3 WATERS

WATER INFRASTRUCTURE ACCESS SYSTEMS

Monkeytoe

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ARE YOU A PART OF A 3 WATERS INFRASTRUCTURE PROJECT?

NEED THE PERFECT ACCESS AND MOUNTING SYSTEMS?

Safety and compliance are key when it comes to accessing valves, tanks, and equipment in water infrastructure assets. In this article, we'll dive into the essential features, design considerations, installation tips, material choices, and chemical protection for your access and mounting structures servicing water treatment facilities. Discover the importance of low-maintenance access systems with the right chemical resistance. So, fasten your seatbelt and let's explore the world of efficient and reliable access solutions for your project!

The three waters

drinking water

wastewater

stormwater

The three waters drinking water, wastewater and stormwater are essential for the health and wellbeing of every community. It is crucial that these systems are safe, reliable, and sustainable. With a renewed focus on infrastructure upgrades, it is essential to consider innovative products and sustainable solutions. Aluminium access and mounting systems can provide the best-in-class outcomes for speed, durability, whole of life costs, and sustainability factors. By utilizing these systems, you can deliver a project that meets the highest standards and ensures the long-term well-being of the community and the environment.

HOW DO I CHOOSE THE BEST ACCESS SYSTEM?

Here are some points that need to be considered when choosing access systems for a water treatment plant:

1. **Safety:** Safety should be the top priority when choosing access systems for a water treatment plant. The systems should be designed and built to meet the relevant safety standards and regulations and should provide safe access to all parts of the plant.

2. **Durability:** Access systems in a water treatment plant are exposed to harsh conditions such as chemicals, moisture, and extreme temperatures. Therefore, it is important to choose access systems that are made from materials that are corrosion-resistant, durable, and long-lasting.

3. **Maintenance:** Maintenance is important to ensure that access systems continue to function safely and effectively. The systems should be designed with maintenance in mind, with easy access to all parts of the system for inspection and cleaning.

4. **Customization:** Every water treatment plant is different, so it is important to choose access systems that can be customized to suit the specific needs of the plant. This includes considerations such as the size and layout of the plant, as well as any specific safety or access requirements.

5. **Life-cycle cost and Sustainability:** While upfront costs are important, it is also important to consider the whole-life cost of access systems, including ongoing maintenance and replacement costs. Choosing durable, long-lasting systems that minimize environmental impact can help reduce ongoing costs over the life of the plant. Choosing locally sourced and manufactured materials is also a consideration for community infrastructure projects. These are explained in government procurement rules under Broader Outcomes and Transitioning to a net zero economy.

CHOOSING THE MATERIAL

ALUMINIUM is a popular and recommended material for access systems at a water treatment plant. It offers many benefits, including its lightweight, durable, corrosion-resistant, and low-maintenance properties. Additionally, aluminium is a sustainable material that can be recycled, making it an environmentally friendly choice. When using Monkeytoe product there is an added advantage of simple effective prefabricated modules and proven compliance design expertise to relevant standards.

GALVANIZED STEEL is a strong and durable option for access systems, with a zinc coating that provides resistance to corrosion. However, the zinc coating can be damaged during onsite alterations, which can compromise the integrity of the steel and result in rust and corrosion. Galvanized steel is also heavier than aluminium, making it more challenging to transport and install. While it is a lower-cost option initially, the potential for maintenance and replacement costs due to corrosion and damage may make it a less cost-effective choice in the long run.

FRP access systems are a lightweight and highly corrosion-resistant alternative to materials like galvanized steel. While they require minimal maintenance and are well-suited for harsh environments, and available in special chemical resistant grades they do have limitations. FRP structures can be 25-40% heavier than aluminum equivalents. [1, 2] However, they can be ideal for installations where electrical, combustion, or chemical hazards are present. Weight comparisons between FRP and Aluminium grating systems may not always be relevant, especially when considering Monkeytoe's specialist lightweight Amplimesh. This unique solution utilizes less material compared to aluminium bar grating and FRP grating.

STAINLESS STEEL access systems are a durable, highly corrosion-resistant alternative to materials like galvanized steel. While they require minimal maintenance once installed, they can be heavy difficult to manufacture and install and very expensive, particularly so since world Nickel priciness have risen since 2022. However, they can be ideal for smaller component installations where highly corrosive chemicals exist such as near dosing station bases.

ADVANTAGES OF ALUMINIUM

Corrosion Resistance

Aluminium has a natural oxide layer that provides excellent protection against corrosion in a wide range of environments, including marine and wastewater applications. This makes it ideal for structures and components that are frequently exposed to water. It also has typically greater resistance to chemically induced corrosion than galvanised steel and is suitable full immersion in most tanks.

Lightweight and Strong

Aluminium is significantly lighter than other metals, such as steel or stainless steel, making it easier to transport, install, and remove. It has the ability to span long distances and carry large loads when designed correctly This feature is particularly important when constructing infrastructure in difficult-to-access locations, such as water treatment plants or remote wastewater treatment sites.

Low Maintenance

Aluminium infrastructure requires minimal maintenance and is less prone to damage from external factors such as tree roots, seismic activity, and soil movement.

WHERE CAN I USE ALUMINIUM IN A 3 WATERS WATER INFRASTRUCTURE PROJECT?

Aluminium Platforms and Mounting: These structures are used to provide safe and easy access and monitoring for tanks, valves mechanical plant, and other water management infrastructure. Aluminium structures are lightweight, modular and durable making them ideal for use in harsh environments.

Aluminium ladders: Aluminium ladders are commonly used to provide access to elevated areas, such as tanks or treatment plant roofs. They are lightweight, easy to install, and resistant to corrosion, which makes them ideal for use in water management facilities.

Aluminium walkways: Aluminium walkways are used to provide safe access to areas with limited space, such as narrow tanks or channels. They are lightweight, durable, and easy to install, which makes them ideal for use in wastewater treatment plants and other 3-waters projects.

Aluminium Stairs: Aluminium stairs are commonly used to provide safe access to elevated platforms, chemical storage areas, tanks, or equipment for maintenance and inspection purposes, such as in-spection chambers, valve chambers, pump stations, detention basins, retention ponds, and outfall structures in 3-waters application.

Stepovers and Enclosures: Stepovers allow safe accessway over piping and other infrastructure. Aluminium is also Ideal for acoustic and visual screens as well as tank covering structures. Aluminium is an ideal lightweight durable material for these applications.

ALUMINIUM: A MORE ROBUST SOLUTION THAN CONVENTIONAL GALVANIZED STEEL

Aluminium access systems offer a distinct advantage over galvanized steel in corrosive environments like wastewater treatment plants. Unlike galvanized steel, which relies on a zinc coating that can deteriorate over time, aluminium's natural oxide layer provides exceptional durability. Additionally, aluminium structures can be easily installed without onsite modifications or welding, eliminating the need for recoating or site painting. This makes aluminium a reliable choice for long-term corrosion resistance and low-maintenance solutions in demanding industrial settings.

DESIGNING CUSTOMIZED ACCESS STRUCTURES FOR YOUR PROJECT

With Water treatment plants and other water infrastructure projects correct, representative design is essential from an early stage. This helps ensure code compliance, costs, plant integration, safety in design, compliance and clash detection are all considered. This can often be achieved through BIM models and early-stage design engagement from access specialists. Monkeytoe have a large custom design and technical resource able provide input for all aspects of the design and engineering process including BIM modelling.

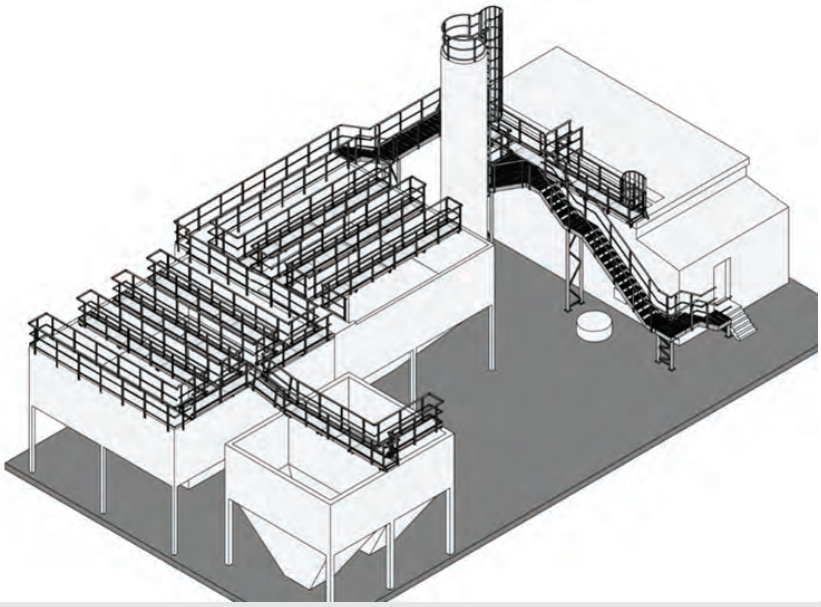


Figure 1 A CAD model with a Water treatment plant access system designed in Aluminium.

DESIGNING AN EFFICIENT, LIGHTWEIGHT AND COMPLIANT STRUCTURE

Designing a fit for purpose structures that provide lower cost of ownership and greater lifespan has been part of the Monkeytoe purpose that it was founded on. This continual pursuit of making 'everything better" means the structures are designed to be durable, efficient to manufacture and install and compliant with code requirements. Due to its lightness, unique structural properties, available profiles and manufacturing processes often an aluminium access system will use a completely different philosophy to a galvanised structural steel design. Designs can be customised for site specific requirements for example the Maraetai Power Station project required the components to carried through access tunnels and have a large amount of installation adjustability.

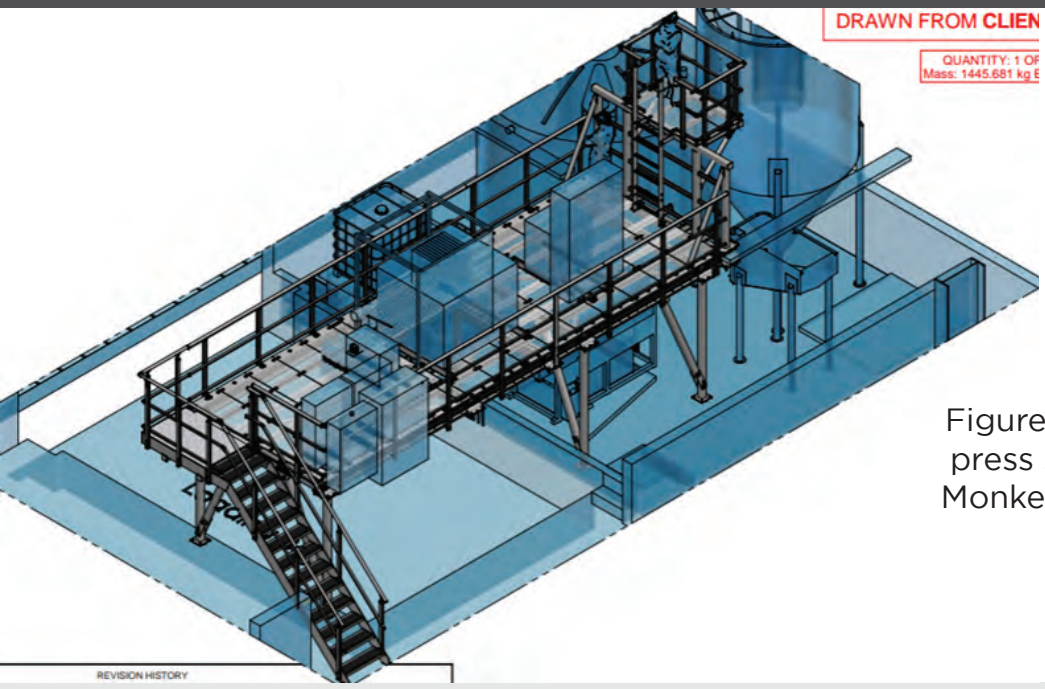


Figure 2 Water Treatment plant filter press support and access system by Monkeytoe using the XBEAM system.

COMPLIANCE AND SAFETY IN DESIGN

Typically, Aluminium access structures are designed using the AS1657:2013 standard, this is a standard suitable for industrial access sites for service and maintenance and is acceptable solution for the NZ building Code. Other codes and related standards used include AS1664 and AS/NZS 1170, for more information on this see here.

Safety in Design is an essential discipline that often requires collaboration, design of safe installation practices and many years of experience to deliver the best out-come, this is something that Monkeytoe pride themselves in.

Specialist applications and environments can also require further specialist engineering, testing and research re-quirements Monkeytoe Technical and Research teams often provide project specificguidance on specialist or challenging applications.

SUSTAINABILITY

Sustainability and local sourcing are important considerations for community infrastructure projects, aluminium access structures can provide a sustainable solution with a long low maintenance lifetime without the need of coating members in chemically hazardous paints and coatings or labour and waste intensive resurfacing that can be required when galvanizing or paint coatings fail. By contrast mill finish Aluminium can outlast these options and be easily recycled in NZ. Monkeytoe also have the ability to source project specific extrusions from NZ smelted aluminium some of the lowest carbon Aluminium in the world while benefiting local workforces. By contrast Steel and FRP structures require manufacturing offshore and importing to NZ and are not able to be readily recycled locally. Monkeytoe also partner with local and regional installation crews providing local benefit.

Figure 3 Aluminium Access system Alliance Mataura Designed and Installed by Monkeytoe

WASTEWATER CHEMICALS

The presence of constant water outdoor environments and chemicals in 3-waters applications can result in corrosive surroundings that damage metal and concrete structures, leading to degradation and requiring repair or costly replacement. It is crucial to ensure your 3 waters project and plant systems can maintain service with minimal maintenance and low lifecycle costs.

Wastewater treatment involves the use of concentrated chemicals such as Sodium hydroxide, Lime, Alum, potassium permanganate, chlorides such as sodium hypochlorite, PAC(poly aluminium chloride) and Polymers used for flocculants and coagulants among many others[3]. When these chemicals come in contact with metals in their concentrated state they can cause rapid corrosion. In many situations wastewater treatment infrastructure uses galvanized steel product in applications involving these chemicals as seen in Fig.4. with the more resistant stainless steel reserved for smaller components near dosing systems where higher concentrations are encountered.

Figure 4 Typical use of galvanized and stainless steel in wastewater treatment plant and infrastructure

ALUMINIUM AND GALVANIZED STEEL IN THE PRESENCE OF CHEMICALS

With high concentrations of chemicals most metals will corrode, however, aluminium typically performs better than galvanized steel and zinc because it maintains its passivity even when exposed to chemicals or oxidizing agents within PH4-9. In humid or aerated environments, aluminium generally does not succumb to pitting in the presence of most liquids [4] and is not significantly affected by the presence of dissolved oxygen in water [5]. In practice the amount of liquid with a PH11 or above staying pooled on the surface of a structure for any length of time generally limited as dilution and evaporation of the high concentration is typically rapid. The highest areas of corrosion are typically wet zones close to the floor where CIP washes and overflows are present, corrosion always requires a liquid such as water for corrosion to continue.

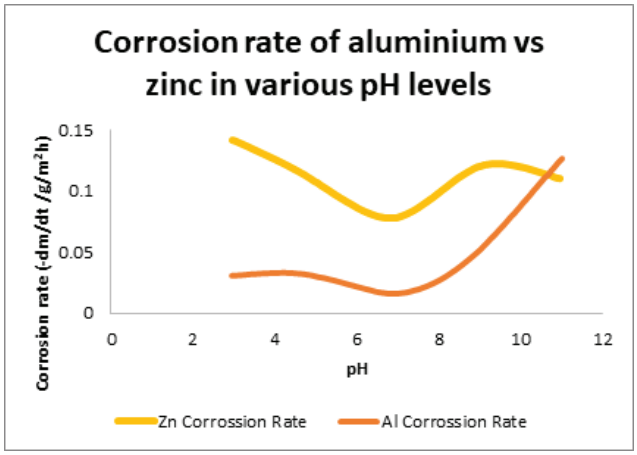


Figure 5: Corrosion rate of aluminium and zinc at various pH levels [5]

In general, aluminium has a lower corrosion rate compared to zinc, except for the solution has a PH of 11, where the corrosion rate of aluminium is practically the same as that of zinc. Only when the PH level becomes higher than PH11 does zinc/galvanized steel have better performance. However, in the once the typically 0.5 mm layer of zinc is removed corrosion becomes rapid in contrast aluminium members are generally 3x the thickness of and equivalent steel section meaning a longer period of time before structural remediation is required. Both Zinc and Aluminium do exhibit increased corrosion rates in the presence of chlorides under neutral and acidic conditions, as shown in the results of studies meaning structures should be inspected at a reasonable interval in these environments[6, 7] in Figure 5.

Common Water Treatment Chemicals Material Compatibility			
Chemical	**Typical pH value**	**Aluminium Structures**	**Zinc/Galvanised Steel** Structures
PAC (Poly aluminium chloride)	3 20-30 % w/w	Good [1]	Lower resistance than aluminium
Ferric Chloride	2-7 30-40% w/w	Good [1]	Lower resistance than aluminium
Lime (Calcium hydroxide, $Ca(OH)_2$)	12. 0.1% to 1% w/w 650mg/litre	Good[2]	Lower resistance at medium concentration, greater at high concentrations
Potassium Permanganate	Typically neutral	Good	Lower resistance than aluminium
Alum (aluminium sulphate)	3.5-7 47%w/w solution	Good	Not recommended lower resistance than aluminium
Sodium hypochlorite	13 15% w/w Solution	Good [2]	Lower resistance at medium concentration, greater at high concentrations
Sodium hydroxide	13 4% w/w solution	Good [2]	Lower resistance at medium concentration, greater at high concentrations
Hydrofluorosilicic Acid- Fluoride	2-3 17-21% w/w solution	Good [1]	Lower resistance than aluminium
Sodium bisulphite	4-7 26% w/w	Good	Lower resistance than aluminium
Copper Sulphate	4-7	Good	Lower resistance than aluminium
Polymers- Synthetic Flocculants, Coagulants	4-9	Good	Good

1. Good when exposed to pH levels greater 4 and less than 11. For pH levels less than 4 in splash zone follow the appropriate protection measures outlined in Figure 8, version 1.

2. Compatible for solutions having pH value of less than 11. If exposed to high pH values for extended periods use splash zone protection version 2 of Figure 8.

3. Zinc coating provides slightly better protection at pH levels greater than 11. However, once the 0.5 mm zinc coating is compromised, the rate of structural deterioration will be more rapid compared to aluminium

PROTECTING CHEMICALLY EXPOSED MEMBERS

In water and process plants where high concentrations of chemicals are used for dosing, treatment and cleaning high corrosion zones are typically concentrated near the floor and the near tank and draining outlets subject to splashing. Components such as Concrete, galvanised steel and fasteners often need regular repair and replacement in these areas unless designed otherwise.

Figure 6 Typical High maintenance installation, galvanised drain recently replaced, flooring in need of repair and access and mounting structures requiring regular painting.

IMPROVING LIFESPAN AND MAINTENANCE WHERE CHEMICALS ARE PRESENT

The maintenance requirements and overall lifespan of metal structures can be greatly improved by minimising the wet contact and splash zone where chemicals and washdown residue are greater. There are 3 simple ways this can be archived depending on the site and project requirements.

Option 1:

Raise the Structure Mounting points on plinths to prevent contact with runoff and chemicals. This can be a simple process if added at the design phase, particularly if the flooring is having a protective coating system, it will not eliminate splashes however the metal components will typically dry stopping the corrosion for which a liquid is required for it to continue.

Figure 7 Low Maintenance solution with Aluminium and galvanised components raised above the wet zone

Option 2:

Use a separate protected section in the Splash Zone:
For even greater durability a separate member can be used in this area see figure 4. For aluminium structures this can be either a Powdercoated aluminium section or a stainless Section.

Version 1: Heavy duty Epoxy Powdercoating is able to protect aluminium from a wide range of acids and bases in both hot and cold solutions. This solution uses a powder coated section of aluminium for the first 300mm – 600 mm of the structure providing greater protection. If needed this can be removed and recoated or repaired if required.

Version 2: The base section of the structure is manufactured from a choice of stainless steel, depending on the environment 304, 316, or Inox grades can be used. This is most durable solution for highly demanding applications with constant exposure or immersion with highly concentrated acids, bases and salt type compounds. Due the passivity of the oxide protecting layer and they surface areas of the aluminium the stainless-steel fasteners and bottom section do not require galvanic isolation, for more detail on this and other connection methods see here.

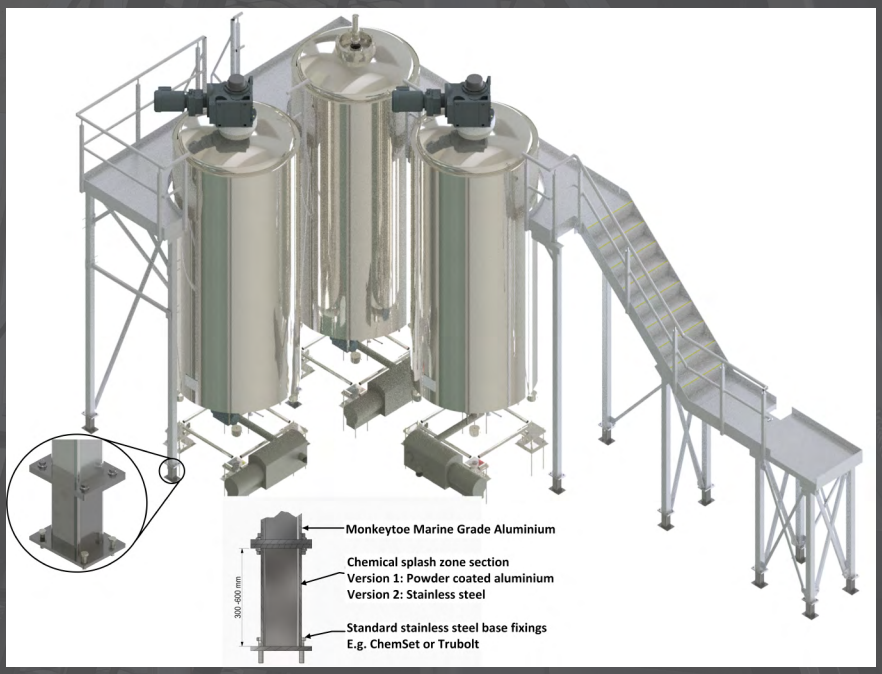
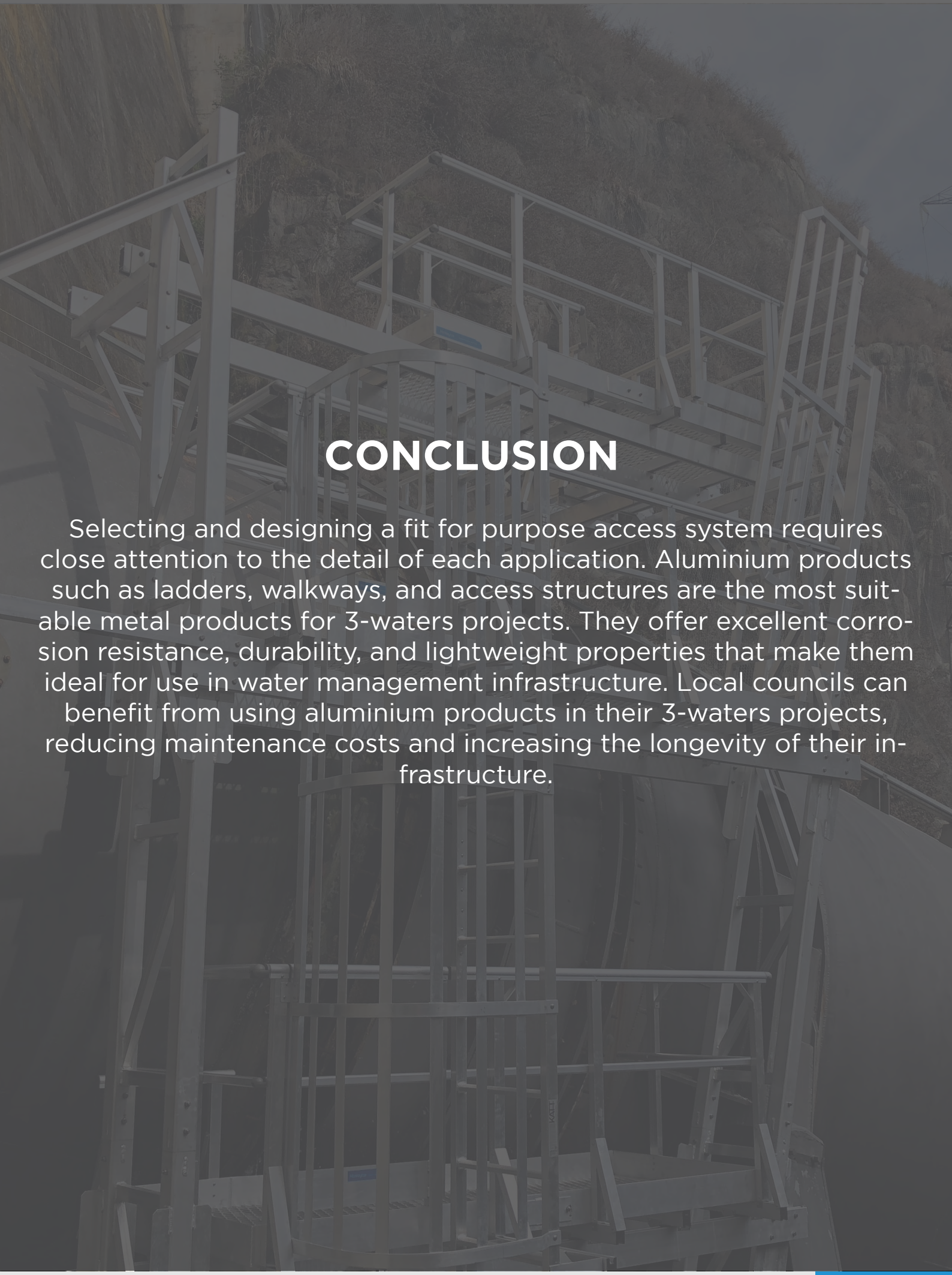


Figure 8: Protected Section in a concentrated Chemical splash zone



CONCLUSION

Selecting and designing a fit for purpose access system requires close attention to the detail of each application. Aluminium products such as ladders, walkways, and access structures are the most suitable metal products for 3-waters projects. They offer excellent corrosion resistance, durability, and lightweight properties that make them ideal for use in water management infrastructure. Local councils can benefit from using aluminium products in their 3-waters projects, reducing maintenance costs and increasing the longevity of their infrastructure.

Monkeytoe

WATER INFRASTRUCTURE PROJECTS

As a leading provider of aluminium solutions for infrastructure, Monkeytoe offers an innovative range of products that can help to revolutionize 3-Water Project. Our product lines include roof access systems, walkways, handrails, platforms, and more. Some recent Water infrastructure projects completed by MonkeyToe are listed here:

MARAETAI POWER STATION

Access and maintenance Platforms

WAIMEA DAM

Custom Monkeytoe ladder and platform access, which reduces risk and provides a durable, corrosion-resistant structure made of marine-grade aluminium for the Maraetai Dam project.

BENMORE DAM

Custom Monkeytoe ladder and platform access, which reduces risk and provides a durable, corrosion-resistant structure made of marine-grade aluminium for the Maraetai Dam project.

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