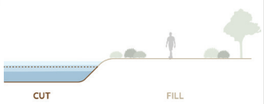
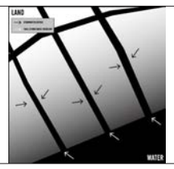
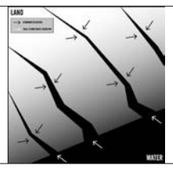
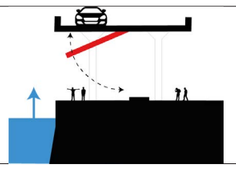
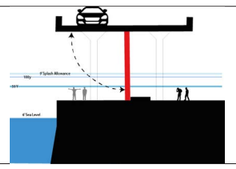
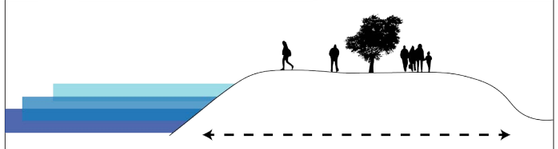
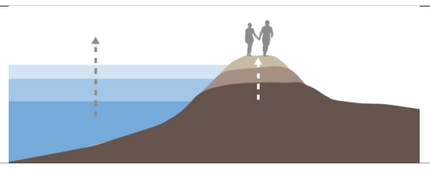
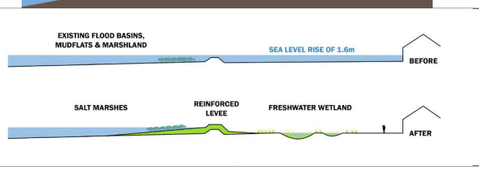
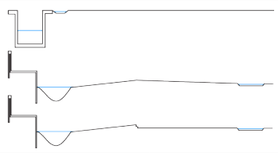
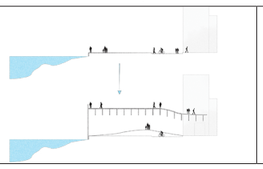
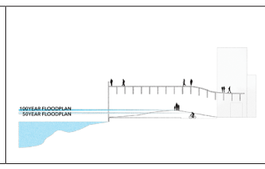
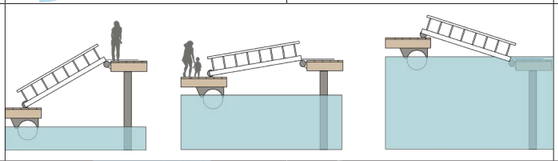
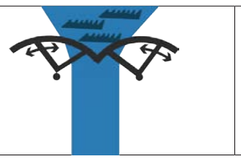
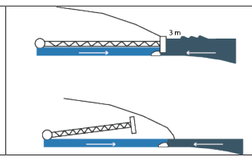
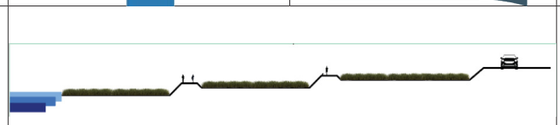
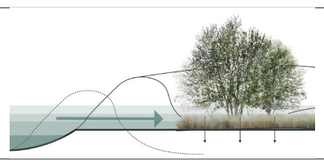
PROTOTYPES FOR RISING WATERS

Prototype Title	How does it work?	What happens as sea level rises?	Description	Where is this used?	Benefits and Values	Tradeoffs
Cut/Fill to Create Land			With cut/fill, soil is removed from the area in front of the stopbank (perhaps to make terraces or wetland areas) and used to build up and widen the stopbanks themselves. Because this strategy "creates land" by widening the stopbanks, the stopbanks can become an inhabitable space that can hold trails, infrastructure, planted areas, etc.	Proposed for use in the Waikakariki capstone project; could be appropriate in places where the stopbank (the fill area) is designed as an inhabitable space.	Turns stopbanks into usable amenities by creating additional land/space; both the lowered cut area and the heightened filled area allow for higher inundation levels without breaching the stopbank; using the fill in situ eliminates the need to dispose of it elsewhere	Cutting and filling can be very disruptive to existing ecosystems; soil along the Otakaro Avon may not be appropriate for use as a structural fill material, though it could be used to backfill areas
Creeks and Canals			Creeks and canals are able to absorb excess storm surge water and sea level rise. They can help to redirect rising groundwater, provide habitat and act as 'spongy' edges and carry water to water bodies in low tides.	Used along coasts and lowlying areas. Can also act as smaller tributaries on upland rivers.	Create linkages futher upstream through communities removed from water edges. Also provides more space for recreational and ecologically activated edges	Potentially more flooding if creeks and canals back up; channelization; takes a lot of time and money to create
Floating Houses			These houses are stabilized to docks by a mooring system that can move with the tides and sea level rise. The docks connect to artificial islands that contain the utility lines supplying the neighborhood.	Used in Amsterdam in the Ijburg neighborhood, potential for use in stormwater ponds or tidal influenced water bodies	The houses are dynamic and modular, relatively inexpensive for the area, and expand "coastal" urban space. In a stormwater pond, residents provide surveillance.	Although the houses may be fine, earthquakes and sea level rise can do damage to the docks and utility lines that they rely on. They also may disrupt marine ecosystems.
Transitional Use			Permanent stop banks are built further back and lower to provide the same protection as higher stop banks close to the river. This creates a more natural river edge, improving habitat for native species. As sea level rises, or storms inundate lower park of stop bank, human use is pushed to the top.	Proposed in the Otakaro Avon Corridor Regeneration Plan	Wider foundations allow for the stop banks to be raised over time. Water interaction can continue to occur with time.	Recreational area gets smaller with time, and stop bank may still need to be raised. As sea level rises, dry/forest ecosystems will be inundated in tidal influenced areas.
Flip Down Deployable Wall			Deployable Wall feature can flip down during high storm water events to protect from flooding and splashing and can transition to a permanent wall to adapt to sea level rise	2 low lying areas between Manhattan and Brooklyn Bridges	Increased space for free program and activities, adapts to sea level rise over time as well as quick adaptations from storms with the flip down function of the wall	How do you access the water in those spaces after the wall is permanently down?
Wide Multi-Functional Stop Banks			Widening stop banks will allow for varied land use, including event spaces for social/cultural enhancement and ecological restoration areas.	Could be used use throughout Otakaro/Avon site	Instead of just being used to stop flooding, the banks will have a social/cultural/ ecological function	Wider stop banks will take up a lot of space. The specific land uses of this space could positively or negatively change the characteristics of the surrounding areas and neighborhoods.
Higher Berms			Over time stopbank will be mounded higher to accommodate rising waters without compromising recreational activities prematurely.	Throughout site where sea level rise will raise the river water levels	Allow continued connection to water over time	Stop bank system will always be employed, recreation area could get narrower and narrower
Dual Wetlands			Salt marshes are restored to take in rising saltwater, while freshwater wetlands remediate and absorb excessive stormwater. Together, dual wetlands serve as sponge to absorb water.	Proposed for use in South Bay area / could be used along Otakaro Avon River where there is large area with brackish water	Stormwater retention and treatment + amenities	Does not address the issue of raising groundwater. Also potentially requires large area for both wetlands.
Upstream Storage			Wet Weather Function - slowing and storing stormwater in designated places for ground absorption and irrigation uses. Dry Weather Function - revert back to year-round and seasonal flows to maintain soil stability and local ecosystem health.	Used in narrow and deep canals upstream. Stopbanks widened on one side, with a gentle sloping grade to offer activation during dry weather conditions.	Water interaction, stormwater retention	Does not take into account more regular inundation (i.e. less dry weather all year long combined with 100 year storms)
Elevated Path			Elevating the path not only provides an area people can walk on but also creates a space under the path for different activities; when flooding occurs or there is a lot of stormwater, this space can also provide a space to prevent the water from going into the city directly, while still allowing for recreation	Coastal area and places where more spaces for activities and recreation is needed. From the precedent study, this method also creates space for educational infrastructure under the path, such as an aquarium	Connect the city to the water; connect the people to the water	More structures need to be built for the elevated pedestrian
Floating Walkways			As water rises, the floating walkway rises as well. The connection with higher ground or with an elevated path is designed to accomodate changing water levels.	Floating walkways are useful in areas with strong tidal influence and fluctuating water levels.	Water interaction	Access depends on connection point being above water level.
Flood Gates			Gates close during storm surges to prevent extreme high water. They are usually open to allow for boat and fish passage.	Typically used at the mouth of an estuary or bay in order to protect valuable assets and mitigate storm impacts.	Huge capital project that serves as a reminder of the presence of large storm events	Extremely expensive, requires a wall on the bottom of the estuary which may have adverse impacts, requires headlands to be built up to level of wall, traps stormwater behind gate
Terraced Levees			Multiple terraces of varying wetlands allow for water tretment and retention as stormwater flows down the terraces to a body of water. People are able to use pathed sections to move through the ecologically beneficial terraces. The levees can act as pathways.	Used in the San Francisco Design Resilience plan project, Our Home. Here the water outflow goes into a bay.	Human interaction with water, multiple uses, education, water treatment, and ecological benefits	Needs a large area, humans could potentially disturb ecology, will slowly lose human space with sea level rise if/as levees are breached
Breach Berm			Cuts into the stopbank allow flow of water into the land behind the berms. Swathes of vegetation and large spaces allow for large amounts of water to spread out the holding capacity while reducing water depth and flood risk. Water can then return to soil as groundwater and return to river once flooding recedes. Can be used to relieve pressure on more endangered sites.	Could be used in mid to upper river, where less tidal influence and flooding impact occurs, as a low-expense/light touch option for less severely endangered sites	Lighter touch, lower cost, allows river to be flexible and dynamic, potential ecological sites, oppotunity for experimentation	Goes against the accepted engineering, extreme flood conditions may cause spillover into nieghborhoods, not particularly suitable for sea level rise conditions, sacrifices site/land for the relief of other sites.