manually restart the heat pump once the DES loop is up and running again. Controls and backup boilers at the Cheakamus Crossing DES Plant are setup to ensure that loop temperature is always maintained in the correct range, in order to prevent needless electric heating expense or damage to the privately-owned heat pumps.

The extent of the DES inside the Cheakamus residences is limited only to a heat exchanger in the heat pump in each residence and then back out to the street. The remainder of the heating systems in the residence are independent of the DES loop and are the responsibility of the owner of the residence. The DES provides a heat sink for the heat pump to utilize in providing heat to the residence. This is illustrated in the photo below.

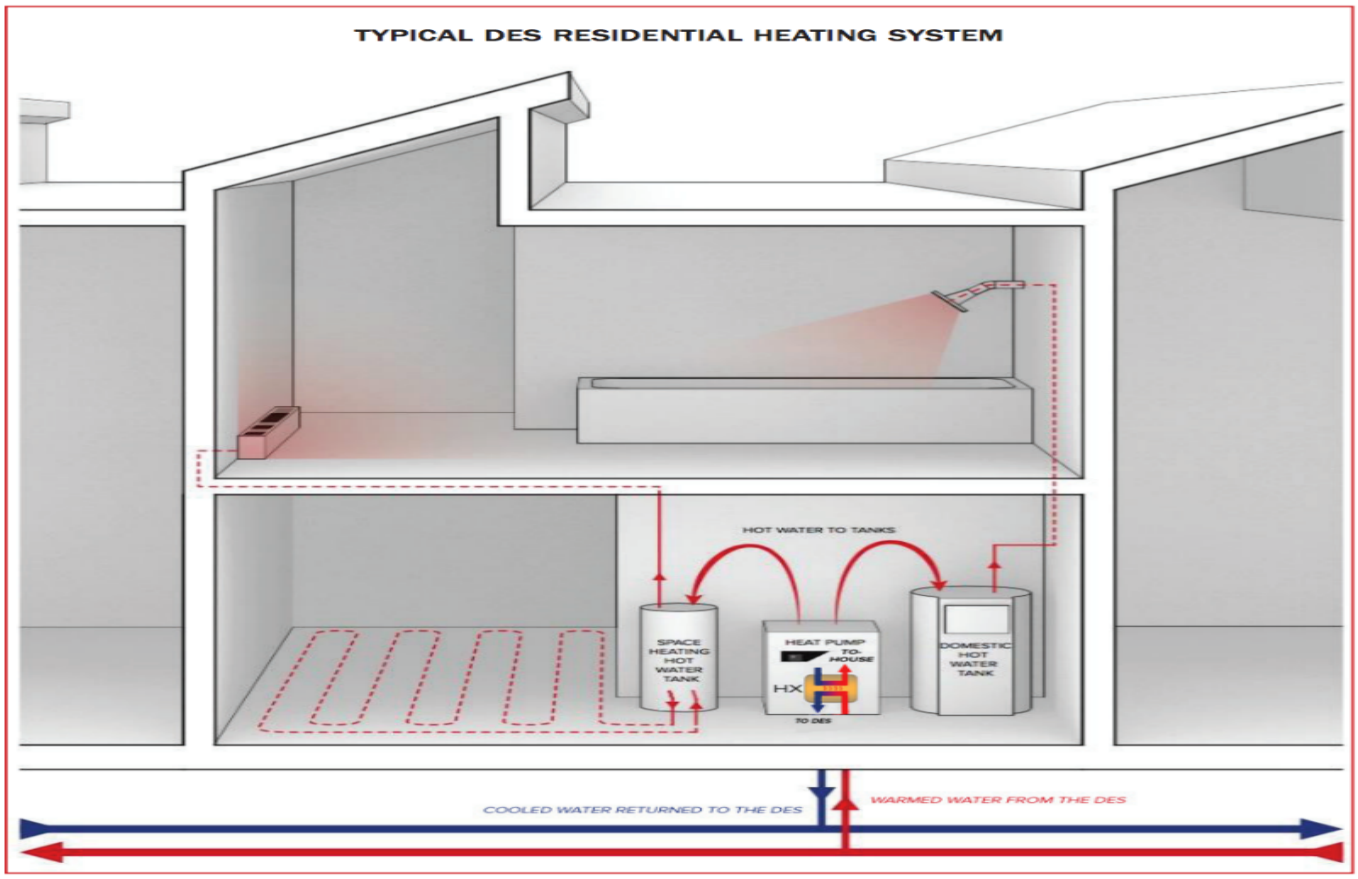

Image 4: DES home typical design
Source: DEC Engineering, Homeowners Quick Reference Guide

The Cheakamus Crossing DES service connections are associated with privately owned heat pumps in the various residential duplexes, row houses, hostel, high performance athlete centre and other commercial properties. The WDC-developed townhouses each have privately-owned heat pumps and control systems within their units.

Each unit is heated by a hot water radiant system. The temperature of the water supplied through the DES is increased by individual heat pumps in each unit for domestic hot water and space heating requirements.

The heat transfer fluid is made by chemically treating regular drinking water to ensure it does not cause corrosion to heat pumps or cause growth of bacteria in the Cheakamus Crossing DES loop piping, then adding fluorescent food-grade dye to help distinguish transfer fluid from other drinking water.

Specific components within Cheakamus Crossing homes developed by WDC that connect to the DES include;

- Heat Pump- The heat pump extracts heating energy from the DES loop and increases the water temperature that heats the rooms and water. Much like a refrigerator (which is cold on the inside and warm on the outside), the heat pump uses the same principles to cool the DES water and heat the water in the Domestic Hot Water and Space Heating storage tank.
- DES Control Valve- This valve regulates the flow of DES water into the heat pump.
- Domestic Hot Water (DHW) Tank This tank stores potable hot water needed for showering, washing, or other uses.
- DHW Heat Exchanger- This heat exchanger contains metal plates that allow the non-potable heating water loop to safely transfer heat to the potable domestic hot water.
- DHW Circulating Pump- This pump circulates the water from the DHW tank to the DHW heat exchanger for heating.
- Heating Water Tank- This is a buffer tank that stores the hot water used for space heating.
- Expansion Tank- This tank contains an air bladder that expands or contracts to absorb pressure changes in the system caused by temperature changes in the heating water.
- Backflow Preventer Devices- Each residential DES system had two backflow devices that required annual testing. These devices were replaced under the Phase 1 program with devices that do not require annual testing. Backflow is an undesirable reverse of flow of water back into the water supply.

2.6 Owner's Home Information Packages

Prior to occupancy, according to WDC, owners participated in a walk-through inspection and orientation of their home, and upon handover received hardcopy general maintenance manuals, and directions on how to log in to an online maintenance and warranty website containing information specific to their unit. Strata property management companies also participated in walk-throughs for the various complexes, and were provided with copies of drawings and operation manuals and participated in strata council meetings to promote owners undertaking annual DES maintenance programs.

Each WDC-developed unit was provided with a unique login and password to the cloud-based platform www.homeinformationpackages.com. Website and login information was included on a sticker placed on the internal electrical panel of each unit. See Appendix A: Website and login detail for Home Information Packages.

On this website, owners are provided with manufacturer's information, warranty information and maintenance information for appliances, electrical, heating and finishings. For each component, there is a page with manufacturer's information, warranty length, product specifications and operating guide as well as supplier and installer information and contact details.

See Appendix A: Website and login detail for Home Information Packages.

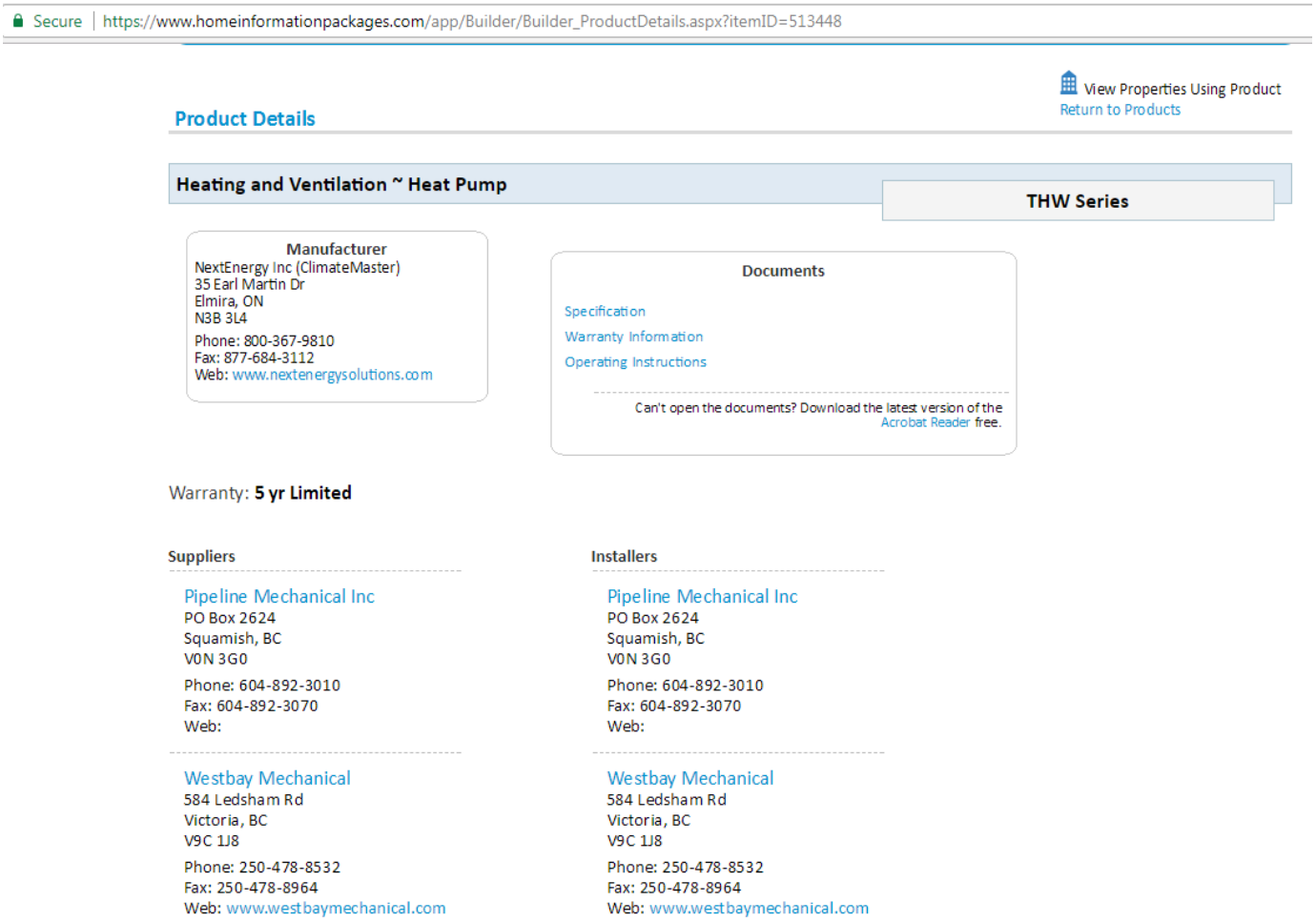

Image 6: Heat pump detail provided on www.homeinformationpackages.com for a unit in the Heights

2.8 Homeowner's Quick Reference Guide

As noted above, www.homeinformationpackages.com provided information on the operating of the system including the need for ongoing maintenance of the DES). In addition, in April 2016, following concerns about in-home system operations raised by homeowners, the RMOW commissioned DEC Engineering to produce a Quick Reference Guide to help homeowners better understand their DES components and provide answers to frequently asked questions along with troubleshooting tips.

The 14-page guide outlines how the heat pump functions and heats homes as part of a DES, optimal thermostat settings, finding qualified contractors, recommended servicing schedules as well as specific instruction on fan coil maintenance.

The troubleshooting section covers issues including one room not receiving heat, “red screen” issues, failure of the heating system to start, lack of hot water and power outages.

See Appendix B: 2016 Homeowner’s Quick Reference Guide

2.9 Technical Service Guide

The RMOW produced a 146-page DES Technical Service Guide with a recommended proper routine maintenance to help ensure that the residential heating system connected to the Cheakamus Crossing DES is operating within the design parameters and in an efficient operational manner.

The guide recommended results of each service visit should be compared to normal operating parameters and set points as provided by DEC Engineering in this service guide. DEC Engineering recommended in the guide that heating system maintenance should be completed twice per year. Each service visit should include the completion of all Maintenance Checklist items listed in the guide. To ensure service consistency, DEC recommended the Technical Guide’s included logbook be kept on site in the mechanical closet/room of each residential unit for the service technician to log the details of every service visit.

See Appendix C: 2016 Technical Service Guide

3.0 DES Studies and Reports

3.1 RMOW DES Energy Study

In November 2015, the RMOW began a six-month study to look at energy efficiency of the DES in Cheakamus Crossing.

As the original energy systems approached six years from construction and activation, the RMOW believed it was important to confirm if the typical DES connected residential heat pump system in Cheakamus Crossing was achieving the energy goals it was designed to meet.

The decision was made to conduct the Energy Study Program (ESP) to measure, analyze and report on actual energy use within a sample group of townhouses and how it compares to townhouses using more conventional electric heating systems. DEC Engineering, the original design firm of the DES and HP systems, in collaboration with the Engineering staff at the RMOW, developed the criteria and methodology of the ESP. A volunteer sample group of six townhouses were chosen for the ESP. Each system passed a technical inspection prior to the study. Next, each system was equipped with an energy monitoring system that was used to record key amperages and temperatures needed to estimate the energy being used to produce space heating and DHW heating during the study period. The study period was set up to allow

for six months of monitoring, beginning in January 2016 and lasting through to July 2016. The collected data was used by DEC Engineering personnel to analyze the energy efficiency and operating costs of the monitored systems, and to provide a comparison to more conventional electric heating scenarios.

The study examined how well Whistler's DES heats houses compared to the amount of electricity it consumes. The study was commissioned to determine how district energy systems perform relative to standard electrical baseboards, and followed the cancellation of a BC Hydro study to examine district energy systems across various BC jurisdictions.

Results indicated the heat pump systems in the townhomes have much lower annual energy costs to produce the same levels of heat energy output, compared to homes that have standard electric water heaters and either an electric hydronic boiler or baseboard heaters.

The heat pump systems using the DES had annual energy costs from 17 to 40 per cent lower than homes using electric systems for heat and hot water, with an average annual savings of $428.00. Multiplying the average annual savings over a typical service life expectancy of 20 years equated to cost savings of $8,560.00 (in 2016 dollars).

The study took into consideration both operating costs as well as total ownership costs, including the cost of energy, the cost of routine maintenance, DES utility fees, and the cost of equipment replacement at the end of its normal service life.

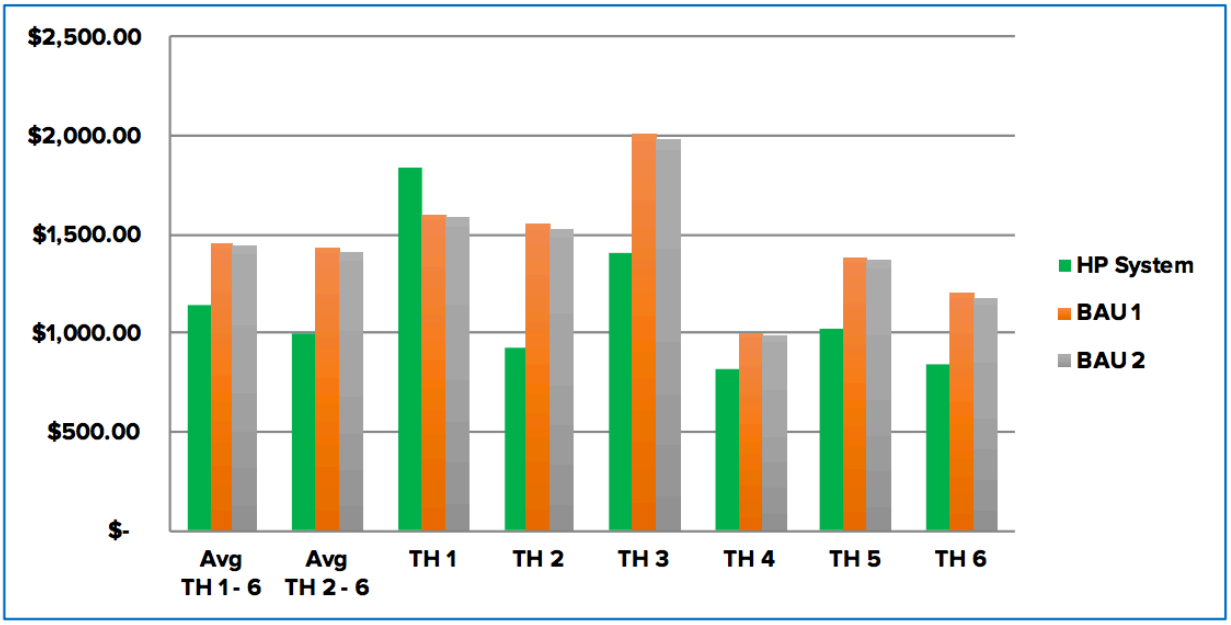

Image 7: *'HP system' denotes DES system compared to traditional electric baseboard/electric hot water tank (BAU 2) and an electric hot water boiler and circulating pipes (BAU 1). Townhouse 1 (TH 1) was only*

using the DES for space heating and a separate electric tank for hot water. As a result, TH 1 still paid a DES fee for the months where space heating was not required. Source: District Energy Study.

Five of the six home heating systems in the study group were found to be achieving the energy efficiency levels they were originally intended and designed for. The one system in the study group that did not, had its DES hot water heating disabled and connected directly to electric supply, therefore was not being operated as it was designed to maximize energy-savings. These results indicate that the home heating systems are capable of meeting the energy and environmental performance targets they were designed to. They also indicate that the performance of the home heating system is sensitive to how they are operated which is directly linked to ongoing maintenance.

The home heating systems were found to be significantly more energy efficient than other conventional (BAU) electric heating systems. The study results indicate they are consuming on average 65% less electricity per year, to provide space and water heating. This corresponds to an average 65% reduction in related GHG emissions.

The study concluded the DES offers additional environmental benefits by substantially decreasing Whistler's electrical and natural gas requirements. Compared to conventional heating technologies, the DES reduces greenhouse gas emissions by up to 95 per cent; the equivalent to taking 350 cars off the road for a year.

Based on an average annual energy savings of 7,878 kWh, every 3.7 years each townhouse HP system could potentially save enough electricity to completely power an average Whistler house for a full year. The potential average annual savings from the 174 Cheakamus Crossing townhouses is 1,370,772 kWh. This represents enough electricity to completely power 52 average Whistler houses each year.

See Appendix D: District Energy Study

3.2 DES Volunteer Committee

In 2015, Cheakamus Crossing residents formed an ad hoc committee to review and discuss concerns with the operation of the DES and individual home heating systems. In spring 2015, WDC and RMOW representatives met initially with a representative of the Cheakamus Crossing DES ad hoc committee, to discuss resident concerns and issues with a view to analyzing system performance.

The consensus between the volunteer group, WDC and the RMOW was to obtain expert third party technical advice to help to better understand the system and various operational issues and challenges that had been experienced by owners. The volunteer residents committee, with assistance from WDC and RMOW, established terms of reference for the purposes of undertaking a proposal call to obtain proposals and fees from experts.

A number of proposals were received and the representatives agreed that the proposal from Integral Group best met the parameters established. Throughout the duration of the initial study by Integral and including the establishment of the Phase 1 and 2 remedial work programs, tendering to qualified contractors, and the work that ensued, WDC posted program updates on the www.CheakamusCrossing.ca site and also met with a DES Volunteer group representative from time to time and communicated by email.

3.3 DES Forensic Report by Integral Group Consulting

In April 2016, WDC commissioned a report from Integral Group Consulting, an independent engineering firm chosen by the Cheakamus Crossing DES Volunteer Committee, for a detailed mechanical engineering design peer review and forensic examination of the home heating systems installed in the townhouses and an investigation of the interface between the home heating systems and the local District Energy System.

See Appendix E: Cheakamus Crossing DES Forensic Report

The report found that design and construction appears to have been typical for a project such as the Cheakamus Crossing development, with site instructions being issued through the construction period to clarify and further detail what was to be provided for the home heating systems.

The report noted disappointment in the completion documentation and lack of detail on the procedures used for startup and commissioning and the lack of final Operating and Maintenance Manuals. However, the author of the 2016 Forensic report was not familiar with the history of the DES and was unaware that at time of commissioning, each WDC-developed unit was provided with a unique login and password to the cloud-based platform www.homeinformationpackages.com. Website and login information was included on a sticker placed on the internal electrical panel of each unit.

Additionally, prior to occupancy, owners participated in a walk-through inspection/orientation of their home, and upon handover received hardcopy general maintenance manuals, and directions on how to log in to an online maintenance and warranty website containing information specific to their unit. Strata property management companies also participated in walk-throughs for the various complexes, and were provided with copies of drawings and operation manuals.

The forensic report included site visits and owner interviews of 19 townhouses in the fall of 2015.

The findings included;

- The systems are remarkably similar considering the number of installing contractors that were involved. Some variations include the following: Heating pump and domestic hot water (DHW) pump direction of flow and location. Some pumps are located in the supply to the buffer tank and DHW heat exchanger, some in the return lines and some pumps are pumping into the heat exchanger and buffer tank, some are pumping out. These differences should not present any operational problems if the pumps are performing at specified flow and pressure. .

- Spirovent air separators are all provided as indicated on the design drawings and are in an appropriate position in the system. These are very good air separators and should provide long term effective air removal from the systems. Smaller automatic air vents are also located in appropriate locations to remove air in the mechanical rooms. We did not see any fan coils with manual air vents as called for on the drawings. We heard no indication that there was air in any of the systems but the fan coils are the high points in the system and where air will accumulate if any is present in the systems and gets past the air separation in the mechanical rooms.

- The fan coils were supplied with heating water several different ways as follow:
  1. Some townhouses had a single control valve and balancing valve.
  2. Some townhouses had a single control valve and no balancing valve.
  3. Some townhouses had control valves and balancing valves per fan coil.
  4. Some townhouses had just control valves per fan coil.
  5. The design drawings called for a single control valve and balancing valve for all the fan coils.
  5. There were less pressure gauges and thermometers than would have been expected but both pressure gauge taps and the operating screen of the heat pumps provide sufficient information to service the systems.
  6. Some systems have less drain points than others with many new drain valves having been installed since the systems were first put into service. These help with doing system flushes but the tank drains and drains on the domestic water heating supply and return could be used to flush and clean the systems with regular servicing.
  7. The locations of the strainer, automatic balancing valve and control valve on the DES side of the system varied somewhat but the strainer was always located upstream of the other two items which is the most important thing.
  8. We noted that the heat pump starts as the control valve on the DES system starts to open. This could cause problems with heat pump startup. A time delay should be introduced or if the valve has an end switch it could be utilized to allow the valve to fully open prior to the heat pump starting.
  9. The switches for controlling the electric resistance heat in both the buffer tank for the heating system and the DHW tank were not consistent. Some had 2 switches, some had no switches, and some had switches including a 3-position switch on the DHW tank.

- Specific comments on the some of the townhouses visited are as follows:
  1. All the Whitewater townhouses visited had the expansion tanks located very close to the floor which does not allow access to the air valve on the bottom of the tanks. These tanks should be raised to allow access to this air valve for expansion tank testing and adjusting.
  2. 1160 Whitewater has the expansion tank for the heating system isolated from the system by the shut off valve. Expansion tanks should always be open to the system they serve. The only time this valve should be shut is when replacing the tank.
  3. #16 Riverbend has had the Tekmar controller changed and we could not determine if the sequences etc. were appropriate. The owner indicated no problems with control of the systems.
  4. #20 – 1375 Cloudburst (The Terrace) has corrosion appearing inside the heat pump. This appeared to come from the unions on the 3-way valve in the heat pump. There was no evidence of water at those locations at the time of the visit. The system has been flushed and material was removed from the system.
  5. #3 – 1380 Cloudburst (The Heights) reported never having had a problem but had just completed a very low flow flush of the system.
  6. #39 – 1275 Mount Fee Road (The Upper Rise) had some problems 2 years ago but after service which included a system flush system has been OK.
  7. #8 – 1245 Mount Fee Road (The Lower Rise) system did not respond to calls for DHW heat or heating but was not “red screened”. Reset heat pump from breaker and system started and was up to temperature and seemed to be responding to calls for heat before we left.
  8. #13 Riverbend owner reported that there had never been a problem and did not think the system had ever been flushed.
  9. #38 – 1275 Mount Fee Road (The Upper Rise) has had the system modified in an attempt to reduce the pressure drop required to be overcome by the heating system pump and the pump size has been increased. Our impression is that the increased pump may have solved the problem without the re-piping but the system will still function as intended with the re-piping. Owner indicated system performance was improved

Other major findings of the report included;

- The flow rate on the DES supply and lack of time delay on the heat pump operation until the 2-way valve is fully open is a concern that should be corrected as it leaves the heat pump in an operating region that is approaching the limits of efficient and reliable operation.

- The Technical Service Guide should be used by the homeowner to outline service requirements to their service contractor and has a form included in the manual that the service contractor should fill out completely as they do each service and be inserted into the manual which should be kept in the mechanical room. This manual then provides a baseline and history of operation of the system and will be invaluable for keeping the systems

running smoothly. The manual suggests 2 full services per year which we agree with. If system operation is stable after 3 services, the homeowner could consider switching to annual service.

- The report recommended water samples from each unit except those included in my review be tested for hardness, TDS and pH and appropriate action taken where required to obtain hardness under 150 mg/L, TDS value under 250 and pH between 6.0 and 9.5. The appropriate action will typically be a flush which should be accompanied by a demineralization of the fill water if out of range of acceptability and a follow up visit to ensure pH is high enough. The report suggested doing the same on a yearly basis to track the water quality and react as required to maintain the water within those guidelines. If the tests show stability the time between tests can be increased.

- Any fan coils that do not have manual air vents should be equipped with them to avoid flushing to vent air. Flushing to vent air will introduce water into the system that may upset a stable water condition in the systems.

- Because of the inconsistencies noted on the control of the backup electric heat for both the heating and domestic hot water the report suggested that each townhouse be checked to confirm that at a minimum the electric heat will be available if the heat pump fails. The Technical Service Guide covers this procedure quite well.

- When shut off valves are provided on expansion tanks, these valves should be open except when replacing the tanks. The Schrader air valve on the bottom of the tank also needs to be made accessible to allow servicing of the tank.

- The report determined the RMOW appears to be doing a good job running and maintaining the DES plant and piping system (external to each home). The minimum supply water temperature of 10C is a good balance of energy efficiency and keeping the temperature high enough for reliable heat pump operation. The report examined operating difficulties in the early days of DES operation and concluded these problems appear to have been addressed.

- The report emphasized it is important to use service contractors who have service personnel that understand the systems, have trade tickets applicable to systems such as Refrigeration Mechanic, Pipe Fitter and Plumber and are willing to use the Technical Service Guide and do the required record keeping such as using the Service Report provided in the guide. The current service contractors (Western Technical Systems, Scoular Mechanical and Custom Air) appear to be capable of this but it will be up to the individual homeowner to ensure they provide the service required.

Overall, the report did not find systemic failure issues with the Cheakamus Crossing DES and recommended that owners source an ongoing maintenance program through service contractors that are familiar with the DES and the privately-owned components in residences.

4.0 DES Phase 1 and Phase 2 Owner's Assistance Program

4.1 Overview

Following the forensic report by Integral Group, WDC, RMOW, Integral Group and a Cheakamus Crossing community representative worked to focus on the challenges encountered in individual homes with the goal of identifying specific deficiencies and looking for ways to facilitate improved operations of the heating systems connected to the DES.

Nine units were closely inspected using a list of 10 specific items that were identified by the forensic report. This data was used as the basis to obtain competitive bids to determine the cost to make repairs for these 10 items, where required, in all WDC constructed townhomes. WDC presented this information with the community representative and Whistler Council and the decision was made to spend up to $350,000 funded by WDC on a two-phase program for inspections and repairs.

167 of the 174 homeowners took part in this program representing 96% of townhomes in Cheakamus Crossing constructed by WDC.

4.2 Phase 1: Energy System Repair and Maintenance Program

WDC organized and contracted qualified technicians for the following work to be done:

1. Inspect flow valve and replace 6 gallon per minute cartridge with 8 gallon per minute cartridge.
2. Install time delay to prevent heat pump from starting until district energy system (DES) flow valve is fully open.
3. Install air relief vents on all fan coils or flush with high flow rates to eliminate air.
4. Inspect and, if required, correct sensor installation and location on both the heating buffer tank and the domestic hot water storage tank.
5. Confirm that backup heat for both heating buffer tank and domestic hot water tank operates automatically.
6. Confirm location of Schrader valves on expansion tanks. Raise tank installation if required to allow access to valve.
7. Adjust heat pump set-points to manufacturer's recommended settings for both heating and domestic hot water.
8. Take water sample from heating distribution system for testing.
9. Flush heating distribution systems

10. Replace backflow prevention device with one that does not require annual testing.

In December 2016, after consulting with the authorized technicians, Integral Group determined that a full system flush should be included in the Phase 1 scope for every home, regardless of water testing results. The flush included the entire heating system: the heat pump, the DHW heat exchanger, in floor heating system, fan coil piping and coils, and buffer tank. This change to the scope of work negated the need for water testing to be done.

4.3 Phase 2: Repairs and Replacements

Following participation in Phase 1, homeowners will have the option to participate in an additional repair program. For each individual unit, WDC reimburse up to 50% of eligible costs for additional home DES repairs and replacements up to a maximum of $1000 based on the following;

- Phase 1 work is completed
- Must be work identified during the Phase 1 program
- Agreed upon work is negotiated directly between Homeowner and Qualified Technician
- Must be completed by one of the WDC Approved Companies
- Only paid invoices (receipts) for work completed by the WDC Approved Companies are eligible for reimbursement.

4.4 Program Wrap-Up

In May 2017, the program entered the final stages of completion. The original deadline was extended, and finishing dates were adjusted on an individual basis to ensure that reasonable time is permitted to wrap up Phase 1 and any Phase 2 repairs.

4.5 Program Authorized Technicians

Authorized companies engaged for this program are;

- Allied Plumbing, Heating & Air Conditioning Ltd.
- Energy 1 Services Ltd.
- Haakon HVAC Services

4.6 Phase 1 and Phase 2 Program Summary

Phase 1 Summary

Phase 1 work at Cheakamus Crossing was undertaken between mid-November 2016 and Mid-May 2017.

Technician reports for Phase 1 reported:

1. All Griswold balancing valves on the DES into each heat pump were found to be 6 USgpm and were changed to 8 USgpm or 9 USgpm as originally specified.

2. The time delay to allow the control valve on the DES to fully open before the heat pump starts has been completed for all the reported residences.

3. Manual air vents have been installed or were present on upper floor fan coils on 83 units out of 134. Whitewater did not require vents on fan coils as there are no fan coils in these residences. The remaining residences have hose bibbs installed to allow for flushing of fan coils.

4. Temperature sensor locations on the buffer tank and domestic hot water tank were reviewed and corrected as follows:

    a. Whitewater: Sensors varied from 3” to 17” above floor on buffer tank and 17” to 33” on domestic water tank. All were corrected to +/- 13” on buffer tank and +/- 17” on domestic water tank.
    b. The Rise: Sensors varied from 3” to 34” above floor on buffer tank and 6” to 33” on domestic water tank. All were corrected to +/- 13” on buffer tank and +/- 17” on domestic water tank.
    c. Riverbend: Sensors varied from 6” to 56” above floor on buffer tank and 14” to 33” on domestic water tank. All were corrected to +/- 13” on buffer tank and +/- 17” on domestic water tank.
    d. The Terrace: Sensors measured were 15” above floor for buffer tank and 10” for domestic water tank. Results for 12 of 27 residences were reported.
    e. The Heights: Sensors measured were 7” or 8” above floor for buffer tank and 14” for domestic water tank. Results for all 27 of 27 residences were reported.

5. Backup heat for both tanks was intended to operate automatically if the heat pump failed to satisfy heat demand from the heating buffer tank or the domestic hot water tank. During initial review it was determined that various modes of control for both these tanks had been provided. This control either allowed the user to select automatic operation (Power Saver), manual operation for domestic hot water or manual override operation for heating or turn off the electric heat in each tank (automatic below); or just on-off control which would have the on mode be automatic and the off mode would turn off the electric elements. This part of the scope was to determine how many homes had this control and how many had just on-off switches.

a. Whitewater: 33 units had automatic switch for space heating, 1 unit that did not have automatic space heating, 23 units had automatic switch for domestic water heating, 11 units that did not have automatic domestic water heating.
b. The Rise: 57 units had automatic switch for space heating, 0 units that did not have automatic space heating, 54 units had automatic switch for domestic water heating, 3 units that did not have automatic domestic water heating.
c. Riverbend: 15 units had automatic switch for space heating, 0 units that did not have automatic space heating, 5 units had automatic switch for domestic water heating, 0 units that did not have automatic domestic water heating.
d. The Terrace: 25 units had automatic switch for space heating, 0 units that did not have automatic space heating, 25 units had automatic switch for domestic water heating, 0 units that did not have automatic domestic water heating. Two units were not reported.
e. The Heights: 27 units had automatic switch for space heating, 0 units that did not have automatic space heating, 5 units had automatic switch for domestic water heating, 22 units that did not have automatic domestic water heating

6. Whitewater expansion tanks that were mounted too low occurred 23 times and all were raised to make Schrader air valve on tank accessible for service. Three homes had tanks mounted low but the Schrader valve was accessible and these tanks were not raised.

7. Heat pump set points were checked, pressure differentials measured and temperature differentials measured. Specifications referred to are from the Cheakamus Crossing Technical Service Guide. Summary and observations are as follows:

    a. With the new Griswold balancing valve on the DES supply to each heat pump the pressure differential measured across the source side of the heat pump correlates with the catalog data for the heat pump at 8 USgpm. This is the case throughout the entire development.

    b. Whitewater:
        i. Pressure into Heat Pump on Heating and Domestic Hot Water: All homes were within specification of 8-24 psi.
        ii. Temperature into Heat Pump on both Space Heating and Domestic Hot Water Heating minimum of 26^{o}C: Nine homes were indicated below minimum but maximum deviation was 3^{o}C which is within acceptable deviation and could be measurement error.
        iii. Temperature out of Heat Pump (Domestic Hot Water only) maximum of 54^{o}C: Seven homes were above maximum of which 5 were within 3^{o}C. The 2 homes above 3^{o}C should reduce their domestic water set point to ensure the maximum is not exceeded. The homes within 3^{o}C might want to check their domestic water set point.

iv. Space Heating Temperature difference range across the Heat Pump of 8-11°C: All homes had temperature difference below 8°C. This in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system.

v. Domestic Water Heating Temperature difference range across the Heat Pump of 7-10°C: All homes had temperature difference below 7°C. This in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system.

vi. Space Heating Pressure differential range across the Heat Pump of 0.5-0.75 psi: All homes had pressure differential above 0.75 psi. This in combination with the temperature differences reported in point iv above indicate over delivery of flow which is a good operating condition for the heat pump and the system.

vii. Domestic Water Heating Pressure differential range across the Heat Pump of a minimum of 1.0-1.5 psi: All homes had pressure differential above 1.5 psi. This in combination with the temperature differences reported in point v. above indicate over delivery of flow which is a good operating condition for the heat pump and the system.

c. The Rise:

i. Pressure into Heat Pump on Heating and Domestic Hot Water: All homes were within specification of 8-24 psi except 2 which were below specification at 5psi. These suites should check the setting of the makeup water PRV and increase the pressure setting of this PRV to obtain at least 8 psi.

ii. Temperature into Heat Pump on both Space Heating and Domestic Hot Water Heating minimum of 26°C: Five homes were indicated below minimum for Space Heating with 2 of those within 3°C, 2 within 6°C and 1 within 7°C. Homes within 3°C are within acceptable deviation and could be measurement error. The 3 suites outside this limit need to have the cause investigated. If these homes were checked in warm weather it could be that the heat had been turned off or there may be a set point issue.

iii. Temperature Out of Heat Pump (Domestic Hot Water only) maximum of 54°C: Fourteen homes were above maximum of which 8 were within 3°C. The 6 homes above 3°C should reduce their domestic water set point to ensure the maximum is not exceeded. The homes within 3°C might want to check their domestic water set point.

iv. Space Heating Temperature difference range across the Heat Pump of 8-11°C: All homes had temperature difference below 8°C except 2 homes were within specification and 4 homes were above specification. The homes less than or within specification in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system. Homes that have higher

than specification should have their system flow rates checked as they may be lower than the design intended especially the 2 homes at 19 and 24°C.

v. Domestic Water Heating Temperature difference range across the Heat Pump of 7-10°C: All homes had temperature difference below 7°C except 3 which were within specification. This in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system.

vi. Space Heating Pressure differential range across the Heat Pump of 0.5-0.75 psi: All homes had pressure differential above 0.75 psi except 3 which were near zero. This in combination with the temperature differences reported in point iv above indicate over delivery of flow which is a good operating condition for the heat pump and the system. The 3 homes below specification should have their systems rechecked for flow blockage as these homes appear to have very low flow rates.

vii. Domestic Water Heating Pressure differential range across the Heat Pump of a minimum of 1.0-1.5 psi: All homes had pressure differential above 1.5 psi except 1 home was within specification and 1 home was just below specification. This in combination with the temperature differences reported in point v. above indicate over delivery of flow which is a good operating condition for the heat pump and the system.

d. Riverbend

i. Pressure into Heat Pump on Heating and Domestic Hot Water: All homes were within specification of 8-24 psi.

ii. Temperature into Heat Pump on both Space Heating and Domestic Hot Water Heating minimum of 26°C: One home was indicated below minimum but maximum deviation was 1°C which is within acceptable deviation and could be measurement error.

iii. Temperature out of Heat Pump (Domestic Hot Water only) maximum of 54°C: Three homes were above maximum of which 2 were within 3°C. The home above 3°C should reduce their domestic water set point to ensure the maximum is not exceeded. The homes within 3°C might want to check their domestic water set point.

iv. Space Heating Temperature difference range across the Heat Pump of 8-11°C: All homes had temperature difference below 8°C. This in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system.

v. Domestic Water Heating Temperature difference range across the Heat Pump of 7-10°C: All homes had temperature difference below 7°C. This in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system.

vi. Space Heating Pressure differential range across the Heat Pump of 0.5-0.75 psi: All homes had pressure differential above 0.75 psi. This in combination with the temperature differences reported in point iv above indicate over delivery of flow which is a good operating condition for the heat pump and the system.

vii. Domestic Water Heating Pressure differential range across the Heat Pump of a minimum of 1.0-1.5 psi: All homes had pressure differential above 1.5 psi. This in combination with the temperature differences reported in point v. above indicate over delivery of flow which is a good operating condition for the heat pump and the system.

e. The Terrace

i. Pressure into Heat Pump on Heating and Domestic Hot Water: All homes were within specification of 8-24 psi except 1 which was 10 psi above maximum limit on heating. This suite should check the setting of the makeup water PRV and adjust the pressure setting of this PRV to reduce this pressure to 24 psi.

ii. Temperature into Heat Pump on both Space Heating and Domestic Hot Water Heating minimum of 26^{o}C: One home was indicated below minimum for Space Heating by 7^{o}C. The suite outside the limit needs to have the cause investigated. If this home was checked in warm weather it could be that the heat had been turned off or there may be a set point issue.

iii. Temperature Out of Heat Pump (Domestic Hot Water only) maximum of 54^{o}C: Fourteen homes were above maximum of which 2 were within 3^{o}C. The 12 homes above 3^{o}C should reduce their domestic water set point to ensure the maximum is not exceeded. The homes within 3^{o}C might want to check their domestic water set point.

iv. Space Heating Temperature difference range across the Heat Pump of 8-11^{o}C: All homes had temperature difference below 8^{o}C. This in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system.

v. Domestic Water Heating Temperature difference range across the Heat Pump of 7-10^{o}C: All homes had temperature difference below 7^{o}C. This in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system.

vi. Space Heating Pressure differential range across the Heat Pump of 0.5-0.75 psi: All homes had pressure differential above 0.75 psi. This in combination with the temperature differences reported in point iv above indicate over delivery of flow which is a good operating condition for the heat pump and the system.

vii. Domestic Water Heating Pressure differential range across the Heat Pump of a minimum of 1.0-1.5 psi: All homes had pressure differential above 1.5 psi. This in combination with the temperature differences reported in point v.

above indicate over delivery of flow which is a good operating condition for the heat pump and the system.

f. The Heights:

i. Pressure into Heat Pump on Heating and Domestic Hot Water: All homes were within specification of 8-24 psi except 3 which were below the minimum limit. Two homes were within 0.5 psi of the minimum 8 psi which is acceptable and 1 was at 4 psi on heating. This suite should check the setting of the makeup water PRV and adjust the pressure setting of this PRV to increase this pressure to 8 psi. Four suites were not reported.

ii. Temperature into Heat Pump on both Space Heating and Domestic Hot Water Heating minimum of 26^{o}C: One home was indicated below minimum but maximum deviation was less than 1^{o}C which is within acceptable deviation and could be measurement error. Four suites were not reported.

iii. Temperature out of Heat Pump (Domestic Hot Water only) maximum of 54^{o}C: Four homes were above maximum of which 2 were within 3^{o}C. The home above 3^{o}C should reduce their domestic water set point to ensure the maximum is not exceeded. The homes within 3^{o}C might want to check their domestic water set point. Four suites were not reported.

iv. Space Heating Temperature difference range across the Heat Pump of 8-11^{o}C: All homes had temperature difference below 8^{o}C except 1 which was within specification. This in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system.

v. Domestic Water Heating Temperature difference range across the Heat Pump of 7-10^{o}C: All homes had temperature difference below 7^{o}C except 2 homes were within specification and 4 homes were above specification. The homes less than or within specification in combination with the pressure differences reported in points vi. and vii. below indicates over delivery of flow which is a good operating condition for the heat pump and the system. Homes that have higher than specification should have their system flow rates checked as they may be lower than the design intended especially the 3 homes at 12.7, 13.6 and 20.6^{o}C.

vi. Space Heating Pressure differential range across the Heat Pump of 0.5-0.75 psi: All homes had pressure differential above 0.75 psi. This in combination with the temperature differences reported in point iv above indicate over delivery of flow which is a good operating condition for the heat pump and the system.

vii. Domestic Water Heating Pressure differential range across the Heat Pump of a minimum of 1.0-1.5 psi: All homes had pressure differential above 1.5 psi except 1 home was just below specification. This in combination with the temperature differences reported in point v. above indicate over delivery of flow which is a good operating condition for the heat pump and the system.

8. Revising the domestic water temperature sensors and changing the control of the domestic water tanks was removed from the Scope of Work.

9. Water samples were not taken once the decision was made to include the full system flushes for all homes.

10. Full flushes were completed on all homes except where occupants asked them not to be completed. Only one home requested no flush.

11. Revised backflow prevention was completed on all homes to eliminate the need to have the original backflow preventers serviced annually to help save the occupants the expense of this testing.

Phase 1 Analysis

Comments from each report received to date by Integral Group have been reviewed and it is Integral's expert opinion that the work indicated to be completed in Phase 2 is characterized as maintenance and parts replacement for a system such as this. The work undertaken in Phase 1 can be described as deficiency repair, maintenance and parts replacement. The systems are now 7.5 years old and will require parts replacement over time such as domestic hot water and buffer tanks which have an 8 to 10-year lifespan.

Summary of comments from contractors in the Checklist Reports are as follows:

1. There were 25 small leaks mostly described as at fittings and seemed related to threaded fittings.
2. There were problems reported for 16 heat pump run capacitors requiring replacement now or in the near future.
3. There were 15 reports of expansion tanks failing, starting to fail or low on air pressure.
4. There were 15 reports of fan coil zone valves sticking and needing replacement.
5. There were 8 reports of heat pump 3-way valve or actuator problems requiring repair or replacement.
6. There were 6 reports of problems with the heating system make up water PRV that requires replacement.
7. There were 5 problems reported with compressor contactors requiring replacement, cleaning or wire replacement.
8. There were 4 pumps reported as requiring replacement.
9. DES piping reported as being piped backwards 4 times.
10. Schrader valves on heat pump refrigerant circuit reported as leaking, needing repair or replacement and refrigerant added to heat pump reported 4 times
11. There were 3 Spirovent air separators reported to need replacement
12. There were 3 automatic air vents that required replacement.

13. There were 3 instances where electric heating elements on the heating buffer tank had failed.
14. There were 2 instances where it was indicated that the domestic hot water tank was starting to fail.
15. There were 12 other issues noted that were not cited multiple times.

Phase 2 Summary

Work orders received to date for Phase 2 have been received for work on heating systems in 25 homes. This includes: 7 from The Rise, 6 from Whitewater, 8 from The Terrace, 1 from The Heights and 3 from Riverbend.

Invoices for the work were eligible for a 50-percent rebate as per the Phase 1 Program outline.

The invoices range from $75.65 to $1,302.04 with a total of $17,295.05 in spending. The average invoice was $665.19 and the median price $637.82. Six invoices were for amounts over $1,000. No invoices were over $2000 so all Phase 2 work so far has been compensated at 50%.

The invoices covered items indicated in the Checklist Reports.

Phase 2 Analysis

Comments from contractors following Phase 1 and Phase 2 work have noted;

1. The contractors agreed that the system was not unusual in application and was suitable for the service intended and the design of the system and the application is sound.
2. An Energy One contractor indicated that he did not feel there was a basic understanding of the system by the occupants and that owner knowledge and education is critical. Energy One noted many of problems addressed were associated with typical hydronic (radiant) systems and have nothing to do with the DES.
3. It was generally agreed that while the overall system differs somewhat from other DES systems installed in the Olympic Village in that each home has a heat pump rather than one building containing a heat pump. The contractors concluded the systems, if maintained properly should operate successfully.
4. There seemed to be a general consensus that the initial cleaning and startup of the systems may have been lacking. There were reports of general construction debris being flushed out of some of the systems.
5. It was generally agreed that heating of the domestic water was the more difficult process than the space heating and if ways to reduce this stress could be found that would eliminate a lot of the problems with red screens. The contractors noted that a compromised heat exchange surface would exacerbate problems with the higher temperature demand of domestic water, however should be repairable with sufficient flushing.

6. All three contractors agreed that the flushing undertaken was required and found a wide variety of system water conditions from fairly clean to so significantly contaminated that multiple flushes were required to obtain proper system operation.
7. Water condition was mentioned with the general consensus being that municipal water was acceptable for the systems but the systems will require monitoring to determine how often flushes might be required.

4.7 On-going maintenance program and options

During the bid process for the Phase 1/2 Programs, vendors were requested to provide bulk pricing for the recommended annual maintenance program. During the application process, homeowners were solicited for feedback on their interest in participating in such a program, and 25% of the applicants responded positively. Being that the question was not posed as part of completing the form for participation in the program, demand may be higher. Going forward, following the Phase 2 completion, WDC recommends owners to approach their Strata Council if they wish to budget for and procure a bulk-rate annual DES maintenance program for their neighbourhood. Stratas may contact WDC to request further information about bulk pricing options for ongoing maintenance.

5.0 DES spending

Spending to date on the homeowner resources, forensic audit, DES Energy Study and Phase 1 and Phase 2 programs for homeowners by WDC and the RMOW totaled $356,970.98 with a breakdown as follows;

- Cost to produce Homeowner Quick Reference Guide and Technical Guide $16,043.96
- Cost for WDC to hire Integral to conduct forensic audit $14,829.02
- Cost for RMOW to fund DES Energy Study $54,598.00
- WDC spending on Phase 1 and 2 Programs $271,500.00

Total $356,970.98

6.0 Summary

The Cheakamus Crossing DES has been in operation since 2010. WDC and the RMOW have responded to concerns raised by owners of WDC-built units to troubleshoot issues that have arisen with the in-home components connected to the DES. In addition to manuals provided in each unit, WDC and the RMOW have provided assistance in the form of homeowner and technical guides and individual unit guides.

Following a two-phase maintenance program in 2016 and 2017 to bring all units to a baseline operations level by qualified contractors, the expert opinion of Integral Group is that the work undertaken to date in these programs is characterized as normal maintenance, deficiency

repair and parts replacement for a system such as this. As the systems are approach a decade of operation, they will require parts replacement over time such as domestic hot water and buffer tanks which have an 8 to 10-year lifespan.

The consulting engineering firms have strongly recommended owners take on the initiative to arrange bulk pricing for an annual DES maintenance program for residents by qualified contractors. This will allow for bulk pricing, stable and consistent servicing and should help maintain the base line that has been established.

There do not appear to be widespread systemic issues with the DES or the individual home heating systems that are the result of installation or component failure. A DES Energy Study concluded the system is providing homeowners with energy cost savings as well as delivering on an overall reduction in energy use.

Resources

- BC Climate Action Toolkit www.toolkit.bc.ca/tool/district-energy-systems
- Geoxergy www.geoxergy.com/gibsons-district-energy-system/
- BC Housing- Strata Housing- www2.gov.bc.ca/gov/content/housing-tenancy/strata-housing
- Whistler Housing Authority- www.whistlerhousing.ca
- Whistler Housing Authority Disclosure statement: http://sales.cheakamuscrossing.ca/pdfs/disclosure_statements/The_Terrace_DS.pdf
- BC Assessment Authority- www.bcassessment.ca
- Cheakamus Crossing Portal- www.cheakamuscrossing.ca

Appendixes

Appendix A- “Photo: Website and login detail for Home Information Packages”

Appendix B – “2016 Homeowner’s Quick Reference Guide”

Appendix C- “2016 Technical Service Guide”

Appendix D- “District Energy Study”

Appendix E – “Integral Group Forensic Audit Report”

Appendix B

Whistler 2020 Development Corporation Cheakamus Crossing District Energy System Recommendations

Report for Council prepared by:
Whistler 2020 Development Corporation and RMOW Senior Staff

September 25, 2017

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Part A:

Introduction

During the bid phase of the 2010 Olympic and Paralympic Games the opportunity to create a significant amount of affordable housing was presented when the Province of British Columbia committed to construct housing in Whistler for use during the Games. The concept emerged for the development of an Athlete's Village that could then be converted to permanent resident-restricted housing as a legacy for Whistler following the Games.

With $31 million in capital funding from the Vancouver Olympic Committee (VANOC) through the provincial and federal government and land from a Land Bank provided by the Province of British Columbia, the RMOW agreed to develop an Athlete's Village for the 2010 Games that would then transition to resident-restricted housing. This new development would add 276 affordable housing units as well as a 55-room hostel and 20 market-priced townhomes.

In 2004, the RMOW created an independent organization, incorporated as a business with the RMOW as the sole shareholder. The name, Whistler 2020 Development Corporation (WDC) was chosen to reflect the community's goal of creating a new, sustainable neighbourhood for full-time Whistler residents, known as the "Legacy Neighbourhood". WDC managed the design and approval process similar to a conventional developer with a focus on the delivery of the Athlete's Village and subsequent Legacy Neighbourhood. WDC Board of Directors members were appointed by Council with a strong focus on extensive expertise in the development and construction business and a commitment to the community. A number of the original board members from 2004 continue to volunteer today and have devoted thousands of hours of their time to the WDC.

Throughout the planning, building and retrofit phases, the WHA and WDC conducted an extensive community engagement process to ensure potential buyers were kept fully apprised. This included regular communications, email updates to approximately 1,000 applicants on the waitlist and advertising in local publications. A collaborative planning process and attention to detail on all aspects of the infrastructure development, landscaping, building design and engineering resulted in a final mix of housing and accompanying finishes that met the identified housing needs of the residents on the purchase waitlist within their preferred price range of $200,000 to $300,000.

The existing Whistler Housing Authority (WHA), which manages resident-restricted affordable housing, worked with WDC to market and manage the pre-sales of the housing in the Legacy Neighbourhood which was marketed as "Cheakamus Crossing". Whistler Real Estate Company was retained to complete the sales contracts with the buyers. The resident-restricted housing units were price-capped at purchase and any

re-sales tied to a maximum appreciation rate tied to the Core Consumer Price Index as with other WHA properties.

Along with recognition as leader in residential the provision of residential housing, Whistler has also pursued excellence in climate change and environmental protection. Accordingly, each of the WDC-developed Athlete's Village/ Cheakamus Crossing housing projects were developed with the Whistler Green Building Program in mind. This community-driven program is intended to encourage sustainable and environmentally friendly design and building practices at a grassroots level. In the design process, project objectives for the Legacy neighbourhood included optimizing site density to lower the overall footprint of the neighbourhood, ecologically sound and drought-resistant landscaping, walking paths and sidewalks to connect to transit routes, adding a new transit route to the neighbourhood as well as direct access to Whistler's Valley Trail.

A District Energy System (DES) was built and connected to all the units of Cheakamus Crossing when the neighbourhood was built for the 2010 Winter Games as the Whistler Athletes' Village.

The system was designed to use low-temperature ambient heat from treated sewage effluent from the nearby Whistler wastewater treatment plant. Using treated wastewater effluent instead of natural gas allows the neighbourhood to reduce greenhouse gas emissions from heating by over 95%.

The DES cost of $4.1 million was absorbed into the $144 million total building costs for the affordable housing units in Cheakamus Crossing, which were shared among the Province (land and land remediation), the Vancouver Olympic Committee (VANOC) ($35 million), RMOW ($8 million) and the Municipal Finance Authority (MFA) ($100 million loan). The RMOW received a two-year extension from the MFA to repay a $13 million outstanding balance.

As the capital cost of the system has been paid, the RMOW does not include capital cost recovery or return on invested capital in its revenue requirements to operate and manage the DES. However, to manage the ongoing maintenance and depreciation costs of the DES, the RMOW collects a quarterly DES fee from homeowners connected to the DES. Rates are set annually by Council based on staff reviews of operating costs.

Expert opinion sought by WDC and the RMOW has identified the critical importance for annual ongoing maintenance in order for heating equipment within homes connected to the DES to operate properly. Each home connected to the DES has owner-operated and maintained components as part of the home's heating system.

Prior to occupancy, WDC provided orientation walk-throughs for each owner and strata corporation and provided warranty and home-owner guides.

At the time of commissioning, each WDC-developed unit was provided with a unique login and password to the cloud-based platform www.homeinformationpackages.com. Website and login information was included on a sticker placed on the internal electrical panel of each unit.

On this website, owners are provided with manufacturer's information, warranty information and maintenance information for appliances, electrical, heating and fixtures. For each component, there is a page with manufacturer's information, warranty length, product specifications and operating guide as well as supplier and installer information and contact details. In addition, WDC and the RMOW have provided assistance in the form of homeowner and technical guides and individual unit guides.

In April 2016, the WDC commissioned a report from Integral Group Consulting, the independent engineering firm chosen by the Cheakamus Crossing DES Volunteer Committee, for a detailed mechanical engineering design peer review and forensic examination of the in-suite systems installed in the townhouses located at Cheakamus Crossing in Whistler, B.C. and an investigation of the interface between the in-suite systems and the local District Energy System.

The report found the Cheakamus Crossing development, design and construction appears to have been typical for a project of this nature. Overall, the report did not find systemic failure issues with the Cheakamus Crossing DES and recommended that owners have an ongoing maintenance program through service contractors that are familiar with the DES and the privately-owned in-suite systems.

To date, the RMOW through WDC has spent $356,970.98 examining the efficiency of the DES, providing homeowners with additional resources, and investigating the existence of a systemic failure which has led to unexpected maintenance costs. Neither the forensic report nor the three contractors who conducted the Phase 1 and Phase 2 programs have noted any evidence of a systemic failure of the DES.

The consulting engineering firm and the maintenance contractors have strongly recommended owners take on the initiative to arrange bulk pricing for an annual heating system maintenance program for residents by qualified contractors. This will allow for bulk pricing, stable and consistent servicing and should help maintain the base line that has been established.

Part B:

Recommendations and future options for the Cheakamus Crossing District Energy System (DES)

In preparing recommendations for Council careful consideration was given to the findings of the DES Summary Report and other matters.

The Report found there were no systemic issues found that related to the design or installation of the DES. The Report also stated that in Integral's expert opinion that the work completed in Phase 1 is characterized as deficiency repair, maintenance and parts replacement for a system such as this.

Following a two-phase repair and maintenance program in 2016 and 2017 by qualified contractors, the expert opinion of Integral Group (the professional engineering firm selected by WDC and the Cheakamus Crossing DES Volunteer Committee) is that the work undertaken to date in these programs has corrected the majority of the identified deficiencies. The review identified that there were no systemic failures associated with either the design or installation of the DES. Integral Group have stated "Comments from each report received to date by Integral Group have been reviewed and it is Integral's expert opinion that the work indicated to be completed in Phase 2 is characterized as normal maintenance and parts replacement for a system such as this. The systems are now 7.5 years old and will require parts replacement over time such as domestic hot water and buffer tanks which have an 8 to 10-year lifespan."

The RMOW and WDC have heard from homeowners of WDC-built townhomes that there is ongoing uncertainty associated with the operation of their home heating systems. Both the RMOW and WDC have diligently conducted a forensic study and extensive maintenance and repair program to determine if there is a systemic issue that has resulted in a failure of the system to operate as designed. Neither the forensic report or the Phase 1 and 2 programs have found any such issues however expert opinion has related the necessity and importance of ongoing maintenance which supports the next steps outlined in the recommendations below. The recommendations recognize the principle of "*caveat emptor*" where the homeowners were provided with the necessary assurance at the time of their purchase of warranty protection on their home and specifically, the components within their home heating systems.

WDC and the RMOW acknowledge that individual home owners have identified financial challenges meeting the ongoing maintenance and operating costs of their home heating systems however, the findings noted above and in the full report do not support further funding assistance to homeowners beyond what is identified below. Speculation around potential assistance from RMOW or WDC should not influence participation by strata corporations from taking advantage of bulk pricing secured by WDC.

Recommendations for the WDC Board of Directors and RMOW Council include:

1) Extend Phase 2 of the DES Upgrade and Maintenance Program to March 31, 2018 with no extension beyond that date:

a. WDC would continue to provide an upgrade program to cover 50-percent of the costs up to a maximum of $1000 per home for issues that require parts replacement or flushing as a continuation of Phase 2 of the DES Upgrade and Maintenance Program. b. Extending the DES Upgrade and Maintenance Program would allow for

further investigation of any potential systemic issues and provide homeowners with support through the winter months when demand on the system is highest.

2) Facilitate bulk pricing for annual maintenance of the home heating systems:
   a. Annual maintenance was identified as a key to ensuring a reliable heating system by all three of the contractors involved in Phase 1 of the DES Upgrade and Maintenance Program.
   b. Bulk pricing is available and can be arranged by strata or another homeowners group (in a manner similar to chimney and dryer duct cleaning).
   c. WDC has agreed to meet with each of the five stratas and their property management companies to explore and discuss this option at a strata council meeting.

3) Allow homeowners to disconnect from the DES:
   a. If unsatisfied with the operation of their home heating systems following the Winter 2017/2018 DES program, a homeowner may choose to disconnect entirely from the DES.
   b. The homeowner will need to accept and acknowledge the implications of this decision. They will save approximately $50.00/month in DES fees, however, the homeowner will be responsible for all expenses and consequences to design and retro-fit a new heating source.
   c. The covenant registered on title (sample attached) compels the homeowner to connect to the DES and pay DES fees whether they are connected or not. A covenant modification or discharge through application to the RMOW can relieve the homeowner from these obligations.
   d. Disconnecting from the DES requires that the homeowner be responsible to contact and receive permission from the RMOW should they (or a future owner) wish to reconnect to the DES. A potential process to disconnect from the DES would include:
      i. Homeowner makes an application to disconnect from the DES
      ii. Homeowner selects their preferred energy solution
      iii. Homeowner signs disclaimer/ waiver
      iv. Homeowner obtains proper permits and installs new energy system
      v. RMOW confirms the homeowner has undertaken the work. RMOW modifies covenant that currently requires payment of quarterly DES fees.
      vii. RMOW finance department modifies the data base and DES billing ceases.

4) Direct RMOW staff to explore the potential sale of the DES to a private company to allow private management and regulation as a utility under the BC Utilities Commission (BCUC):
   a. The sale of the DES from the RMOW would allow the new utility to apply for regulation as a utility through the BCUC.
   b. The BCUC regulates several geothermal community heating and cooling systems throughout B.C. The operation of these systems is similar to the Cheakamus Crossing DES.

c. The BCUC is responsible for ensuring customers receive safe, reliable services at fair rates from the entities it regulates. The BCUC balances that responsibility against the need to ensure utilities are afforded a reasonable opportunity to earn a fair return on their invested capital. In addition to regulatory responsibilities, the BCUC reviews ratepayers' complaints and inquiries about regulated entities within its jurisdiction.
d. The sale of the DES to a private utility could allow independent oversight of DES billing and service for Cheakamus residents.
e. The sale could include negotiations to include the ownership of components within the "strata lot" and allow homeowners to potentially lease the components in their home from the utility, with the utility managing and maintaining these components on an ongoing basis.
f. The potential downsides of this proposal are likely higher monthly fees for the DES as owners would be paying a third party for management and maintenance of the DES. A majority of DES users (homeowners and businesses) within Cheakamus Crossing would need to be in favour of moving to a private utility management process.
g. The possible benefits could allow owners to move towards a more "worry free" home heating system as it may be possible they would no longer own the components within their homes and be responsible for maintenance.