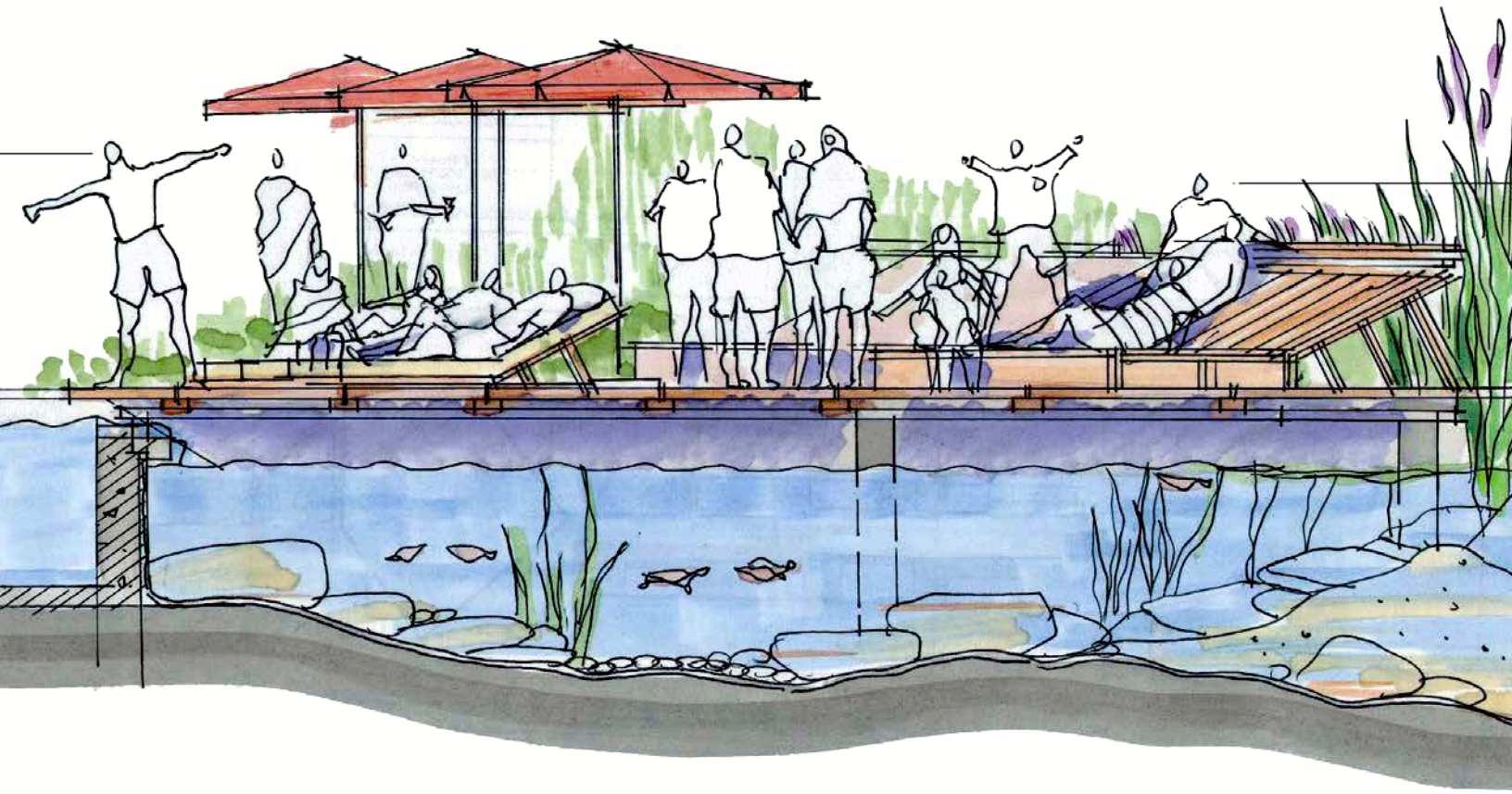
Natural Swimming Pools

The Future of Public Swimming without Chlorine

March 2016



HCMA
Architecture
+Design

An Introduction to **Natural Swimming Pools**

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Cover: Sectional schematic of proposed natural pool conversion for New Brighton Pool.
Image courtesy of PWL Partnership

Above: Naturerlebnisbad Bingerbrück
Bingen, Germany, Polyplan GmbH

INTRODUCTION

Natural Swimming Pools are defined as pools that use naturally occurring biological water filtration and treatment methods to provide pure and clean bathing facilities that mirror natural bodies of water, without the use of chemical treatment.

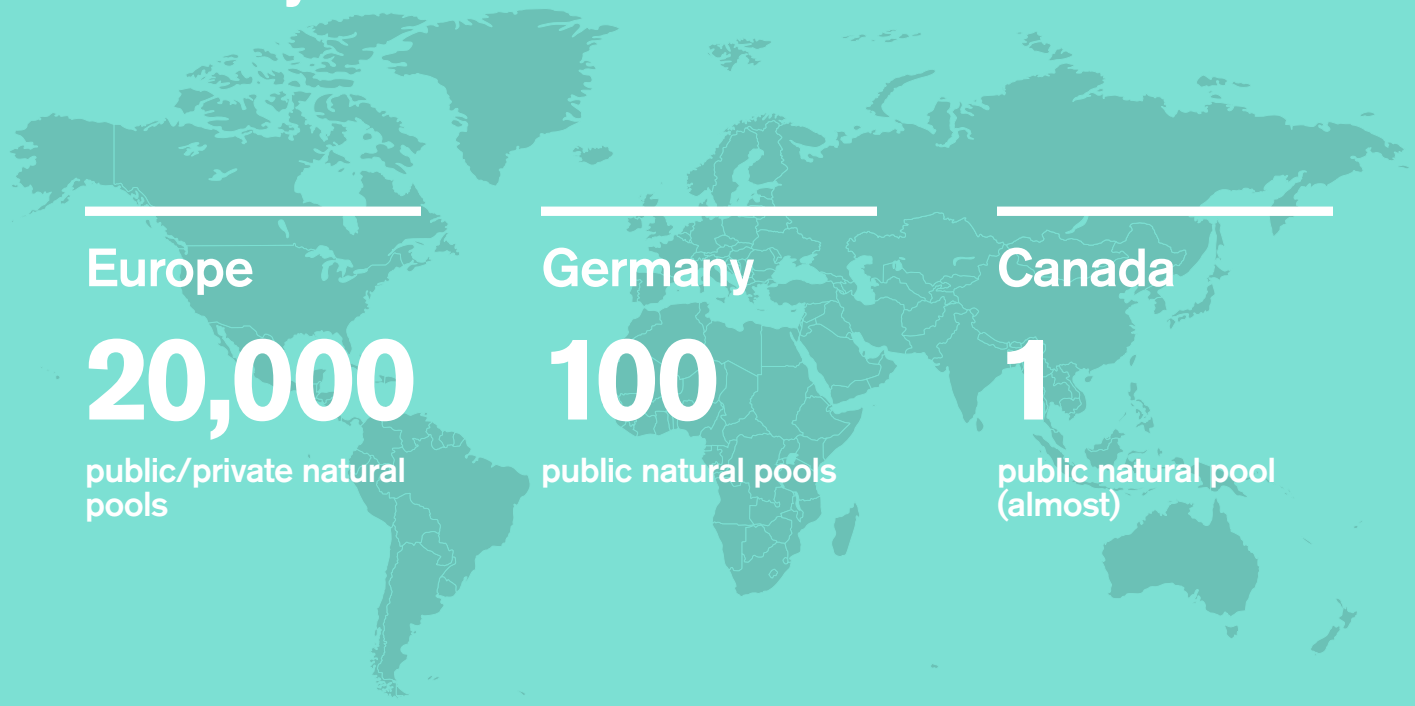
Water quality in these pools depends on ecological conditions, frequency of use and the biological system used. Impurities introduced into the pool are eliminated firstly through natural filtration, such as gravel screens, and then through biological purification using a 'regeneration zone' housing plant material.

The treatment method used in natural pools is a naturally occurring, safe and sustainable alternative to mechanical and chemical treatment commonly used in the majority of indoor and outdoor pools worldwide. Natural Swimming Pool systems have been successfully applied to public and private new-build pools in addition to the conversion of existing chemically treated pool facilities.

MAIN CHARACTERISTICS OF A NATURAL SWIMMING POOL:

- It is a contained and recirculated vessel
- No chemicals or devices are used to sterilize or disinfect the water
- The pool conforms to conventional swimming pool code with respect to safety regulations e.g. depth, configuration, access, egress, etc.

Natural Pools **Globally**



Europe

20,000

public/private natural pools

Germany

100

public natural pools

Canada

1

public natural pool (almost)

The first natural pools appeared in Austria and Germany in the 1980's. There has since been a rapid increase in numbers, with over 20,000 public and private natural pools now in Europe. The first North American public natural swimming pool opened in Minneapolis, Minnesota in July 2015, and currently there is a natural pool development under construction in Edmonton, Alberta.

A sustained growth of Natural Swimming Pools is predicted, facilitated by rising public concern related to possible risks associated with current pool chemical treatment methods – often linked to allergy and respiratory symptoms as well as eye & skin irritation syndromes in swimmers caused by disinfection by-products (DBPs) including trihalomethanes and chloramines[1].

1 Florentin, Hautemanière & Hartemann (2011) Health effects of disinfection by-products in chlorinated swimming pools

Natural Pools:
Why are we doing this now?

OUR RELATIONSHIP WITH WATER

Water is an essential part of human life. Historically, humans have developed complex cultural and social relationships with water that can be found in cultures across the globe. The origins of public bathing can be traced back to ancient Indus Valley Civilization, before the more widely publicized examples in Ancient Greece and the Roman Empire. Roman baths were integral to daily life in ancient Rome, serving as gathering spaces for socializing, relaxing, and cleansing. In Western India, Stepwells were central to the culture and served as sites for drinking, washing, and bathing. Beyond these utilitarian purposes, Indian Stepwells evolved into places for social gathering, sacred ceremonies, and festivals. The most recent resurgence in large public baths was during the 19th Century with the British importing the custom after finding successful examples in India and Japan.

COMMUNITY AQUATIC FACILITIES

The value of public aquatic facilities to the communities they serve is extensive, with direct health benefits to swimmers supplemented by considerable evidence that aquatic programs contribute to the physical and emotional well-being of the community. Evidence has indicated that regular aerobic exercise can decrease the risk of chronic illnesses[2], and that water-based exercise is proven to improve mental health by decreasing depression and anxiety, in addition to encouraging social connections across varied demographics.[3] A recent study for the BC Ministry of Health Planning found that physical inactivity costs the British Columbian health care system $211 million a year in direct healthcare costs. The same study concludes that if 10% more British Columbians were physically active the province could directly save an estimated $18.3 million every year in prevented healthcare costs, plus an added $31.1 million in productivity gains.[4]

“water-based exercise is proven to improve mental health by decreasing depression and anxiety, in addition to encouraging social connections across varied demographics.”

2 U.S. Department of Health and Human Services (2008) Physical Activity Guidelines for Americans: Be active, healthy, and happy! www.cdc.gov/healthywater/swimming health_benefits_water_exercise.html#seven

3 Nova Scotia Dept. of Health and Wellness 2014) Nova Scotia Operational Guidelines for Aquatic Facilities.

4 Colman, Ronald PHD GPI Atlantic (2004), The Cost of Physical Inactivity in British Columbia. www.gpiatlantic.org/pdf/health/inactivity-bc.pdf

CHEMICAL POOL TREATMENT AND RISKS

There is a rising public concern regarding chemical pool treatment methods and the risks associated with exposure to disinfection by-products. Disinfectants such as chlorine added to maintain pool water quality can react with other chemicals and pollutants in the water to form a variety of disinfection by-products (DPB's). Swimmers can inhale pool DPB's that have vaporized above the waters surface. The level of exposure varies based on duration and intensity of effort while swimming (adult competitive swimmers are considered to be at greater risk than occasional swimmers). Common adverse health effects from pool DPB exposure includes eye, skin and respiratory irritation, in addition to concerns over asthma, reproductive and cancer risks which are being studied (yet these studies have often been inconclusive). Well managed public pools are reducing exposure risks through increased air circulation, in addition to showering policies which remove human-derived chemicals (such as perspiration, body oils and cosmetics) that can react with chlorine disinfectants to form DPB's. However, the risks of DPB exposure continue to grow, and may even act as a deterrent to some users. While safety measures have been established to ensure chemical concentrations remain within safe limits, there remains a lack of investigation into the full extent of these risks on human health despite the suspected carcinogenic properties.

A NATURAL SOLUTION?

Given these reasons, investment in a more diverse range of aquatic facilities that use natural treatment methods would represent sound social investment. Key to this diversification is the applicability to outdoor swimming, which is argued to hold many benefits over indoor swimming. Views of natural surroundings are shown to greatly reduce stress and improve mood. Fresh air cleanses the lungs and strengthens the immune system as well as boosts energy levels. Swimming under the sky is more pleasurable than indoors, and alludes to a sense of freedom. Beyond swimming, users can enjoy relaxing in natural sunlight which has been found to elevate mood and improve muscle strength. The closer humans are to a natural environment, the more health benefits they are able to take advantage of.

"The closer humans are to a natural environment, the more health benefits they are able to take advantage of."

A natural pool still requires testing procedures to track and ensure water quality, yet chemical treatment purchases are eliminated, mechanical and electrical pumping requirements are minimized and water is continually recycled – eliminating the risk of chemically treated water being released into municipal water systems. An anticipated reduction in the operation and maintenance costs of Natural Pools would serve to reduce cost-per-swim for outdoor pools that are traditionally difficult to maintain and justify.

In a growing context of outdoor pool closures due to high operational costs, the public continue to ask for this service. Natural pools may present a solution to this dilemma by providing reduced operational costs by pumping energy reductions and eliminating chemical treatment to maintain facility viability. The increasing number of natural swimming pools across Europe and North America are receiving growing exposure and public presence, which is expected to result in an increase in public demand in the near future.

Sanitization of Public Swimming Pools: **A Brief History**

Public bathing offered a wide-scale solution to the urban hygiene reform movement in both Europe and USA in the 1890's. Since the mid-1900s chlorine has been widely adopted as the primary disinfection method for public swimming pools, and has been so broadly used that the smell of disinfection by-products has now become widely associated with the experience of social bathing. However the continued adoption of chlorine for sanitizing purposes can be attributed to historical events and market trends, rather than its superior performance. The health effects of chlorine exposure and the environmental impact of treated water began to surface in the 1980's. This led to an increased interest and research into alternative treatment methods, leading to the rise of Natural Swimming Pools as a safe solution. This combination of chemical free bathing with the provision of environmentally conscious filtration systems will continue to grow in popularity.

1860's

Cholera was thought to be associated with poor human hygiene, so bathing was encouraged in the hopes of preventing outbreaks. In 1866, the city of Boston opened five floating baths. These wooden structures extended over a river so the water could continuously flow through. New York city followed suit and opened floating baths in the Hudson river.

1890's

A hygienic reform movement grew in larger cities both in the United States and Europe, the goal being to promote health through cleanliness by providing the urban poor with public baths. Thus the American Association for the Promotion of Hygiene and Public Baths was founded in 1912 in New York City.

1900's

Chlorine is produced as the by-product in the production of sodium hydroxide, and needed to find a market. By the early 1900's chlorine was being used to aid in sanitizing swimming pools.

1903

What is considered to be the first chlorinated pool in the US opens at Brown University

1910's

Ultraviolet sterilization was an early alternative to chlorination. In 1919 the Hotel Pennsylvania was advertising that its two swimming pools were *"filtered clean, and then purified by violet rays. No Chlorine, no chemicals".*

1920's

Dr. W.A Manheimer concluded that ozone was superior to chlorine for sanitizing swimming pools, because chlorine used in waters with a high concentration of organic matter created an odor problem.

1934

A Chemist named C.H. Brandes developed a method of introducing silver ions into a pool as a sterilizer, however the cost was substantially more than chlorine.

1950's

Polio outbreaks were on the rise, and swimming was regarded as a cause. A study showed that chlorine was actually one of the few known chemicals that could inactivate the virus. Chlorine became the new face of sanitation, with strict regulations on chlorine in pools in place by the early 1960's. It is thought that polio outbreaks of this period were responsible for replacing the natural swimming hole in favor of the man made pool.

1960's

Installed at the New hyde Park Municipal Pool in the late 1960's, this system monitored and controlled chlorination, alkalinity, filtering, and water levels.

1970's

Saltwater pools first appeared commercially in New Zealand in the early 1970's. Salt water chlorination is a process that uses electrolysis in the presence saltwater to produce hypochlorous acid and sodium hypochlorite, which are sanitizing agents already commonly used in swimming pools. (As such, a saltwater pool is not actually chlorine-free; it simply utilizes a chlorine generator instead of direct addition of chlorine).

1974

Growing concerns increase over disinfection by-products such as chloroform and other trihalomethanes found in chlorinated pools. The search for a 'chemical free' pool continues.

2000's

Concerns regarding health effects from exposure of chlorine by-products as well as the release of chlorinated pool water into the environment through municipal sewer systems has prompted the emergence of biological treatment systems. These have been popular in Europe since the 1980's, and are gaining increasing popularity in North America.

Source: Kevin Olsen, "Clear Waters and A Green Gas: A History of Chlorine as a Swimming Pool Sanitizer in the United States," Bulletin of the History of Chemistry 32, no. 2 (2007)

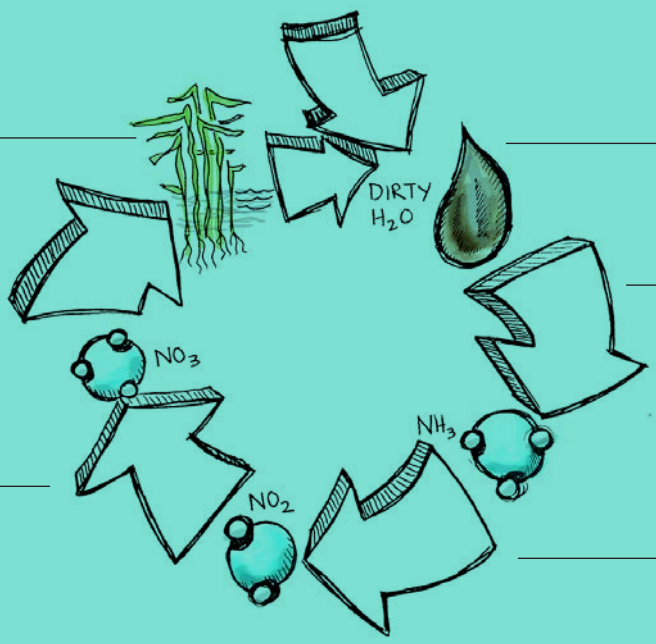
An Overview of Natural Swimming Pool **Design and Operation**

A natural swimming pool is able to purify and clean bathing water without any chemical use. After exiting the swimming zone through skimming, water is fed by gravity through filters that collect large debris and particulates. It then flows into the 'regeneration zone' where it can be filtered through layers of gravel substrate.

The regeneration zone provides a balanced ecosystem by breaking down harmful bacteria in 'exhaust' water and converting it into nutrients for plant growth. This system stabilizes over time as biological components evolve into optimized ratios, contributing to the self-sustaining advantage this method of filtration provides.

Once the water is sufficiently purified it is pumped out of the regeneration zone and back into the swimming zone.

NITROGEN CYCLE OF NATURAL POOLS



Nitrates are taken up by plants as fertilizer, making use of the once harmful compounds in a useful way

Detritus from bather load and organic matter

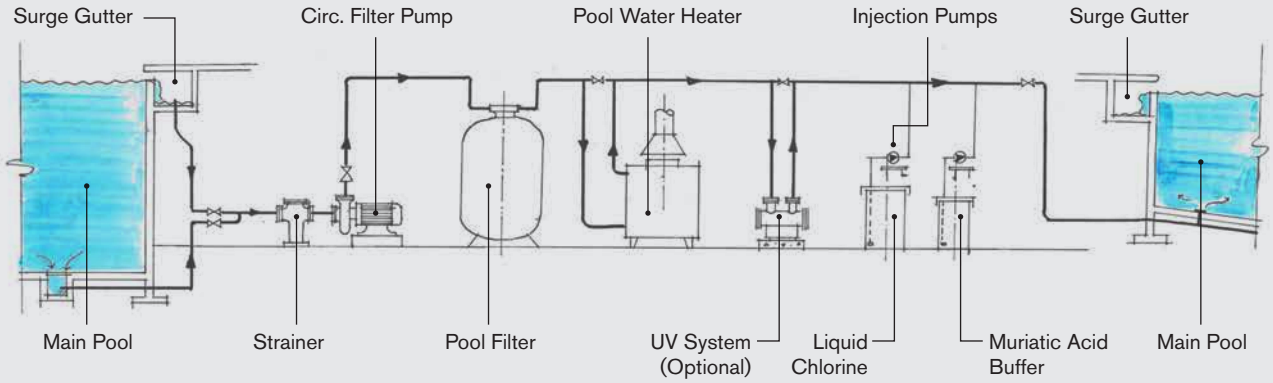
Heterotrophic bacteria consume organic material in the water, oxidizing it and breaking it down into water, CO2 and ammonia.

Nitrobacteria convert nitrites to nitrates

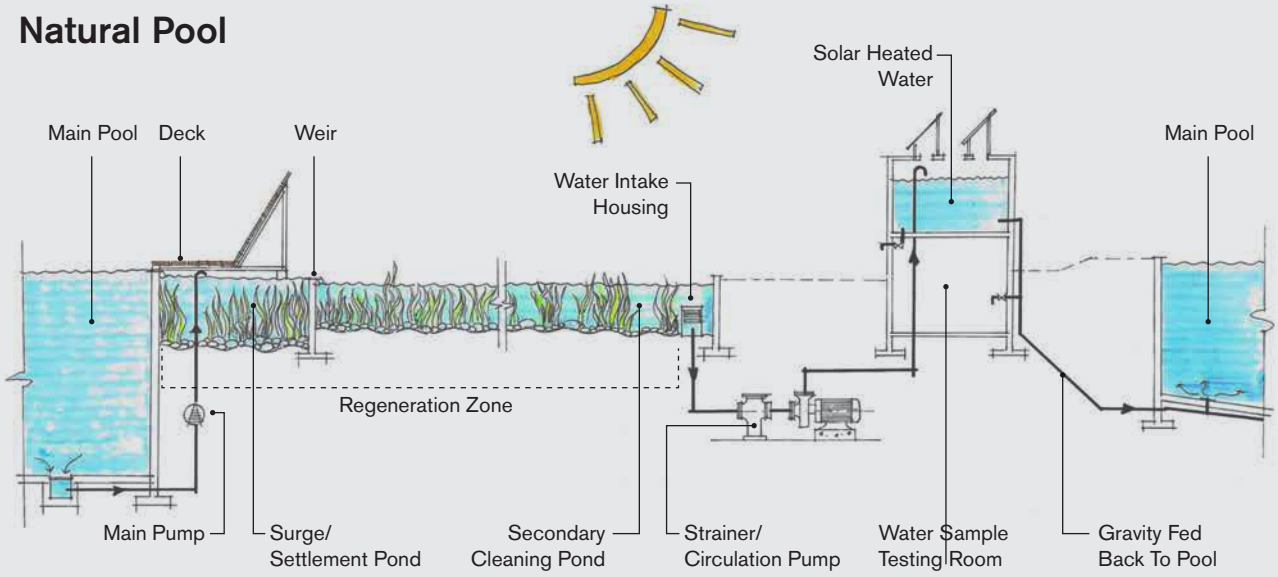
Nitrosomonas bacteria convert ammonia to nitrites

Mechanical System Comparison:
Typical vs. Natural

Typical Pool



Natural Pool

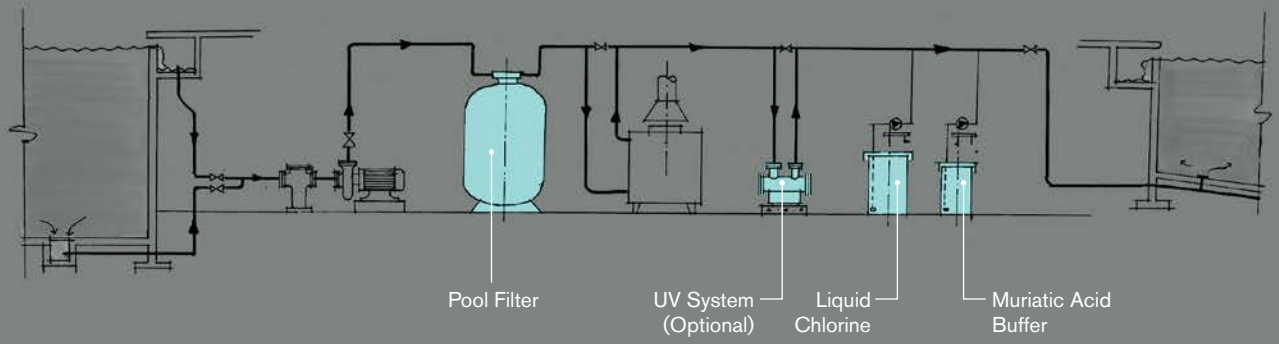


Diagrams courtesy of AME Group

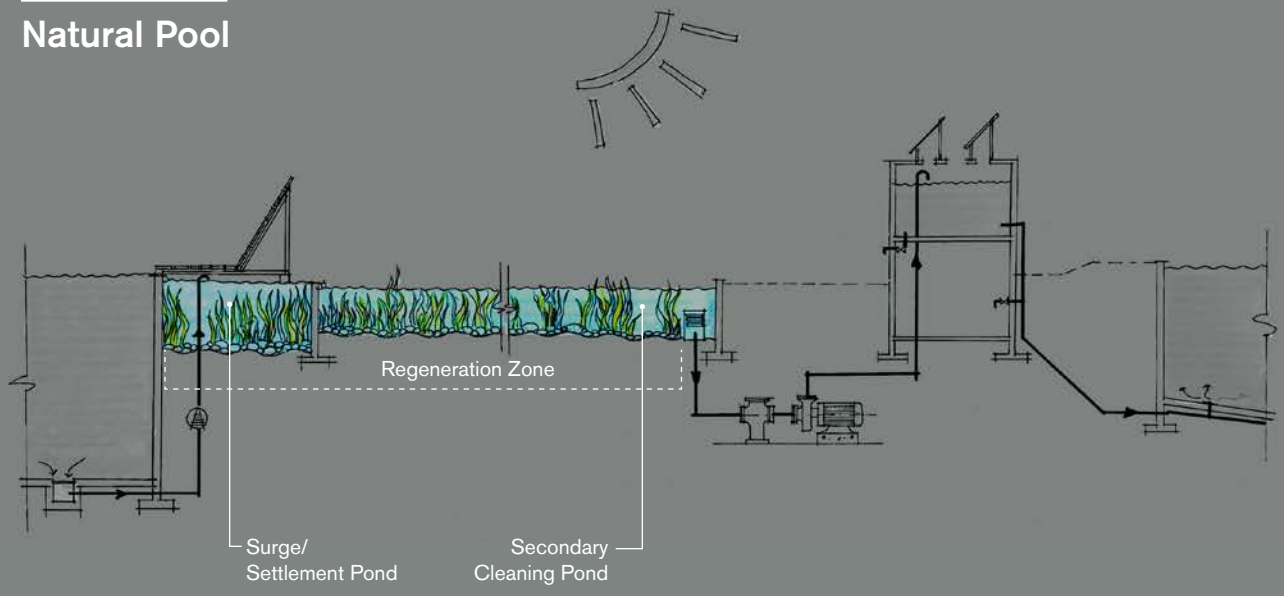
Step 1:
Pool Filtration

In a natural pool system, filtration is provided in the form of a settlement pond with a gravel screen, as opposed to a mechanical filter that requires a constant energy source. The use of chlorine (liquid or other), buffer agent and an optional U/V system are eliminated and replaced by a biological filtration zone containing plants such as reeds, bulrushes and duckweed.

Typical Pool



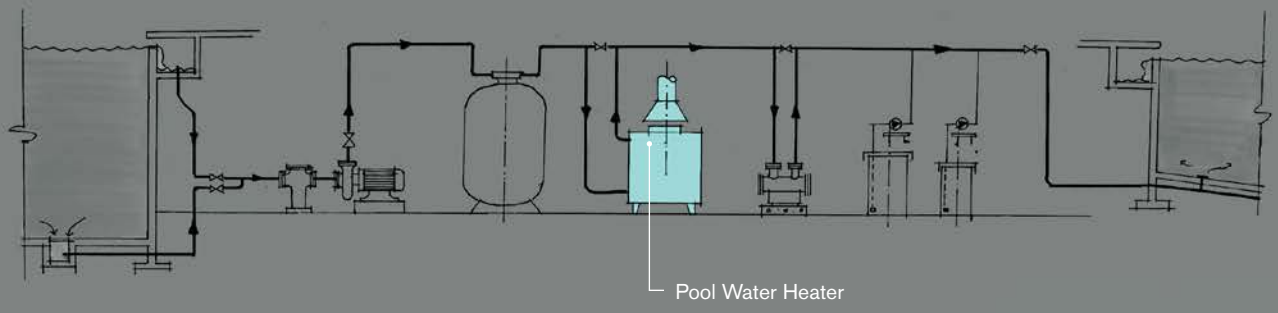
Natural Pool



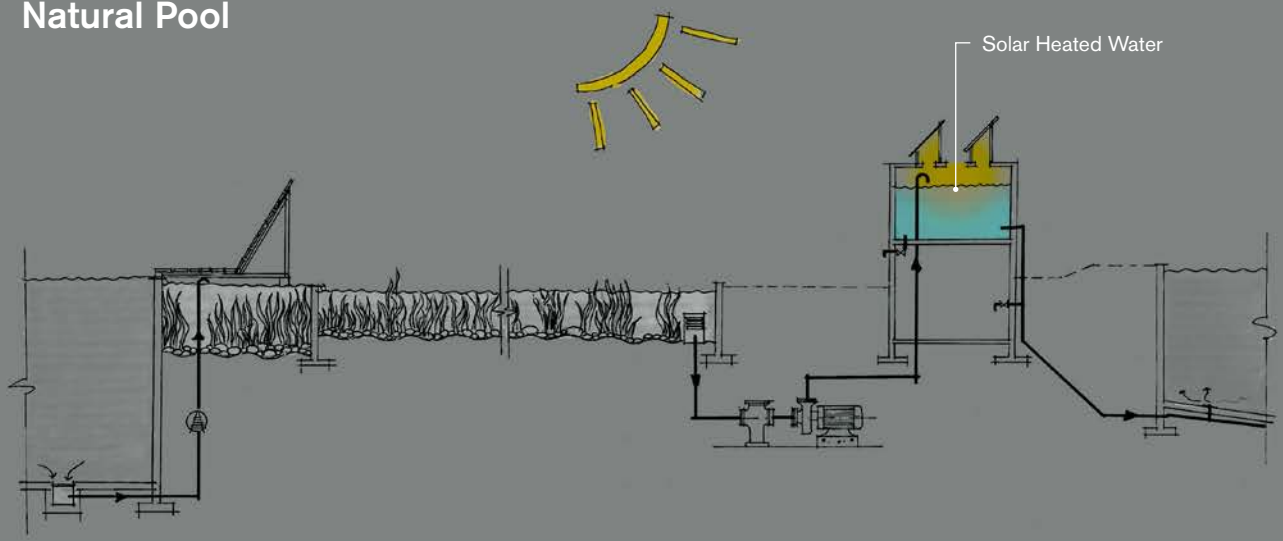
Step 2:
Pool Heating

Instead of an energy intensive water heater, the natural pool system can take advantage of passive solar energy to heat bathing water if required.

Typical Pool



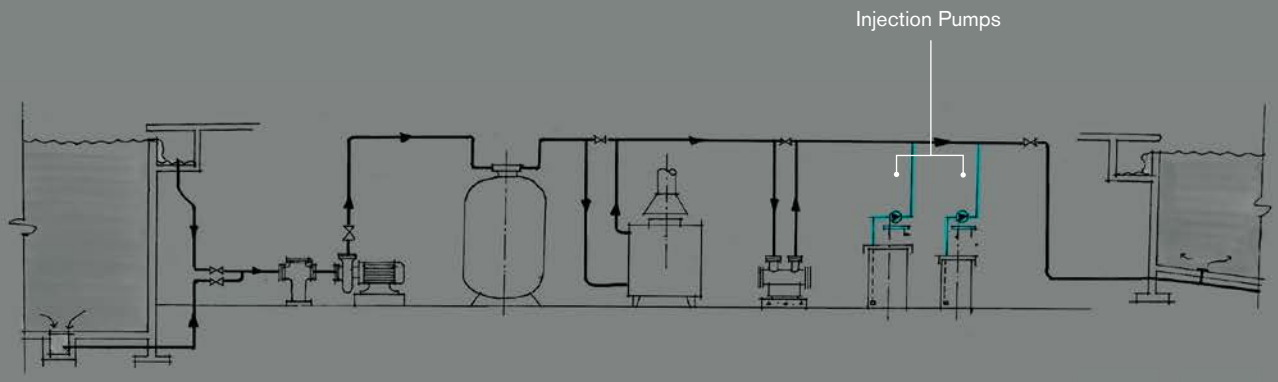
Natural Pool



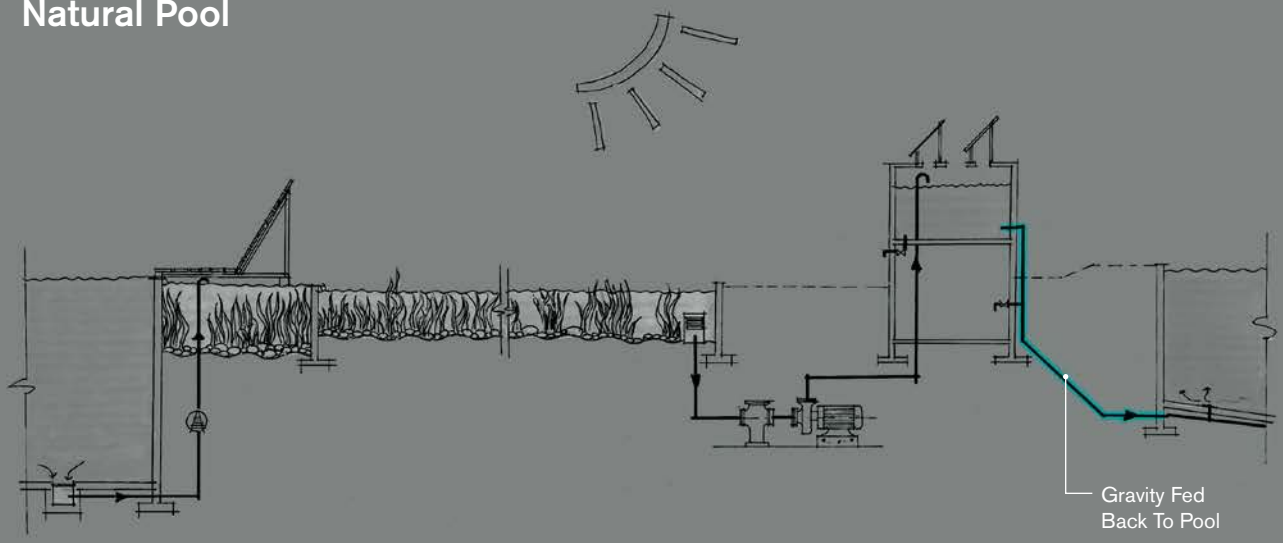
Step 3:
Water Flow

The natural pool system can rely predominantly on gravity to drive water flow, reducing pumping requirements throughout the system with the potential to reduce operating costs.

Typical Pool



Natural Pool



Advantages of Natural Pools Over Chemically Treated Pools

ENVIRONMENTAL BENEFITS

Besides increasing green space and providing a visually pleasing natural setting created by the planting in the regeneration zone, natural pools eliminate concerns over chlorinated water run-off into municipal sewers, therefore lessening the amount of chemicals entering our water system. Furthermore, planted regeneration zones provide a thriving habitat for insects and amphibians.

EXPERIENTIAL QUALITY

A biological treatment system with a balanced ecosystem can improve water quality and visual experience through enhancing the natural habitat and surroundings.

HEALTH AND WELLNESS

Natural swimming pools provide the opportunity for swimmers with sensitivities to traditional pool chemicals to engage in bathing activities, ensuring greater inclusivity. The biological processes in the filtration system can also serve as useful tools for environmental education.

OPERATIONAL COSTS

Natural swimming pools represent an innovative solution to new builds and conversions of current pool facilities with high operating costs. The gravity fed filtration process can reduce overall facility energy use, and coupled with elimination of chemical use can reduce operating costs considerably. However, this should be balanced against potential increases in the regular staff maintenance related to ongoing maintenance of surfaces and plants.

POSITIVE PUBLIC PERCEPTION

Natural swimming pools enhance perception of a cities wider sustainability objectives, and can be viewed as a positive message or stride towards these goals.

Disadvantages of Natural Pools Over Chemically Treated Pools

CAPITAL COSTS

While costing is largely dependent on final layout and scope, it is generally regarded that natural pools cost more to construct than conventional pools. This is mainly due to the need to construct two pools (swimming basin and regeneration zone) and plant matter used for filtration.

USER BEHAVIOR/PERCEPTION

As the natural pool filtration system does not provide a 'sterile' facility, a degree of behavioral adaptation is required to maintain healthy function and not overburden the system. Examples include showering before entering the pool to remove contaminants such as sweat and sunscreen, and acknowledging the regeneration basin as a sensitive area that is not for swimming. In addition, the light green colour of the bathing water can be misinterpreted by some as 'murky', leading to negative impressions related to cleanliness and hygiene.

USER EDUCATION

In order for the natural pool filtration system to function optimally, user education is required to understand the basic processes of water ecology. This can include planting management and prevention of obtrusive wildlife activity.

Key Considerations
for Owners, Operators and Design Teams

HEALTH REGULATIONS

As natural swimming pools still represent a deviation from societal 'norms', current health regulations will require a special approval process. It is strongly recommended that early dialogue is started with local health authorities, to ensure that any preconceptions regarding natural swimming pool performance or risk can be resolved through stakeholder education.

Discussions with the Health Authority are recommended to work towards a performance based criteria for safe and clean swimming, rather than the prescriptive criteria established by the relevant health regulations. This approach would be consistent with the governance of other available natural swimming opportunities, such as municipally governed beaches and lakes. The recent delivery of some public natural swimming pool projects in both Minneapolis and Edmonton (both listed as case studies within Section 2) will provide health authorities with evidence that natural pools can be maintained with exemplary health records.

The German FLL (Landscaping and Landscape Development Research Society) have developed a set of guidelines for the planning, construction, servicing and operation of outdoor pools using biological water purification. These guidelines (last updated in 2011) prescribe a method of water quality measurement that can be used as an alternative to traditional chemical disinfection, and are widely regarded as the most rigourous standard for natural pools construction and safe operation globally.

PROJECT DELIVERY

Knowledgeable and experienced manufacturers of NSP systems exist in the marketplace, but qualified design professionals should be included in the project team to integrate systems into the site and ensure the owners objectives are met.

Key Considerations
for Owners, Operators and Design Teams

SITE CONSIDERATIONS

The regeneration zone must meet various criteria for the optimal function of the natural pool: its scale in relation to the size of the swimming tank and bather load, its ability to use gravity for water flow; and it must be protected from external threats in order to function successfully. The natural pool can be considered a wetland for plant life, but the introduction of wildlife (ducks/birds etc) is always avoided. This is due to the organic matter that wildlife will produce, that will increase the stress on the filtration system.

PLANTLIFE STABILITY

Ensure the site is suitable to support the growth of a variety of plantlife which act as biological filters. Because a natural pool is a living system, it will require a period of phased occupancy (bather load) upon opening. This is required so as not to overburden the filtration system which will require a period of growth before operating at full capacity.

CLIMATE

Natural pools have been constructed in temperate climates similar to BC, in addition to many other locations around the world. We are not aware of any climatic restrictions for natural pool operation, however plant matter should be carefully considered to be native to that particular climate to ensure survival of the system. In colder climates a natural pool will need to be 'winterized' like a traditional outdoor pool (plumbing lines, pumps, and filters drained). The swimming tank can be covered, and the regenerative zone protected with a mesh to prevent debris from entering.

OPERATIONS & MAINTENANCE

Crucial to the successful functioning of the natural pool is to have an educated staff team, as well as local specialists for support as required. The natural swimming pool requires daily, weekly, and monthly maintenance during the bathing season to maintain system stability.

NATURAL INDOOR POOLS?

Generally, all natural pools have been implemented as outdoor facilities. However, in July 2011 an indoor heated natural pool was built in the UK by Clear Water Revival. In these examples, the regeneration zone can be situated outdoors.

BATHING SEASON MAINTENANCE SCHEDULE

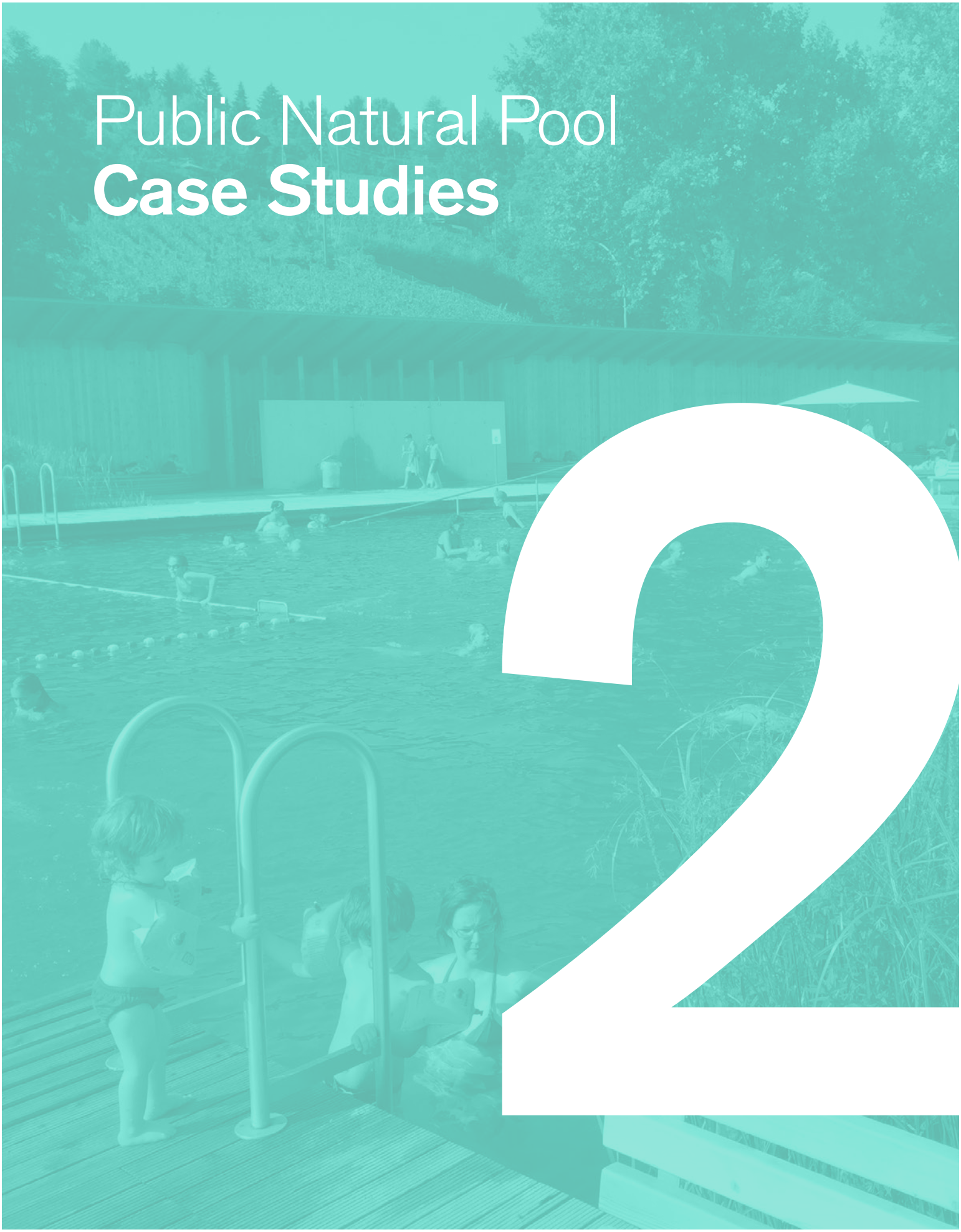
Daily
Empty pump & skimmer baskets. Clean basin walls and floors.

Weekly
Clean out skimmers & overflow. Perform microbiological testing. Remove dead plant matter in regeneration zone.

Startup
Equipment commissioning – check all pumps for working order. Start filters and clean system. Clean swimming zone with mobile pumps.

End of Bathing Season
Cut back all planting and remove all dead biomass. Drain pool water. Clean swimming zone with mobile pumps. Drain and winterize equipment.

Public Natural Pool
Case Studies



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Naturbad Maria-Einsiedel
Munich, Germany

Completed 2008

Client SWM Munich

Budget 3.3 M Euros

Size 2,750 m^2
(includes children's area, shallow and deep pool area)

System Conversion of an existing facility. The filtration system consists of aquatic plants and two gravel filters below ground. Children's play area was converted into regeneration basin. Pools have a green lining to give a natural impression.

Left: Naturbad Maria-Einsiedel
(Images from muniqueando.com)

Top Right: Before Naturbad Conversion

Top Left: After Naturbad Conversion
(Images both from Google Earth)

Naturbad Riehen
Riehen, Switzerland

Completed	2014
Client	Gemeindeverwaltung Riehen
Architects:	Herzog + de Meuron
Planners:	Rapp Arcoplan AB, Basel
Consultants:	Wasserwerkstatt
Budget	3.5 million
Size	1,000 m^2 (bathing); 5,000 m^2 land area.
System	Regeneration basin with aquatic plants. Ecological cleaning capacity for 2000 bathers a day

Top Left: www.blickamabend.ch
Top Right: kubusmedia.com
Bottom: P. Fast

Webber Natural Swimming Pool
Minneapolis, Minnesota

Completed July 2015

Client Minneapolis Parks

Planners Landform

Consultants BioNova

Budget 6 million

Size 21,000 ft^2 (500,000 gallons water)
Regeneration basin is approximately 16,250 ft^2

System Regeneration basin with 7,000 aquatic plants rooted in layers of limestone and granite gravel. Entire volume of pool water recycled every 12 hours. Regeneration basin inhabited by frogs, turtles, and other wildlife.

Images: Minneapolis Park & Recreation Board

Borden Park Natural Swimming Pool
Edmonton, AB

Completed Spring 2016

Client City of Edmonton

Architects GH3

Consultants Polyplan

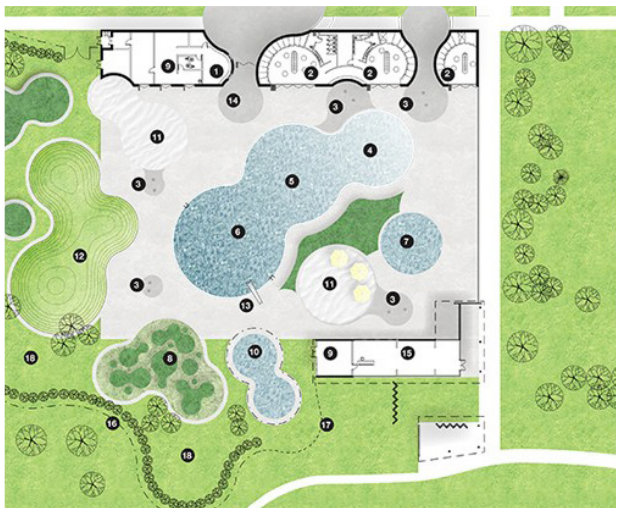
Structural/ Mechanical/ Electrical Morrison Hershfield

Budget 12 million

Size 829 m^2 building and site (400 Swimmers)

System Regeneration pond, biofilter and hydroponic plants. Lack of soil results in consumption of all nutrients needed for algae growth by plants. Bio-mechanical filtration and in-situ zooplankton.

Images: awards.canadianarchitect.com



Hypothetical Design Study: New Brighton Pool

3

INTRODUCTION

HCMA took the key learnings from our research on Natural Swimming Pools and applied these to a hypothetical design study focusing on the conversion of an existing conventional outdoor pool in Vancouver's New Brighton Park.

New Brighton Park is a waterfront park located in the Hastings-Sunrise district of Vancouver, with a thriving residential neighborhood to the south, several working industrial plants including Cascadia Grain Terminal and CP Rail to the east and west, and a clear view of the North Shore mountains across Burrard inlet to the north. The park is popular year round for its sports fields, off leash dog area and waterfront access, and in the summertime for New Brighton Pool - one of only three outdoor public pools in Vancouver.

The design study was carried out in collaboration with PWL Partnership (landscape consultant) and AME Group (mechanical consultant).

PWL Partnership

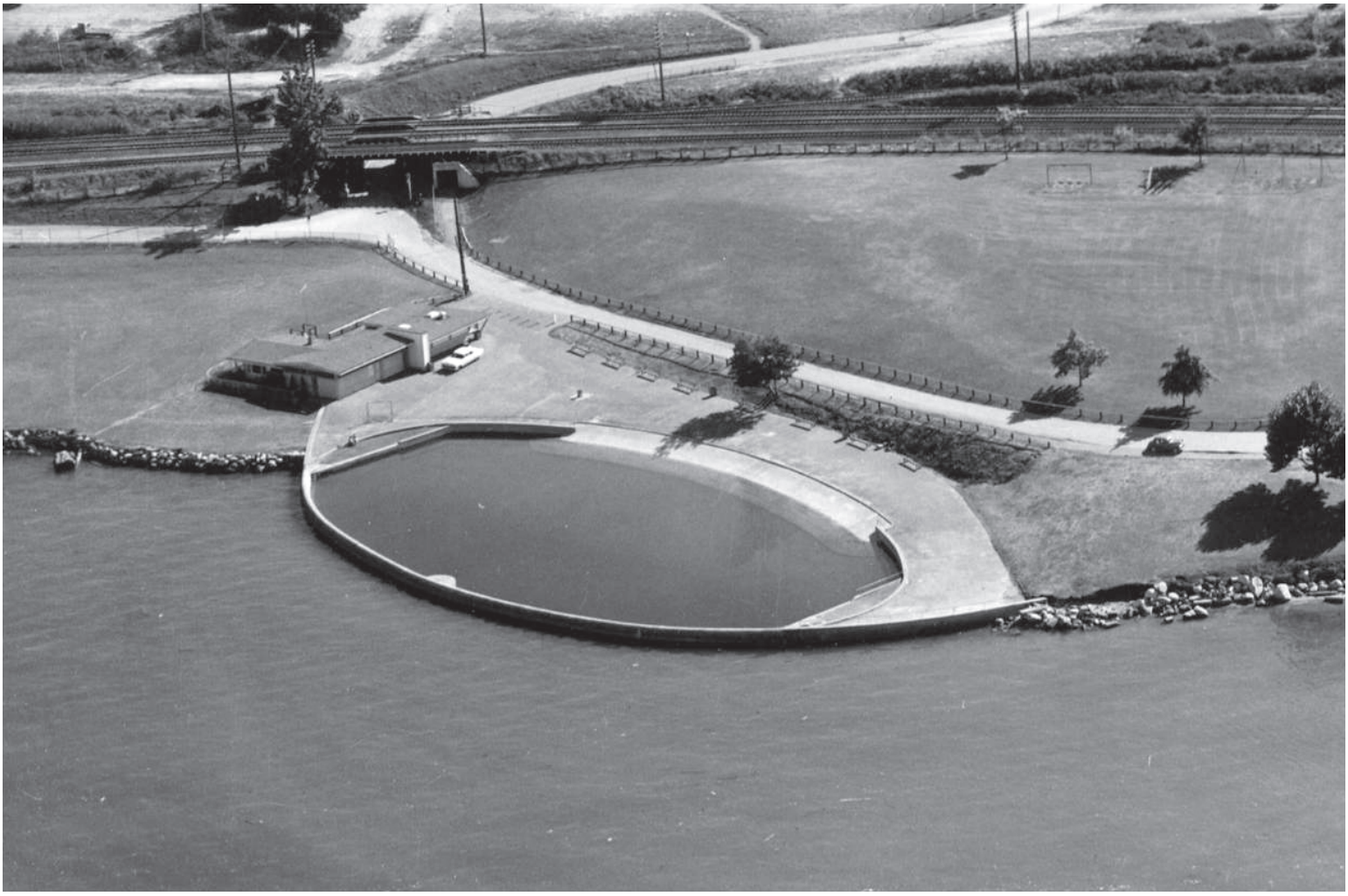
5th Floor, 1201 West Pender St
Vancouver BC V6E 2V2 Canada

604.688.6111
info@pwlpartnership.com

AME Group

1100, 808 West Hastings St
Vancouver BC V6C 2X4 Canada

604.684.5995
contact@amegroup.ca



New Brighton Pool, City of Vancouver Archives (1960)

New Brighton Pool was selected for this design study in part because of its popularity and usage, but also due to its age and history. New Brighton Pool is a much-loved and well used public amenity that began in 1935 as a result of public lobbying. It was originally constructed as a tidal pool that provided a safe alternative to ocean swimming at the park, addressing concerns related to ocean currents and increasing port activity. The tidal pool was closed in 1971 due to increasing pollution and was rebuilt as a conventional chlorinated pool in 1973, by which time the foreshore had been infilled significantly, transforming the pools relationship to the ocean. Given its age and heavy summertime use, the pool is in need of a refresh and is likely to have systems that are in need of replacement. In addition, the Vancouver Board of Parks and Recreation is currently exploring the restoration of habitat in New Brighton Park. The goal of the proposed project is to restore habitat for Burrard Inlet's fish and wildlife, increase public access to nature and restore the many streams that were buried as a result of the infill used to extend the shoreline. The proposal includes a 1.2km stream corridor from Hastings and Creekway parks to the south through a new salt marsh along the shore adjacent to New Brighton pool.

City of Vancouver Archives (1968)

New Brighton Pool
A Brief History

1863

New Brighton, previously known as Hastings Townsite, is considered to be the original area in which Vancouver began. The City of Vancouver laid a plaque in 1968 to recognize the significance of this area.

View of New Brighton in the early 1900's, looking East, City of Vancouver Archives

1934

Origin of pool at future New Brighton Park, due to a lack of swimming facilities in East Vancouver complicated by dangerous waters at Second Narrows/Burrard Inlet.

1935

New Brighton Pool is constructed as an outdoor tidal pool for $21,000 - the result of extensive community lobbying.

City of Vancouver Archives (1942)

1964

Site foreshore extended with infill, and continues throughout the 1960's.

1971

New Brighton Pool is closed due to Burrard inlet pollution - a combination of industrial effluent and sewage from outflow pipe.

1972

Woodward's Foundation donates $250,000 for the new pool project, the City of Vancouver matches this amount. New Brighton Pool re-opens the following year.

Vancouver Park Board

City of Vancouver

2015

New Brighton Park being considered for habitat restoration, in order to daylight the streams buried in the 1960's when infill was used to extend the shoreline.

LEGEND

1. Six Lane 25m Pool
2. Kids Splash Pad
3. Concession
4. Change Rooms
5. Zero Entry Leisure Pool

EXISTING NEW BRIGHTON POOL

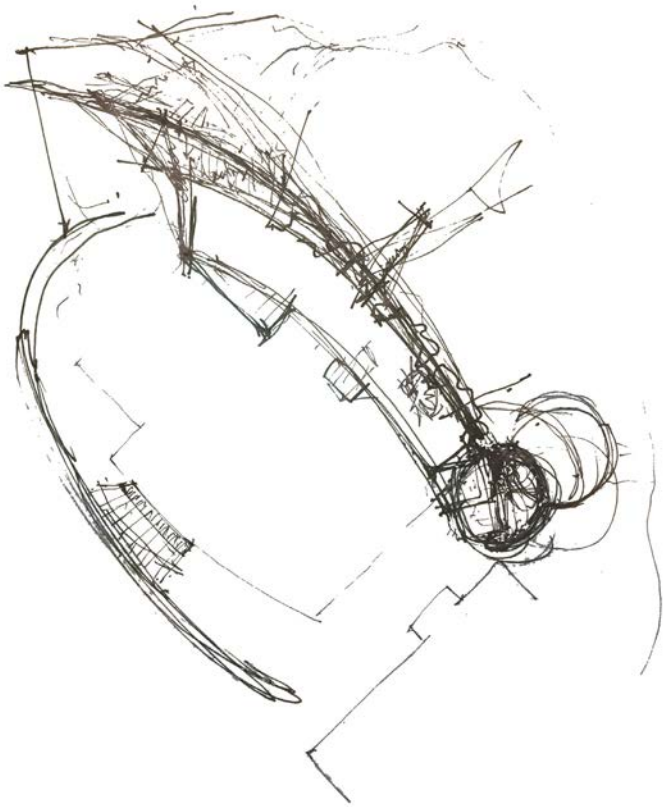
The age of the pool and the imminent need for facility upgrades, combined with the opportunity to extend the naturalization of the adjacent shoreline, made New Brighton Pool an ideal site for this design study. New Brighton is an ideal site as it has sufficient adjacent greenspace to support the planting required for the pool regeneration zone.

Together with PWL Partnership (landscape consultant) and AME Group (mechanical consultant), we explored the sites conditions and opportunities in order to develop an unsolicited proposal for a natural pool conversion project at New Brighton.

DESIGN RATIONALE

As the intent of the site is to move towards an overall naturalization, the natural pool design integrates as much as possible with the proposed transformation of New Brighton Park. While our focus for the case study is on naturalizing the pool, we also focused on improvements to the overall pool design to increase the social space and enhance user experience. Our approach takes care to maintain as much as possible of the existing infrastructure, leaving the majority of the concrete pool tank and surrounding deck intact.

The north edge of the pool is modified to create an overflow gutter (see natural pool mechanical diagram on page 10), and a curved wooden deck with an angled back portion is added at the same location, concealing the gutter edge and acting as a wind break and lounging opportunity. This new social space provides ideal exposure for sunning, and provides lookout opportunities to the regeneration area and the mountains beyond to the north. Adjacent to the new wooden deck, a gently sloped south facing grassy area is added within the control area for picnicking and socializing.



POTENTIAL CONCEPTUAL PLAN

LEGEND

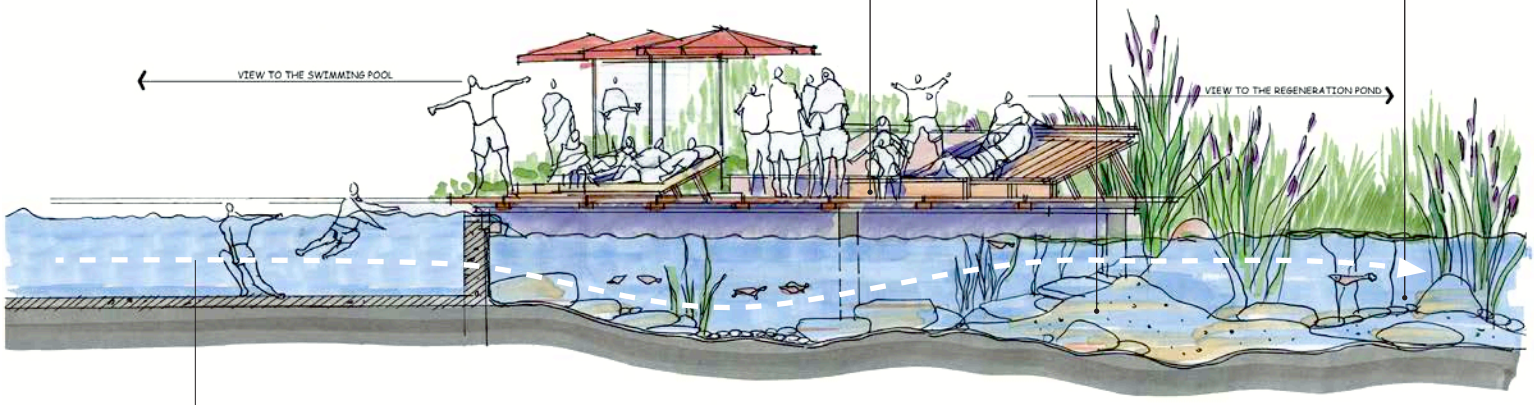
1. Lounging Lawn
2. Swimming Tank
3. Sun Deck
4. Surge/Settlement Pond
5. Regeneration Zone
6. Water Tank and Testing
7. Concession
8. Outdoor Plant-Filtered Showers

POOL FILTRATION

The surge/settlement pond flows below the new wooden platform, and connects the water to the secondary cleaning, or regeneration pond, beyond.

WATER FLOW

Gravity helps guide the water through the biological filters and eventually circles back to a water tank testing station, where it is checked for cleanliness before returning to the swimming pool.



Water Flow

Top: Site Plan

Bottom: Section through pool tank and regeneration pond.

CONCESSION

The existing concession stand is relocated from a point accessible from outside the pool deck, and replaced with a new circular on-deck concession stand providing easy access to food and refreshments from the new wooden social area.

AMENITIES

The existing pole mounted showers and low wall in front of the change facilities are removed and replaced with a series of rain showers on a circular wooden deck surrounded by aquatic planting to enhance and encourage bathers to shower before entering the pool, and also to express the naturalization of the shower water.

Image: Site Section

ACCESS AND LANDSCAPE

The design also adds shaded bench seating along the south edge of the pool, integrates walkways and seating into the landscape design to provide overlook and education opportunities off of the main walking trails, and adds seating as part of the control fencing along the north edge to provide views of ocean and mountains to the north.

CONCLUSION

The New Brighton Pool design study aims to show how the natural filtration system described in the research component of this paper can be used to transform an existing conventional outdoor pool, while also exploring opportunities to significantly increase the social potential of this much-loved public amenity.

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Web
hcma.ca

Email
office@hcma.ca

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HCMA Architecture + Design

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@hcma

HCMA Architecture + Design
hcma.ca

Vancouver

400 - 675 West Hastings Street
Vancouver BC V6B 1N2 Canada

604.732.6620
vancouver@hcma.ca

Victoria

Suite 300, 569 Johnson Street
Victoria BC V8W 1M2 Canada

250.382.6650
victoria@hcma.ca