City of Richmond
No. 2 Road North Drainage Pump Station Upgrade

2018 PUBLIC WORKS ASSOCIATION OF BRITISH COLUMBIA PROJECT OF THE YEAR AWARD SUBMISSION

1 Executive Summary

The City of Richmond's No.2 Road North Drainage Pump Station is a focal point on the City's dike system, drawing the public to connect with the function of the station through public art and architectural design, while providing a robust post-disaster facility for the City's flood protection needs. The project was completed on-budget through collaboration between the City, the design team and the Construction Management company.

The station's design protects the sensitive red-coded habitat within the Fraser River, and the adjacent tidal flats, while providing public amenity space and public engagement. The design of the station was carried out in consultation with a respected local artist. The station's mechanical ducting was placed on a lower level to provide a sense of spaciousness within the glass-walled building, showcasing the station generator and controls to the public. Public open houses allowed the City to field residents' concerns regarding the station, and resulted in modifications to the roof surface based on adjacent high-rise residents' concerns regarding glare.

The Construction Management company developed a comprehensive site-specific Health and Safety programme, with strict enforcement of protocols, which resulted in zero lost-time injuries during construction. The result is a robust flood protection structure, which will serve the City's residents for years to come, while providing a public attraction and connecting public to the infrastructure which they rely on every day.

This document is organized based on design and construction tasks. The following table provides a reference for PWABC's key evaluation criteria, indicating the relevant sections of the report:

a.	Benefit to community	Sections 2 and 3
b.	Substantial completion, schedule and budget	Sections 5 and 10
c.	Environmental and social benefits	Sections 3 and 7
d.	Innovation in design	Sections 3 and 4
e.	Public participation	Section 8
f.	Safety record	Section 6
g.	Environmental protection	Section 7
h.	Quality of final works	Sections 2 and 3
i.	Complexity	Sections 3 and 4

A summary of lessons learned is provided in Section 11.

2 Background & Project Overview

Located at the mouth of the Fraser River, the City of Richmond is an average of one metre above sea level. The City provides drainage and flood protection to protect its businesses, agriculture and over 200,000 residents from river and ocean flooding through the management of 49 km of dikes; 39 drainage pump stations with a combined pumping capacity of over 1 million gallons per minute; and over 800 km of ditches and storm sewers. As part of the City's broader capital program, drainage pump station and dike upgrades are defined through rigorous technical analysis and planning, and form part of the City's long term flood protection strategy. These upgrades are built to design standards that address projected climate change and sea level rise over the next 100 years.

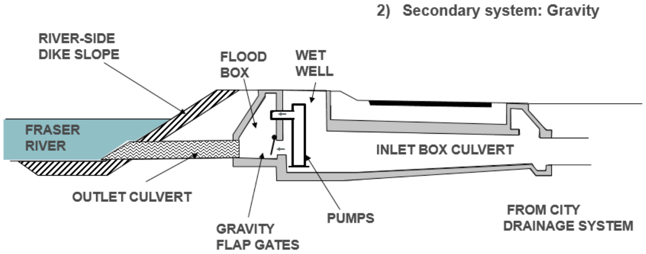
How Drainage Pump Stations Work

Drainage pump stations are strategically located throughout the City and accept drainage flows from designated catchment areas. All stations generally work on the same premise as follows:

- *City storm drainage is collected from a catchment area and is conveyed to a drainage pump station usually located along the bank of the Fraser River.*
- *At low tide, water flows through the station into the River through gravity flap gates with no assistance from the pumps.*
- *At high tide, water level sensors detect the water level rise and automatically start the drainage pumps.*
- *The pumps continue to operate until the water level drops again.*
- *The pump station is automatically controlled by an on-site computer that is staff monitored remotely 24 hours a day, 7 days a week.*
- *An standby generator is available in the event of a power failure.*

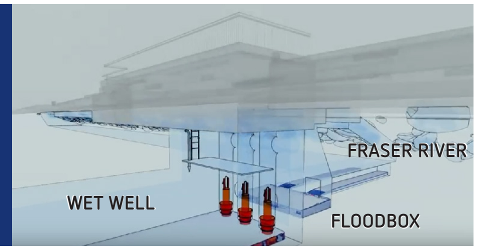
TYPICAL DRAINAGE PUMP STATION

1) Primary system: Pumped
2) Secondary system: Gravity

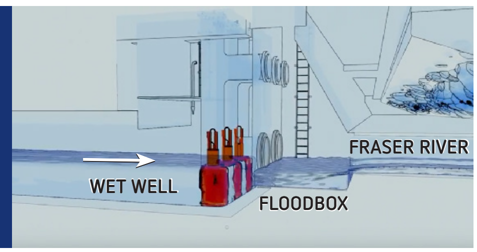


Stormwater is collected and conveyed to the pump station.

Stormwater gathers in the pump station wet well.

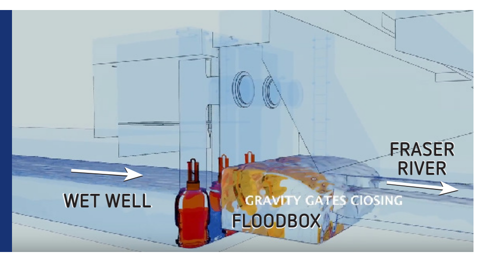


Water level sensors constantly measure the stormwater level within the wet well.

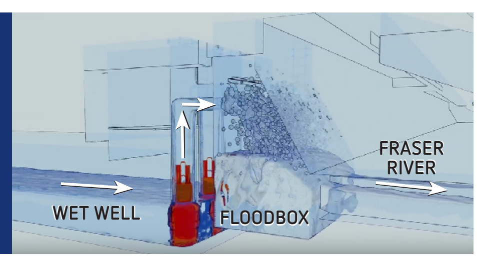


At low tide, stormwater flows through the station from the wet well into the floodbox, and ultimately out into the River, with no assistance from the pumps, through gravity flap gates.

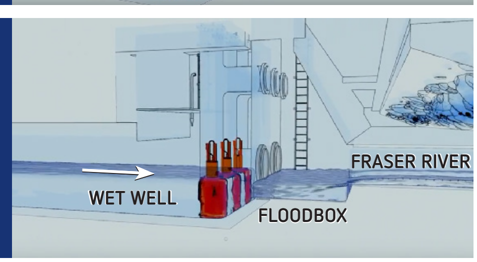
At high tide, water level sensors detect the rising water levels and automatically start the drainage pumps.

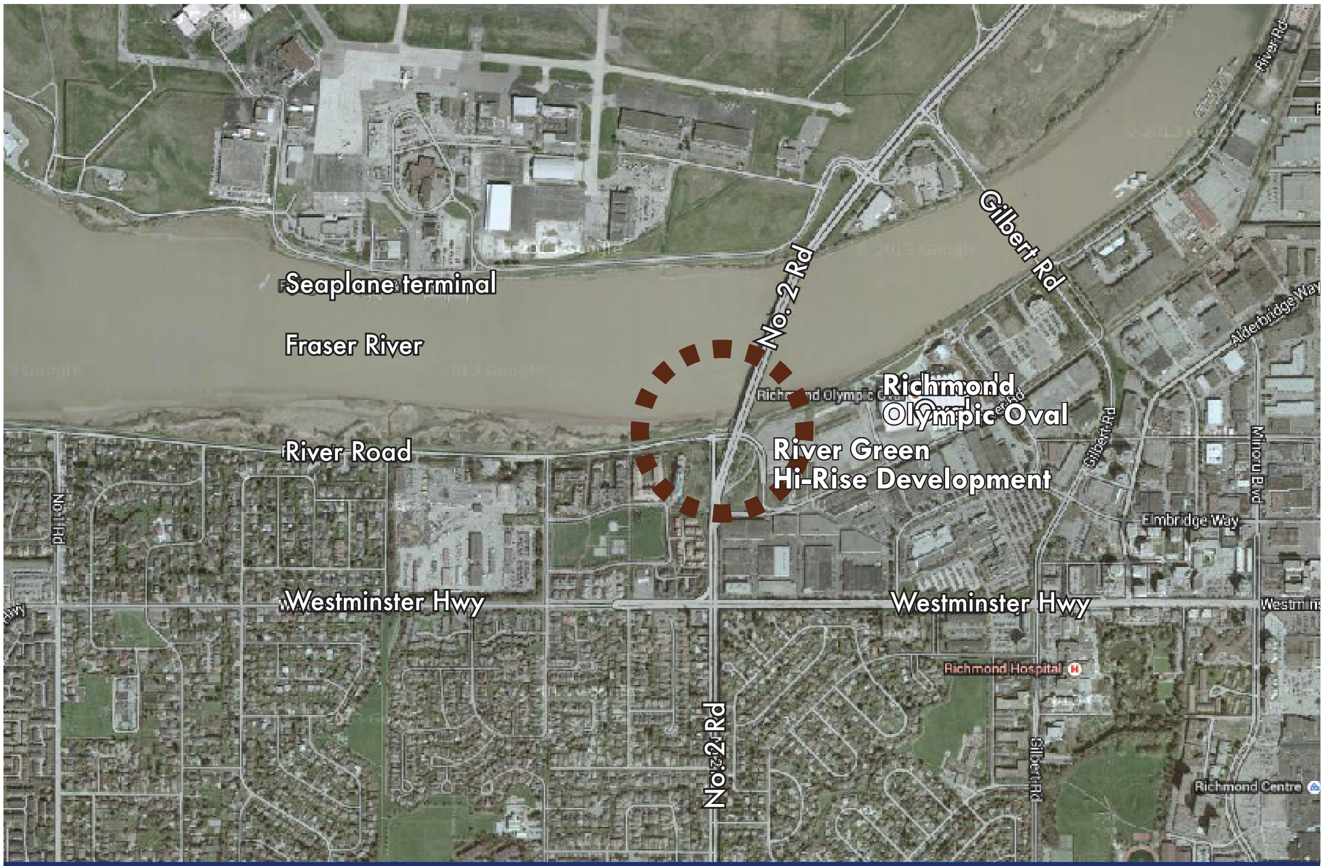


Stormwater is pumped from the wet well into the floodbox, and ultimately out into the River.



The drainage pumps then automatically shut down once the wet well stormwater levels drop.





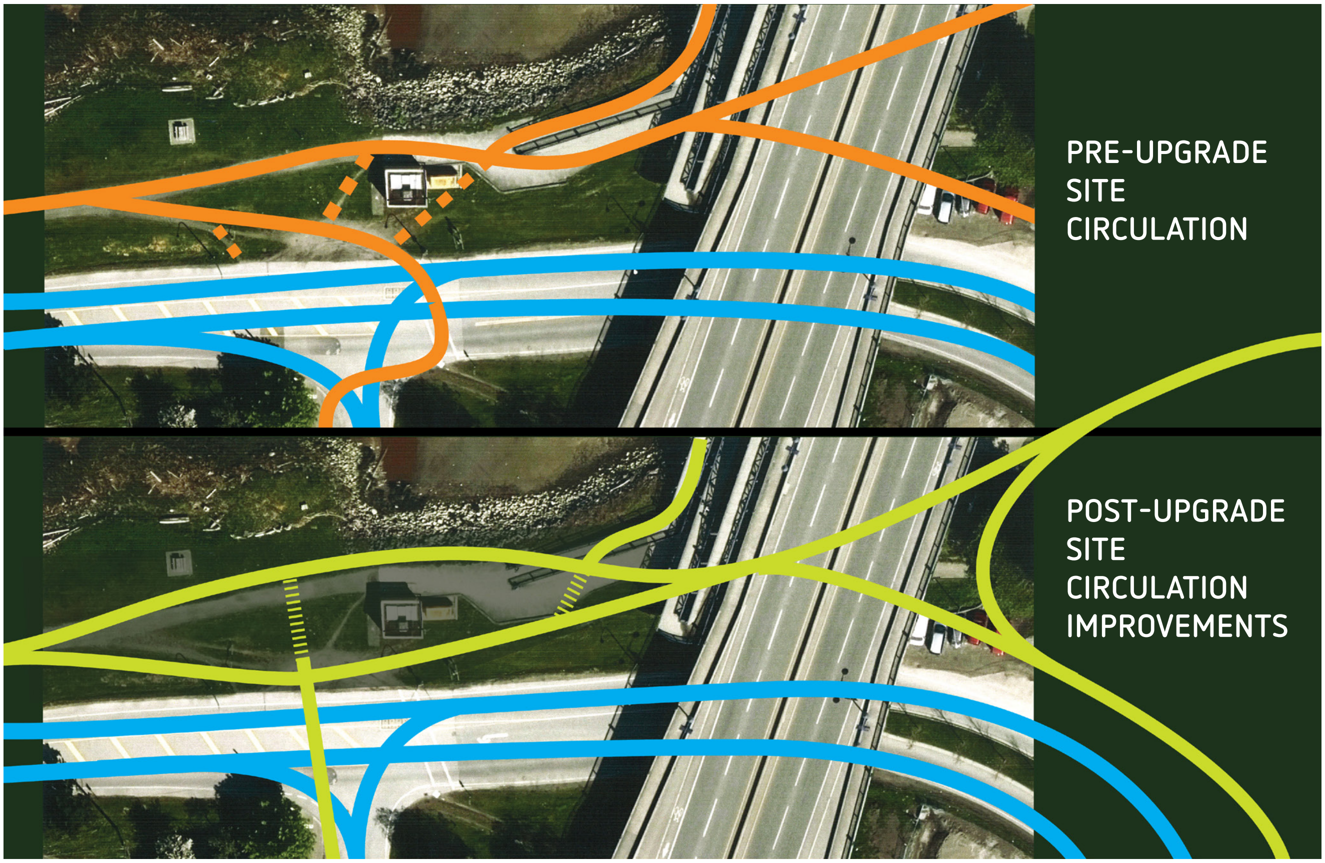
In 2014, the City carried out a planning study for drainage infrastructure which identified the following deficiencies at the No. 2 Road North Drainage Pumping Station:

- ***Inadequate capacity:*** The station's capacity needed to be increased from 1.9 m^3/s to 4.7 m^3/s to meet the flood management plan requirements.
- ***Aging equipment and controls:*** The station controls and equipment are from the original construction in 1974. The equipment is near the end of its service life. The equipment does not have the functionality offered by modern systems.

In response to the deficiencies identified, the City commissioned an upgrade to the station. The City's mandate for recent drainage pump station upgrades has been to make them public features, acting as nodes along the dike trail network and featuring interesting architectural design elements. Because of the high profile location of the No. 2 Road North Drainage Pump Station, the City sought a design which drew attention and engaged the public, with an emphasis on interpretive components, public space and local art. The pump station is located at a main entry point into the City, near the No. 2 Road Bridge to the Vancouver Airport, close to the Richmond Olympic Oval, and adjacent to a major residential hi-rise development (River Green).

Key Design Requirements Included the Following:

- A pumping capacity upgrade from 1.9 m^3/s to 4.7 m^3/s using three new 127 HP KSB axial flow pumps controlled by variable frequency drive.
- Using the existing concrete wet well structure to accommodate the pumps.
- New motor control center (MCC) and standby generator.
- Communication and power connections between the new MCC and the new equipment within the existing concrete wet well structure.
- Post-disaster station design to resist a 1 in 2,475-year earthquake with only minor damage.
- New 600 V BC Hydro power service with associated infrastructure upgrades.
- Raising the dike crest by 1.5 m to meet provincial diking guidelines.
- Landscaping around station and improved flow of pedestrian and bicycle traffic.



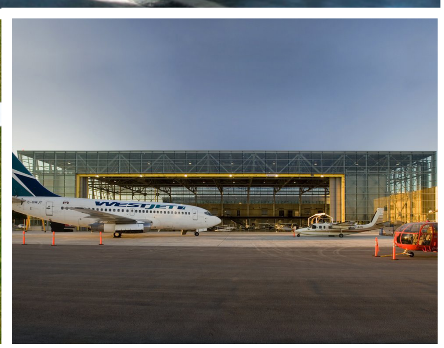
3 Station Architecture and Public Art

Many of the City's new drainage pump stations feature public art. For the No. 2 Road Drainage Pump Station, the City went one step further. Public art was integrated into the design process by featuring a respected local artist on the design team.

The City of Richmond Public Art Program, in partnership with Richmond Engineering and Public Works, engaged an artist to work collaboratively with the contracted design team on the replacement of the No. 2 Road North Pump Station. The role of the artist was to identify opportunities for artistic expression which aligned with the programmatic requirements of the building. The ability of the selected artist and design team to collaborate throughout the design process was imperative to the success of the project.

Germaine Koh, a local Vancouver-based artist, worked with the project consultants to inform the design concept of the building. Germaine Koh is an internationally active artist whose work uses commonplace objects and everyday activities to create connections between people, systems and situations that encourage us to pay attention to the world around us. She has been a recipient of the Shadbolt Foundation VIVA Award and a finalist for the Sobey Art Award. She is also the City of Vancouver's Engineering Artist in Residence for 2018–2019.

Ultimately, the City chose a design concept incorporating the long history of aviation that continues in the area. The design also encourages public interaction with the various forms of water flowing through the site.



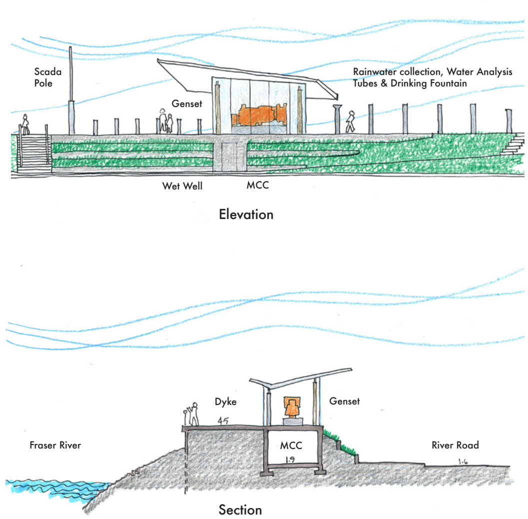
As the station is located within a highly utilized dike trail system, the overall character and use of the site as a transition zone between urban and natural conditions was considered. The foreshore features ecologically sensitive tidal plains, which the design team sought to preserve. Native species were used for all plantings to complement the local ecosystem.

Three architectural concepts were presented by Feenstra Architecture for the City's consideration. Each concept addressed temporary service vehicle parking, dike access for heavy service vehicles, clearance to the adjacent No. 3 Road bridge pedestrian ramp, future dike upgrades, and pedestrian and cyclist flow through the site. Feenstra Architecture is a Vancouver-based architectural firm which has designed several of the City's drainage pump station buildings, including the award-winning No. 1 Road North Drainage Pump Station. The firm's design process aims to integrate each infrastructure project into a local setting and to inform the public of it's functional aspects.

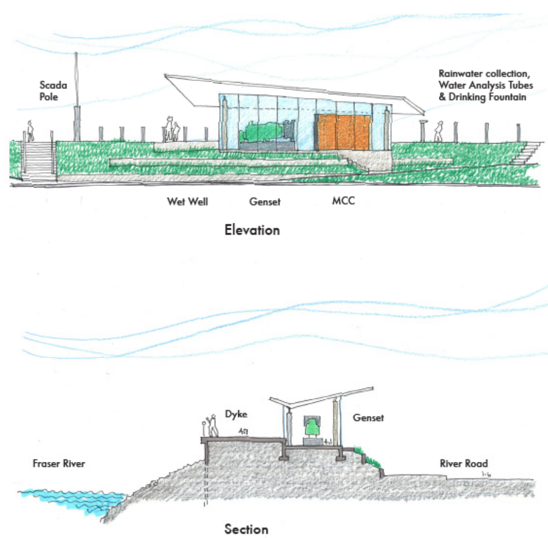
The fundamental creative intention was to conceive the entire site as "functional artwork". The common theme for all three proposed design concepts was to bring the operations of the site to the foreground, whether its fascinating mechanical functions, the energy and material flows around it, or its position as a transfer point between urban and natural processes.

The City chose a design concept which incorporates the theme of aviation, and encourages interaction with the various forms of water near the site. The iconic glass-walled building perched on the dike with an elegant wing-like butterfly roof recalls the long history of aviation that continues in the area. The glass walls invite public viewing of the station's controls and generator. The public is similarly drawn into the functionality of the station by hearing and seeing stormwater discharging into the flood box through the metal grating at the pedestrian level. Public interaction is enhanced by a hand pump which the public can use to pump stormwater from the wet well to the flood box, mimicking the overall functionality of the station.

A line of custom-fabricated steel columns extends along the axis of the building, the Fraser River and the pedestrian path. The columns feature samples of the different types of water on the site: City drainage water, silty Fraser River water, saline Georgia Strait water, rainwater collected from the roof, and municipal drinking water. Each of these water sources is showcased visibly within its own column behind tempered glass, with labels that identify each source.



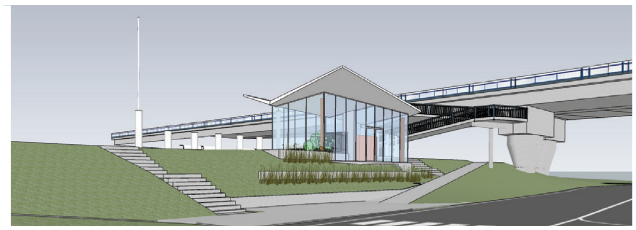
Concept 3 - Floor Slab Elevation 1.9m



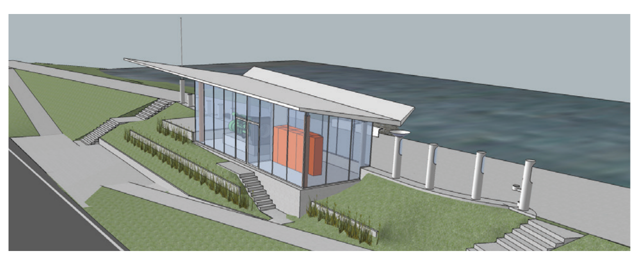
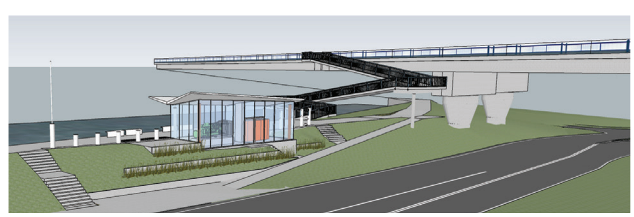
Concept 3B - Floor Slab Elevation 4.1m



- An iconic structure perched atop the dike recalls the ***long history of aviation*** that continues in the area.
- The ***elegant wing-like butterfly roof*** of the pump station floats above a glass volume that encloses fascinating industrial equipment: the motor control center and standby generator.
- The transparent building connects with the site details that ***make visible the various forms of water*** that flow around the site.
- Extending on axis with the building and aligning with the primary pedestrian, float plane, and river flows, is a clean, clinical, line of shaped steel columns displaying samples of the ***different types of water on the site:*** City drainage water, silty Fraser River water, saline Georgia Strait water, rainwater collected from the roof and municipal drinking water.
- Each of these water sources is showcased ***visibly within its own column behind tempered glass,*** the visible differences between the sources further emphasized with labels that identify each source.
- ***Public interaction with the site*** is further enhanced by a hand pump which the public can operate to mimic the overall functionality of the station, by pumping the collected stormwater from the wet well on the City side to the flood box and then out to the Fraser River, while viewing and hearing the discharge from metal grates on the dike crest.
- Overall, the material references are to aviation and scientific observation: ***light metals, glass, with minimal structure and stainless steel fixtures.***





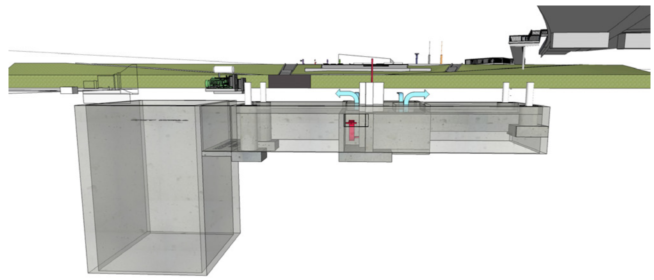
4 Lower Level

The pump station's unique design includes a lower level which provides three key functions. The lower level houses the Heating, Ventilation and Air Conditioning (HVAC) system, conveys surface drainage, and protects the station's electrical connections during a seismic event.

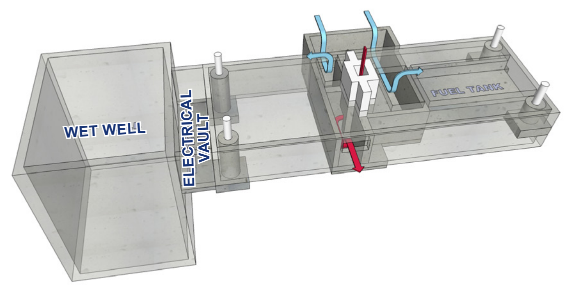
The HVAC system was designed around the building architecture – to provide unfettered public viewing of the station's controls and generator. The design team created a unique system which utilized the substructure of the building for the fresh air intake and exhaust from the building's motor control centre room and standby generator room.

For the generator room, air is passively brought in below grade and distributed through floor grating. When the generator is in use, the air is actively exhausted by the generator through a glass curtain wall louvre on one side of the building. When not in use, air is exhausted by an exhaust fan through the structure's central concrete column, back down into the substructure and exiting through a louvre on the exterior of the substructure. For the MCC room, air is actively brought in by a supply fan through sub-floor PVC ducting and floor grilles and is passively exhausted through floor grating, exiting through a separate louvre on the building exterior substructure.

Inside the MCC room, energy-efficient indoor heat pump units are mounted above the MCC on a steel frame surrounding the MCC anchored to the floor, and outdoor units are located adjacent to the building in a locked enclosure. The design also provides a subfloor storage space to keep the interior space uncluttered, with operational supplies and equipment neatly stored away. This design approach provides a clean, unobstructed



The hidden below grade ventilation system provides a clean unobstructed view through the curtain glass walls.



view through the glass curtain walls, and keeps the roof space open and "airy", which supports the artistic intent of the overall structure.

The lower level also conveys surface drainage from the site into the wet well through exterior gratings which serve as trench drains. All drainage is collected in a trough below grade and discharged into the wet well through check valves.

The lower level is also a key part of the station's post-disaster design. The pump station consists of two parts – the new building with the generator and controls, and the buried wet well which is existing. Based on the geotechnical assessment, the two parts of the station could experience differential settlement of up to 0.9 m during a design earthquake. The lower level of the station provides a connection vault for the pump cables, allowing movement between the two structures without damaging the electrical connections.

5 Construction Management

The existing wet well structure was successfully incorporated into the design.

Construction of the pump discharge gates, located in the floodbox.

Project delivery in the utility construction industry typically involves a primary contractor who performs construction work in accordance with specifications and drawings, based on a stipulated price, unit prices, or the cost of construction plus a fee. For the No. 2 Road Drainage Pump Station Project, the City entered into a Canadian Construction Documents Committee 5B construction management contract (CCDC 5B), working with a Construction Management Company to deliver the project. Construction Management is a form of project delivery characterized by the collaboration of the Owner, the Consultant, and the Construction Manager working as a team, to deliver efficiencies in schedule, cost, and constructability, particularly in the pre-construction phase of a project. For this project, the City contracted separately with:

- A Consultant for the complete design, and technical advisory services and field review services during construction, and;
- A Construction Management company that participated in the design process to help to ensure optimal economy and efficiency in the selection of materials, systems, construction methods, and scheduling. The Construction Management Company also engaged trade contractors as subcontractors, and was responsible for administering and overseeing their work during the construction and post construction phases.

The Construction Management process provided overall scheduling, cost, and construction planning foresight benefits to the City.

The Construction Management Team provided and maintained a progress schedule during the pre-construction phase, and compiled a master schedule prior to construction. The Construction Management team, in collaboration with the subcontractors, provided regular monthly schedule updates at the outset of construction with 2-week and 4-week look ahead schedules as necessary when construction activities were at their peak. Construction commenced September 5, 2016 and achieved substantial performance on October 31, 2017. Schedule slippage occurred during the ground densification piling stage due to difficulties with existing ground conditions. The design team, in collaboration with the Construction Management team and the piling contractor, resolved these issues through procedural reviews and the resultant recommended piling installation procedure adjustments were successfully implemented. The station is now totally complete, including landscaping and site works.

6 Safety Performance

Health and safety was paramount for all project team members throughout all stages of the project. The City along with the Construction Management team extended and promoted their culture of safety in the project through the project's Health, Safety, and Environmental (HSE) Program. The HSE Program was specifically fine-tuned for the project to protect all site personnel and help eliminate near misses, injuries, property damage, and incidents involving the public and the environment. The program was in accordance with Worksafe BC policies and procedures, local health and safety by-laws and all applicable industry standards for construction projects. Furthermore, the HSE plan was assembled to stress the City's and the Construction Management team's commitment to workers' rights, recognizing workers' Rights to Refuse, Right to Participate, and the Right to Work without being subjected to discriminatory action.

Beyond the specified provincial and federal safety legislation and Industry standard safety procedures, the HSE program laid out Site Orientation procedures developed in accordance with project specific requirements. These orientations were held regularly by the construction management team for all site personnel. Implementation of the Orientations was extremely important to the success of the overall Project safety performance given the large and diverse range of subcontractors, trade specialists, suppliers, consultants, inspectors and guests visiting the site throughout the construction phase. The HSE Site Orientation Procedures were implemented to identify and control all site personnel, as well as educate all workers and visitors on the overall project safety program and highlighted specific activities and hazards that may have been of importance on that particular day.

As a result of the commitment by all parties to safety being an overriding priority, there were *no lost time injuries recorded during construction.*

7 Environmental Protection

Dike upgrades along the foreshore were specifically designed to keep all disturbances above the high water level, helping to preserve the natural habitat.

Richmond's foreshores are extremely valuable ecological areas. The Fraser River is one of the world's largest salmon producing rivers and Richmond's shores provide essential rearing habitat for juvenile salmon and well as supporting an abundance of other life and ecological processes. Drainage from the No. 2 Road North Drainage Pump Station discharges directly into the foreshore of the Middle Arm of the Fraser River. The foreshore in the area was identified early in the process as red-coded at the point of discharge (as per Port of Metro Vancouver's classification system based on the former FREMP classification). Red-coded habitats are considered the most important fish habitat under this classification system. In addition to the red-coded habitat concerns, other potential impacts were identified through the preparation of a Biophysical Baseline and Impact Assessment. This approach helped to identify the key environmental aspects of the project specific to the current provincial environmental legislations and the respective regulations. These included the Fisheries Act, administered by Fisheries and Oceans Canada (DFO) and Environment Canada (EC); the Water Act governed by the Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO); Species at Risk Act administered by EC; and the Migratory Birds Convention Act and the Wildlife Act, which in the absence of regulatory systems for authorization, is managed by Best Management Practices on a case by case basis. Each specific legislation and regulation was reviewed as the design process progressed, clarifying the regulatory requirements to complete the project while minimizing environmental impacts.

A project Environmental Management Plan (EMP) was developed and implemented to reflect the City's commitment to protect the aquatic and terrestrial habitat associated with the project works. The Construction Management team successfully utilized the EMP to implement site-specific mitigation measures and Best Management Practices (BMP's) ensuring compliance with all environmental legislation requirements. The EMP helped the Construction Manager to meet or exceed all compliance requirements. The Construction Manager kept environmental disturbances to a minimum, and all possible precautions were taken to avoid unnecessary impacts to the natural environment, both within and adjacent to the project site. All wastes and surplus materials generated by project activities were handled and transported in accordance with applicable regulations and standards.

For the dike upgrades, specifically the dike foreshore design upgrades, the design intentionally kept all disturbance above the high-water level which avoided "Serious Harm to Fish" as identified though the Fisheries Act. The review process determined that a submission of an environmental notification to MFLNRO was required and was easily obtained. The strategy was successful in preserving the natural habitat and enhancing the newly constructed foreshore area adding value to the areas existing aquatic and terrestrial habitat.

The original ground densification design called for concrete caps on Douglas Fir untreated and debarked timber piles. Due to construction sequencing and existing dike excavation concerns, the contractor requested chromated copper arsenate (CCA) or creosote-treated Douglas Fir piles be spliced onto the untreated Douglas Fir piles in lieu of the concrete caps. The Qualified Environmental Specialist (QES) for the project determined that there were no guidelines or regulations regarding the use of CCA or creosote in aquatic environments set for by the DFO, EC or the BC Ministry of Environment. In the absence of such guidelines under the standard approach, the QES investigated further and confirmed that the BC Ministry of Transportation (MOT) and MFLNRO have guidelines regarding the use of treated wood in and around aquatic environments that could be followed in this particular case. According to the MOT and FLNRO guideline documents, CCA and/or creosote treated wood was determined to be acceptable for use on the project provided the treated sections were installed outside the wetted perimeter (i.e., the areas outside the high water level along the foreshore and above the measured groundwater table.) The design was updated to ensure the splice point between the untreated and treated piles were installed at the appropriate elevation, thereby practicing sound environmental protection measures.

The natural terrestrial and aquatic habitat of the mighty Fraser River.

Some of the significant Environmental Mitigation measures practiced onsite include:

- Turbid sediment laden water was diverted away from denuded areas and discharged to vegetated areas within the property allowance of the project.
- Erosion and sediment control measures were installed and regularly inspected, protecting the fish bearing water.
- Raw concrete, concrete leachate, and other deleterious substances were contained and cleaned within designated areas, protecting land and aquatic environments.
- Clearing of existing vegetation was kept to a minimum.
- Disturbed riparian areas were restored with a native species landscaping plan.
- Air quality was managed through regular inspection of equipment, keeping dust-generating activities to a minimum and the prohibition of burning materials onsite.
- Appropriate spill response preparedness and waste management procedures were applied.

8 Community Relations

Residents and local businesses learned about the station upgrades details and the related impacts through public open houses. The City held three drop-in style open houses over the course of the project, giving the public an opportunity to learn about the pump station upgrade design details, project schedules, and ask questions. The City received constructive feedback during the sessions and relevant concerns were addressed.

Due to the unique wing shaped design of the station roof, selecting the appropriate roof materials was an important and crucial design component. One consideration was given to the reflectivity of the top roof layer. Originally, an aluminum roof surface was considered for its overall look and durability. However, due to the proximity of residential high-rise buildings, and residents' concerns of excessive sunlight reflection, a low-reflectivity membrane material was used instead. This accommodated the residents' concerns without compromising on the overall roof aesthetics or material durability.

Given the project is located within a highly utilized dike trail system, it was crucial to protect the public from the construction zone, while keeping the dike trail system open to the public. Both ends were achieved by temporarily re-routing pedestrian and cyclist traffic safely around the construction site using temporary fencing and easy to understand warning and detour signage.

9 Soil Densification

To achieve a post-disaster rating, soil densification was required under and around the station. Soil densification was achieved by driving 281 timber piles with a diameter of 150 mm to 18.3 m below the surface, spaced 1 m apart.

The energy required to drive piles can sometimes damage adjacent structures. Approximately 12 m west of the station wet well lies an active 900 mm diameter welded steel watermain and concrete valve chamber, running perpendicularly through the dike approximately 2 m below the surface. Since the watermain was constructed in 1977 and its condition was unknown prior to construction, it was extremely important to ensure the watermain and chamber remained unaffected by construction activities. The piling operation boundary was only meters away from the watermain, so a plan was devised to prevent damage to the existing watermain and chamber during pile driving activities. This plan consisted of five approaches:

1. Settlement monitoring survey pins were installed directly on the watermain pipe and concrete chamber structure and monitored daily during the piling operation to record any movement.
2. Vibration monitoring points were installed on the pipe and chamber and data was recorded daily to ensure set thresholds were not surpassed during the piling operation.
3. A preconstruction structural condition assessment was conducted from the interior of the chamber to ensure the structural integrity of the chamber was acceptable.
4. Piles within 5 m of the watermain and chamber were pre-drilled to help control the surrounding densification and reduce vibration.
5. Construction equipment traffic was restricted to limit vibration and loading on the watermain and chamber.

The plan was successfully executed upon completion of the piling operation; no signs of direct or indirect damage to the watermain or chamber were noted.

In addition to monitoring adjacent existing City-owned infrastructure, private structures near the site were monitored during the piling operations. Vibration monitoring data was reviewed daily and no exceedances to threshold limits were recorded for the duration of the piling operation. In addition to the vibration monitoring, a visual and photographic survey was completed prior to pile driving, recording the previous condition of the adjacent buildings and structures. A follow-up post construction survey was used to demonstrate and document that no damage was caused by the piling operation. This proactive approach not only benefited the City in managing risk, but also protected local private properties from construction-related activities.

10 Cost and Value Engineering

The unique nature and complexity of the structure resulted in a cost proposal which exceeded the available budget. The City and the design team worked with the Construction Management company to identify opportunities for cost reduction. Significant cost savings were achieved in the following areas:

- ***Roof structural system:*** An alternate structural system was selected for the station roof which was less costly, but still achieved the desired performance and architectural intent. The original roof design concept was unique in that the overall thickness of the roof was relatively thin, with tapered, rounded edges reminiscent of the edge of an airplane wing. The roof's structural design involved rigorous finite element analyses, due to the complexity of the overall shape. After thorough investigation and consultation with local metal fabrication plants, a compromise was reached with a re-design that sacrificed on the overall "thinness" of the roof by introducing more conventional roofing design concepts. The re-design significantly simplified the fabrication and assembly processes while still maintaining the original artistic vision. In addition, interior roofing tiles were removed exposing the interior roof beams and girders that created a more voluminous feeling, indicative of the interior of an airplane hangar.
- ***Soil densification:*** Because timber piling was a major cost contributor, significant cost savings were achieved by confining the extent of soil densification to areas directly affecting the stability of the pump station, instead of densifying the surrounding site.

11 Lessons Learned

Several challenges were overcome in this project which provide learning opportunities for future projects. These included:

1. ***Cost engineering:*** Project costs were critically assessed at every project phase, which allowed this technically complex multidisciplinary project to be completed within budget. Costs were assessed at the conceptual, detailed design and construction phase. At each phase, opportunities for cost savings were identified and implemented. Successful collaboration between the City, the design team and the Construction Management team was key to the success of this approach.

2. ***Public involvement:*** By actively engaging the public during the design phase, the City avoided costly changes during construction and public complaints.

3. ***Schedule flexibility:*** The pile driving activities took longer than anticipated due to denser than anticipated shallow soils at some locations. The schedule was accelerated through review of alternate construction methods for the roof and the dike raising.

4. ***Public art integration:*** In previous projects, the City sought to integrate public art at the end of the design or construction phase, as an addition to the project. This approach created a disconnect between the design team and public artists. For this project, the City sought a new approach, making the artist part of the design team. The artist and design team became collaborators rather than competing interests, allowing for a shared vision of both the functional and artistic intent of the station. The result was seamless integration of public art into the design, and a station which captures the public's attention and interest.

Project Team

City of Richmond
Owner / Project Manager

WSP | Opus
Prime Consultant — Civil, Mechanical, Electrical

Feenstra Architecture
Station Architecture

Connect Landscape Architecture
Landscape Architecture

Dillon Consulting
Environmental Consulting

Integral Engineering
Structural Engineering

Tetra-Tech
(formerly Marine + Earth Geosciences)
Geotechnical Engineering

Stuart Olson
Construction Management

Richmond City Hall
6911 No. 3 Road
Richmond, British Columbia V6Y 2C1