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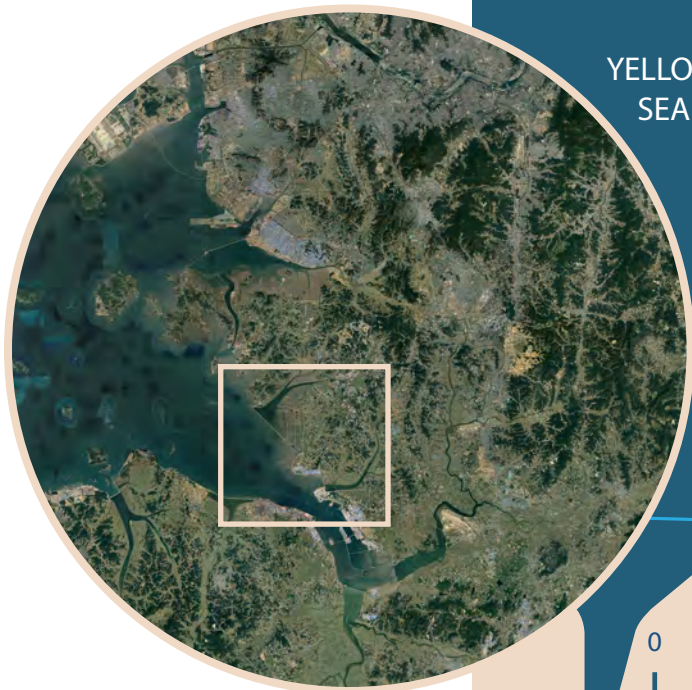
LA205 Environmental Planning Studio

Spring 2019

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Introduction

South Korea's Hwaseong wetlands and the surrounding basin provides critical habitat for endangered bird species, supports the livelihoods of local farmers and fishermen, and is rich with cultural history. At risk due to reclamation impacts, development and industrial expansion, the Spring 2019 UC Berkeley Environmental Planning Studio class analyzed this unique site and the issues it faces. Ultimately we propose a plan to preserve the site's ecological integrity.



Context

Hwaseong, South Korea, is a rapidly industrializing agricultural Seoul suburb of 640,000 residents. The city is home to several reclaimed estuaries, including the study site in Namyang Bay. Hwaseong's economy was traditionally based on agriculture, with rice farming along the floodplains in the city's river valleys and on mountain terraces. Recently, industry has boomed within the city, which has the world's largest Kia manufacturing plant, a major Kia design center, and thousands of other small factories. Runoff from upstream agriculture and manufacturing has accumulated in the study site since the South Korean Government-owned Korean Rural Community Corporation completed seawall construction to reclaim the tidal wetland in 2006. The reclamation was part of the Korean Government's massive effort to create agricultural and industrial land in the country's tidal estuaries; a 2014 study estimated that 65% of South Korea's tidal flats were reclaimed since the 1950s.

The city is located approximately 40 miles south of Seoul, directly north of the major port city Pyeongtaek (where Kia exports the cars made in Hwaseong), and directly west of Suwon, a larger industrial city where the Korean and United States air forces have bases.



A Changing Landscape



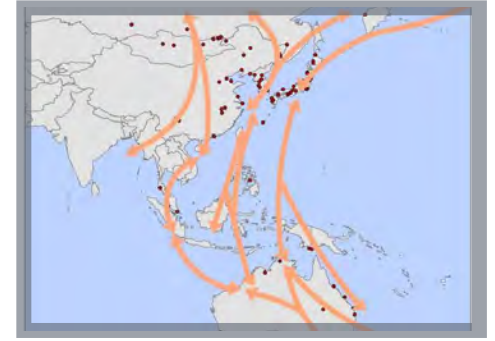
Source: Google Earth

Formerly known as Namyang bay, this area has undergone rapid change in the past two decades. In 2006, a 9.8 km seawall was completed to facilitate land reclamation and create a freshwater reservoir within the bay. 4,482 ha has been filled in the reclamation area primarily for agricultural use. The majority of the reclamation land is on the east side of the bay, but filling has occurred around the entire perimeter and extends over 10 km inland past the confluence of two incoming tributaries. Constructed levees now run along the edges of the reclamation land. Due to water quality issues minimal seawater

exchange has been restored creating a brackish lake and suboptimal rice farming conditions in the reclamation area. Due to the interrupted sediment transport barges dredge sediment from the reclamation lake and deposit it off shore. Using historic aerial imagery we estimate that prior to impoundment over 4,300 hectares of mudflat and over 2,200 hectares of upland salt marsh existed within Namyang Bay. Today very little mudflat habitat remains within the seawall and the remaining natural mudflat and salt marsh extent outside the wall is estimated at 1,941 ha and 20 ha respectively representing a 70% loss in habitat.

International Importance

Hwaseong wetland provides critical habitat to a number of resident and migratory birds. Counts from 1997 - 2003 estimate that the bay supports and estimated 104,000 shorebirds annually (Birds Korea). Part of the East Asian Australasian flyway, many of these birds utilize the site as a stop-over along their migration to and from breeding territory making Hwaseong wetland internationally important for the conservation efforts of many threatened and vulnerable shorebirds.



East Asian Australasian Flyway

Great Knot (EN)

The Great Knot, endangered with a declining population, is a focal species of this wetland. This small charismatic wader visits the wetland along its migration and feeds in inter-tidal mudflats. Hwaseong wetland hosts 3- 12 % of the Great Knot population annually making it the second hot spot globally for the species.



Black-faced Spoonbill (EN)

The Black-faced Spoonbill is an endangered umbrella species for wetland ecosystems and is the focus of international conservation efforts. The spoonbill is a stop-over visitor but is also known to breed nearby in Incheon to the north. Spoonbills feed in inter-tidal mudflats and breed on small rocky islets, making foraging trips of up to 20 km from nesting sites. The wetland hosts 3-6% of their international population.



Chinese Egret (VU)

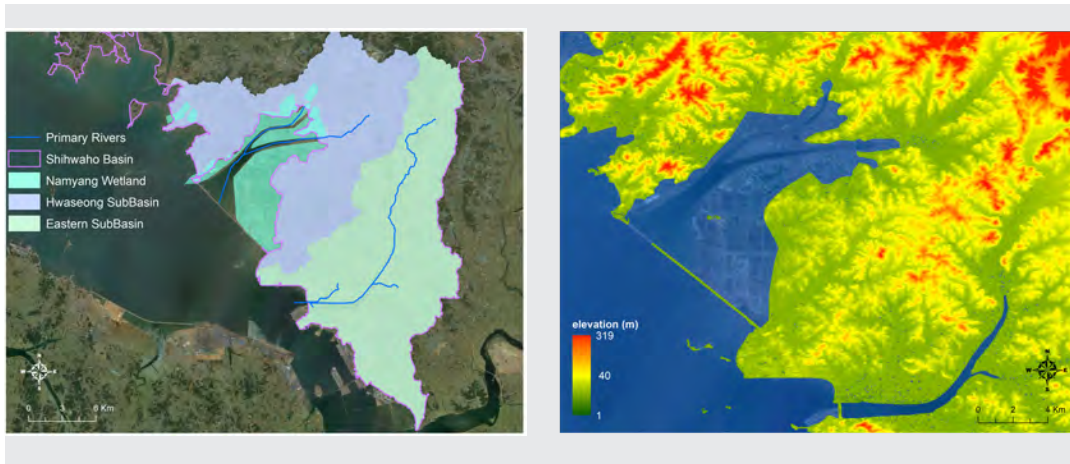
Chinese Egrets, a symbolic species in Korea, are commonly seen in the wetland. Listed by the IUCN as vulnerable with a declining population, these Egrets forage in inter-tidal zones, fish ponds and rice fields.



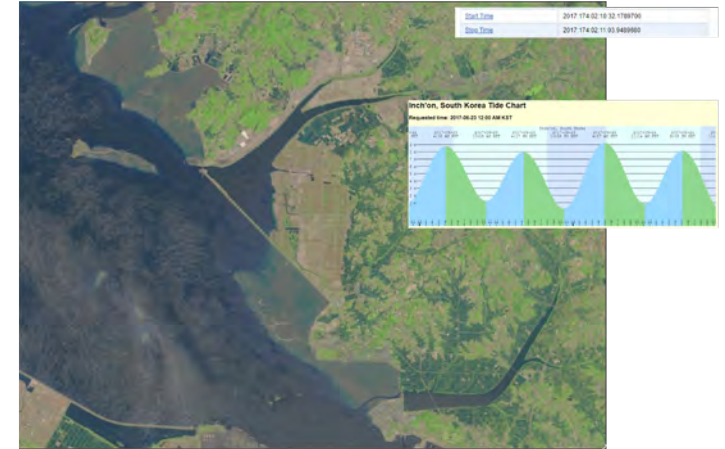
Physical Setting

Hwaseong wetland is situated at the mouth of a relatively small and steep coastal watershed on the Yellow Sea. The Hwaseong basin is roughly 250 Km² and consists of two primary tributaries. To the east a longer narrower 235 km² basin of drains to another reclamation lake which has been impounded for nearly 40 years and sits between the Kia factory and their main export port.

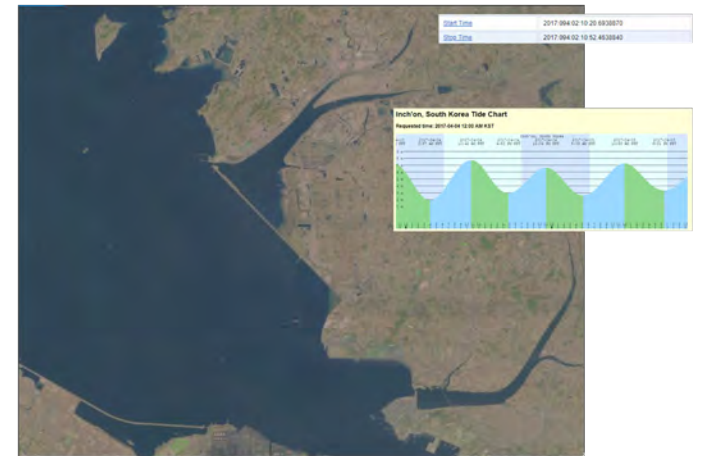
The expansive footprint of the historic Namyang bay is flat and near mean sea level. The reclamation land occupying this area is protected from flooding by the seawall, tide gates and levees. Beyond the bay flats the terrain rises fairly quickly with nearby mountains peaking around 300 meters. This topography makes developments on natural land surrounding the bay unthreatened by sea level rise according to preliminary modeling efforts.



Low tide



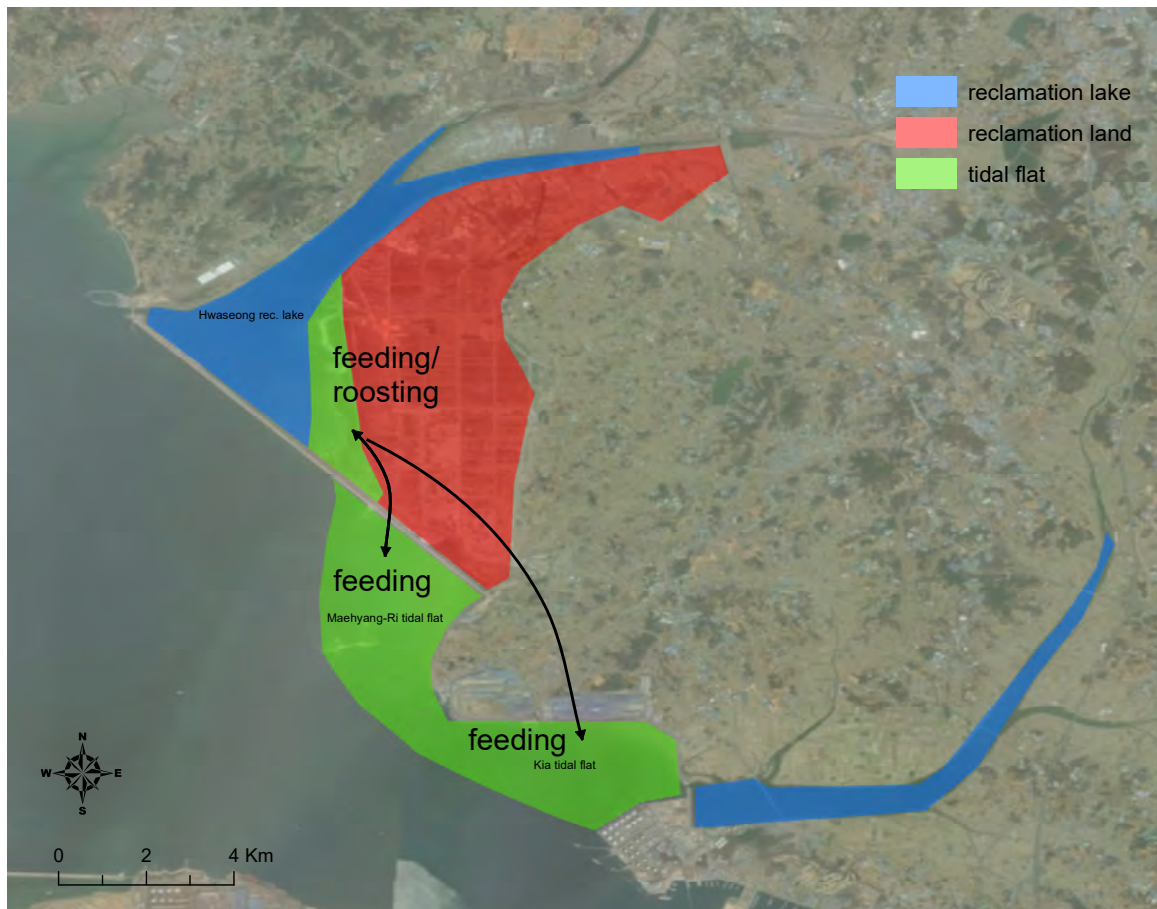
High tide



This region sees large tide swings reaching up to 9 meters throughout the year which create dynamic mudflat ecosystems along the coast. Outside of the seawall and to the south and west of the current Kia factory 1,798 acres of natural tidally influenced mudflat remains intact and exposed at low tide.

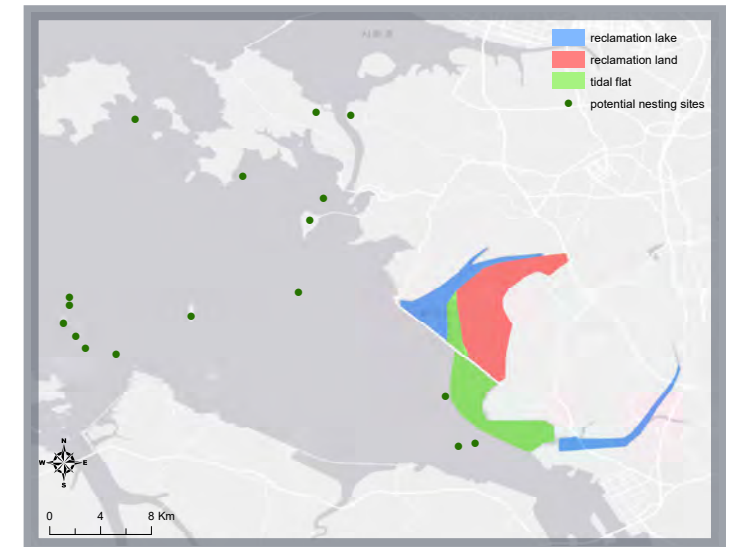
Habitat Dynamics

Shorebirds utilize different components of Hwaseong wetland throughout the cycle of day. The most productive natural mudflat habitat lies outside of the seawall. At lower tides, species like the Great Knot and the Black-faced Spoonbill forage in the mudflat feeding on bivalves, gastropods and crustaceans. At high tide, or to otherwise seek refuge, birds roost within the constructed seawall, which provides shelter and a stable shallow water depth. A small portion of upland salt marsh (20 ha) remains on the outside of the seawall which supports a unique biotic community. Although significant natural habitat has been lost, the seawall has created a novel ecosystem that is utilized by historically present species and new visitors alike. The reclamation lake and rice paddies also provide habitat for a number of Anatids (e.g. ducks, geese, and swans).



Hwaseong habitat types

Nesting Potential



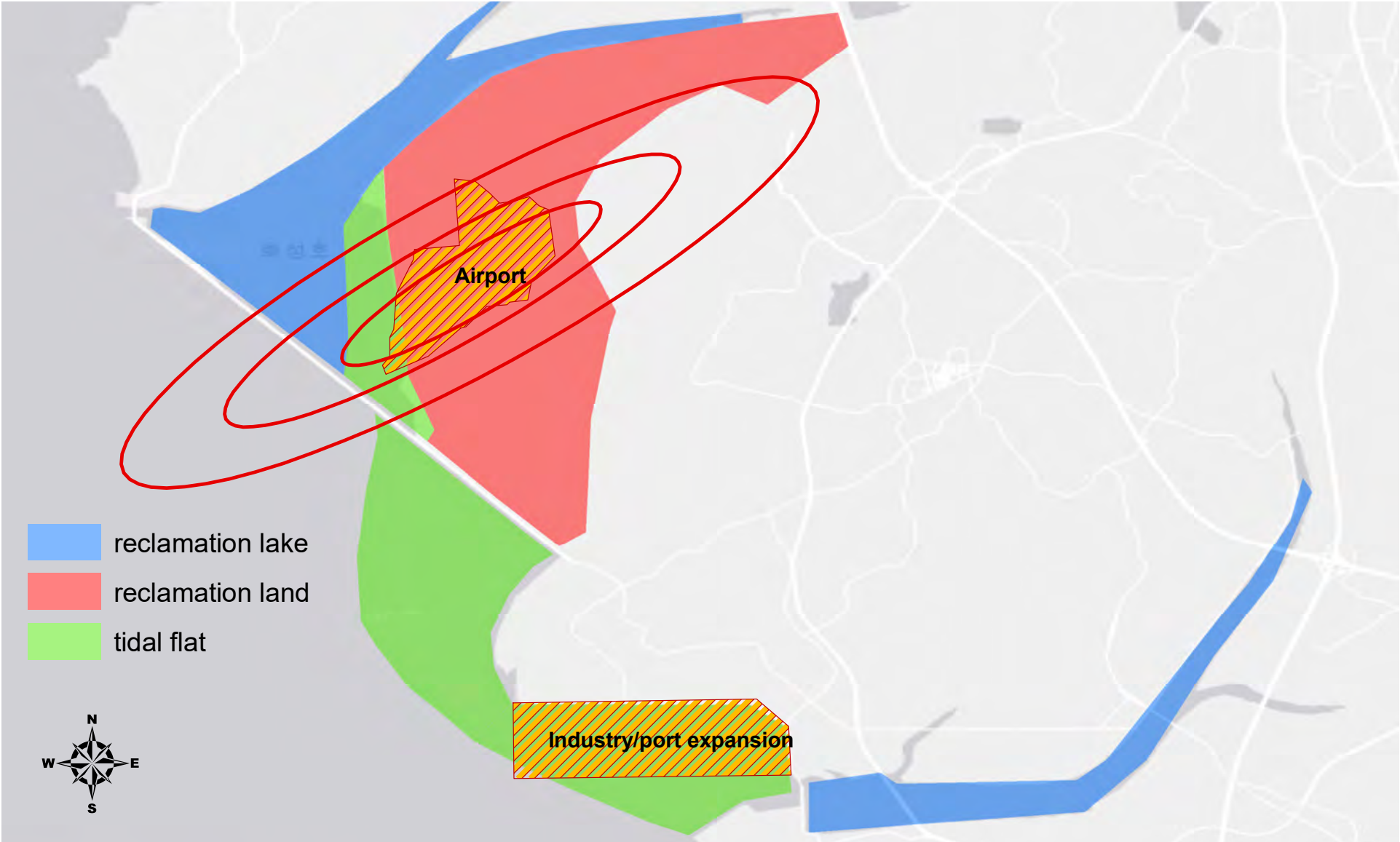
Spoonbills require small isolated and uninhabited rocky islands for breeding. Offshore several suitable islets exist within their daily flight range.

Community & Ecosystem Threats

Pollution

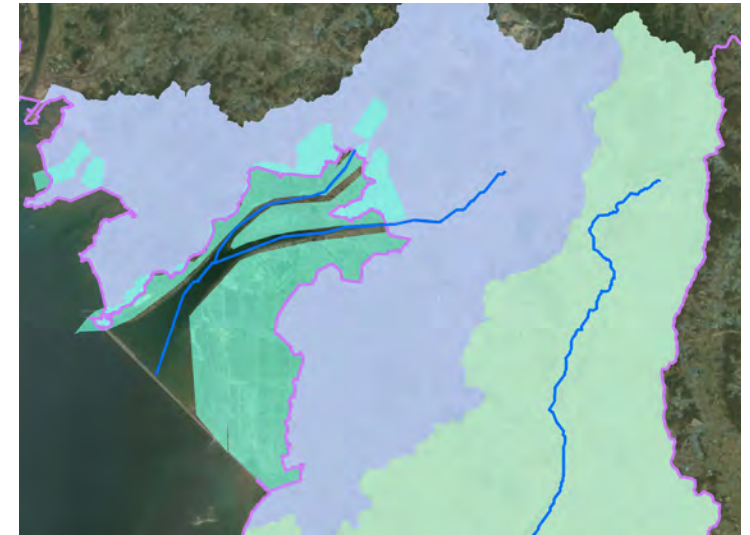
Industry Expansion

Airport

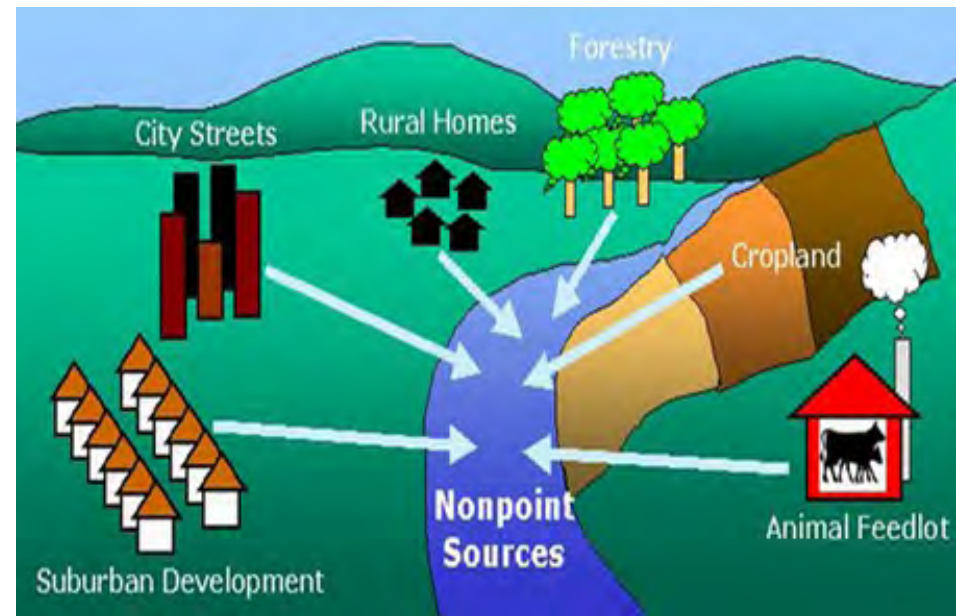


Pollution

Water quality within the reclamation lake is an ongoing concern. Both increased industry and ongoing agricultural practices in the basin have the potential to contribute to pollution making its way to the wetland. Local insight indicates that all factories are required to treat contaminated water on site and that non-point source pollution from agricultural and livestock runoff is likely the primary contributing factor. As such, primary pollutants accumulating in the wetland are presumably organic compounds which are less of a concern for the health of birds and wildlife than heavy metals from industry. Further study is required to confirm the major contributors and primary pollutants found in the reclamation lake. The limited seawater mixing now allowed through into the reclamation lake is inadequate and water quality remains a threat to wildlife, fishermen, and farmers.



Pollution sources throughout the Hwaseong watershed are likely contributing to poor water quality within the reclamation lake



Typical contributing factors to non-point source pollution. Source: NOAA

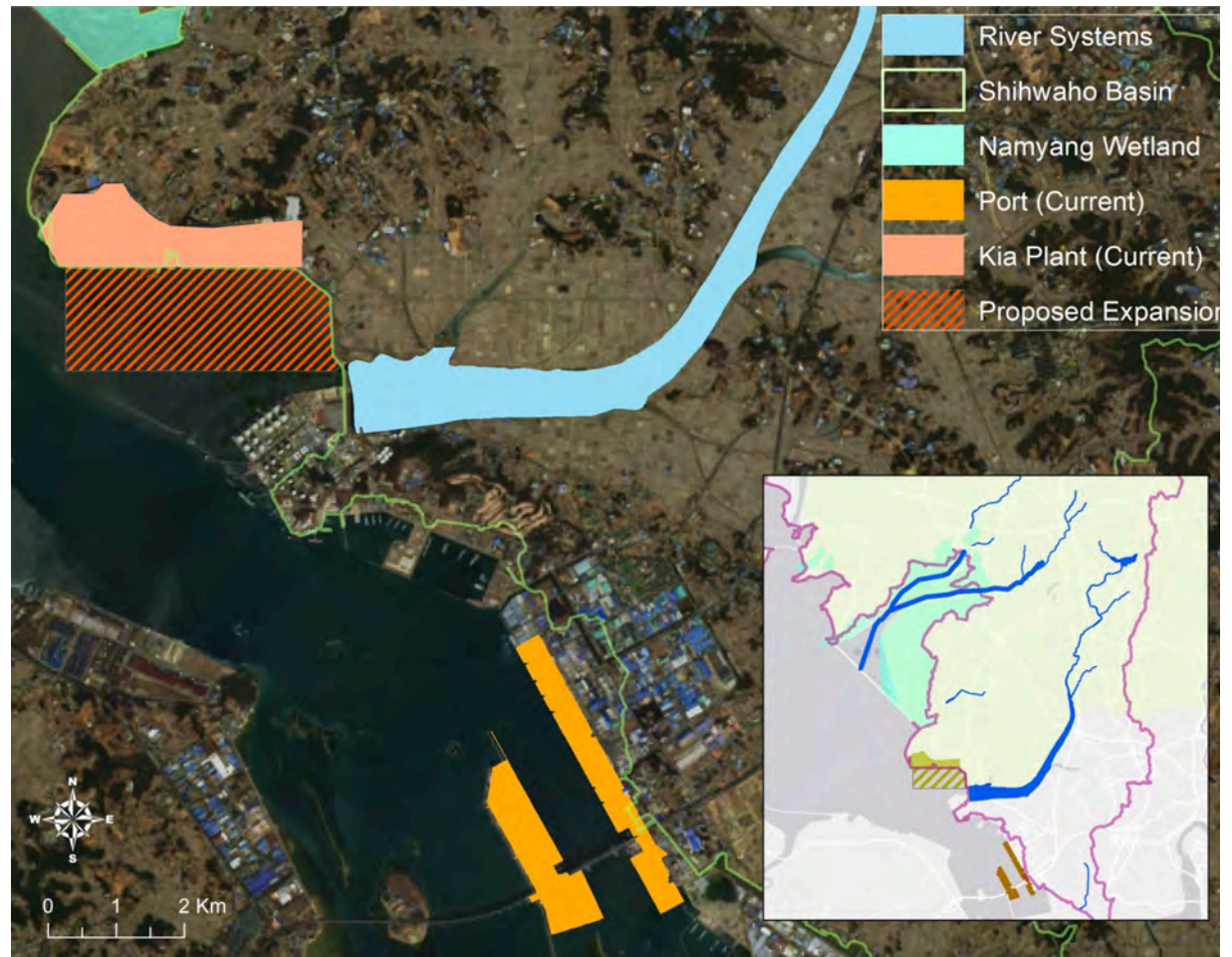
Industry Expansion

Hwaseong's manufacturing industry has the potential to further expand into the study site due to the industrial development pressures the city faces and the suboptimal productivity of agriculture and fishing in the reclaimed wetland because of runoff pollution and saltwater intrusion. In addition to the Kia factory overlooking one of the study site's ecologically important tidal flats, there are several smaller factories overlooking the reclaimed area.

Kia proposed expanding the factory and constructing a port on the adjacent tidal flat, but the proposal is currently stalled. Despite support from the Hwaseong Municipal Government and the local fisherfolk, the Korean Ministry of Maritime Affairs and Fisheries opposed the proposed port due to the area's proximity to the existing port in Pyeongtaek, according to Dr. Nial Moores of Birds Korea. Dr. Moores also speculated that a recent contraction of the global automobile industry may have reduced the economic incentives to expand manufacturing.

Beyond Kia, the reclaimed area also has the potential for industrial development due to the lack of flat land in Hwaseong and the pace of industrial growth in the city's interior. Although we were not able to identify any specific development threats in English-language materials, Hanchul Jung, the coordinator of Hwaseong's branch of the Korean Federation of Environmental Movements (KFEM), expected that if left unchecked, the reclaimed area will eventually be industrialized. As industry expands throughout Hwaseong's available flat land, the Koreans we consulted agreed that the city's residents currently do not prioritize the ecological health of the wetlands to significantly oppose development if it brought jobs for locals and increased tax revenue for the municipal government.

Industry would have severe negative effects on the wetland ecology because of habitat destruction, increased pollution, and noise that would scare away the area's endangered bird populations. Further studies are needed to determine whether the area could continue to support bird populations if industry expanded into some, but not all, of the study site.



Air Force Base

The South Korean Air Force base in Hwaseong's eastern neighbor, Suwon, shut down in 2015 in response to complaints from Suwon residents about noise pollution and the reclaimed wetland in the study site was a proposed site to relocate the base. Our Korean colleagues agreed that Hwaseong residents and the city's government strongly oppose the proposed relocation because of the same noise pollution concerns and what our colleagues described as a general South Korean aversion to the military due to the country's history of war and militarization following the division with North Korea. Our colleagues thought that opposition was strong enough that the air base was unlikely to relocate to the study area, but if it did, it would have disastrous effects on bird populations due to noise, in-air collisions, habitat destruction, and pollution. Furthermore, one can speculate that the Korean Air Force might take intentional measures to keep birds away from the site to avoid birds flying into aircraft engines.



Existing Air Base Location



Proposed Air Base Location



Protection & Preservation

In 2017 Birds Korea, Korean Federation of Environmental Movements, and the City of Hwaseong applied for Hwaseong wetland to become a flyway network site with the EAAFP which would bring international attention to the importance of this wetland. These parties are also seeking to gain Ramsar designation for the wetland, which would provide more political conservation incentive. Designating the wetland as a National Wetland Protection Area or other preserve is also a potential outcome, which would halt industry expansion and development. Fisherfolk and local residents favor conservation and some limits on development, especially the construction of an airport. While ecological health and the potential for eco-tourism improve with preservation, it alone provides limited economic benefit and is opposed by industry and the military.



Source: Nial Moores



EAAFP application site boundary.

Source: Birds Korea

Ramsar Designation

The Ramsar Convention is an intergovernmental treaty established by UNESCO that supports the conservation and wise use of wetlands. Hwaseong wetland meets several criteria for Ramsar designation:

- **Criterion 1** - Site contains representative, rare or unique wetland types
- **Criterion 2** - Regularly supports an assemblage of globally threatened waterbirds including at least four threatened species regularly in internationally important concentrations
- **Criterion 5** - More than 40,000 shorebirds stage at the site annually. More than 20,000 Anatids use the site annually.
- **Criterion 6** - 9 to 11 shorebird species are regularly supported by the site in internationally important concentrations of greater than 1% of their population.

Goals

Hwaseong is at a crossroads in its development and now has the opportunity to balance economic growth, human quality of life, and environmental preservation to define itself as a leader in green economy. Environmental movements often fall short of their goals due to conflicts – real or perceived – with the financial considerations that decision-makers prioritize. To make preservation of wetland bird habitat attractive to stakeholders in Hwaseong, including local residents of all walks of life and municipal officials, we sought to develop a plan that would allow those stakeholders to enjoy the wetland and its wildlife while taking an active role in and benefiting financially from the responsible management of Hwaseong's natural treasures.

Proposal: Wetland Eco-park

Research showed that eco-tourism would provide the best balance of ecological and economic value to accomplish the goals for the site. Eco-tourism, along with the city's increasing industrial might and existing tourist attractions – including historic monuments, outdoor activities, and in-progress Universal Studios development – would also bring prestige to the city if it tied these strengths together in a compelling message. Locals with a deeper understanding of the culture, language, etc. will likely up with a more compelling slogan for the city's proposed rebranding, but we propose a message such as "Hwaseong: where traditional lifestyle meets Korea's green future."



Photo Credit: Jeong Han-cheol



Photo Credit: <https://www.asiaone.com>

Our Vision

In our vision, families could come for the afternoon, week-end or longer and enjoy various recreation opportunities. From spending the night in a bungalow overlooking the rice fields, to kayaking in the marsh, or eating breakfast outside your tent with majestic bird swarms up above.

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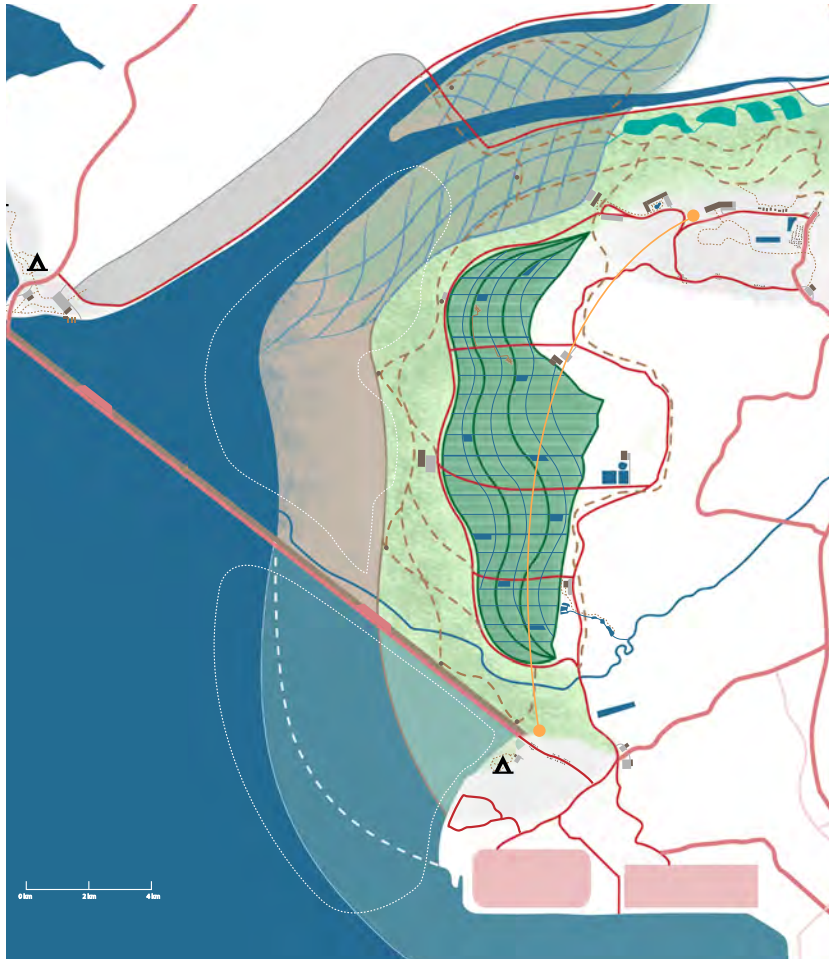
Bungalow Experience



Kayaking Adventures



Campsite views

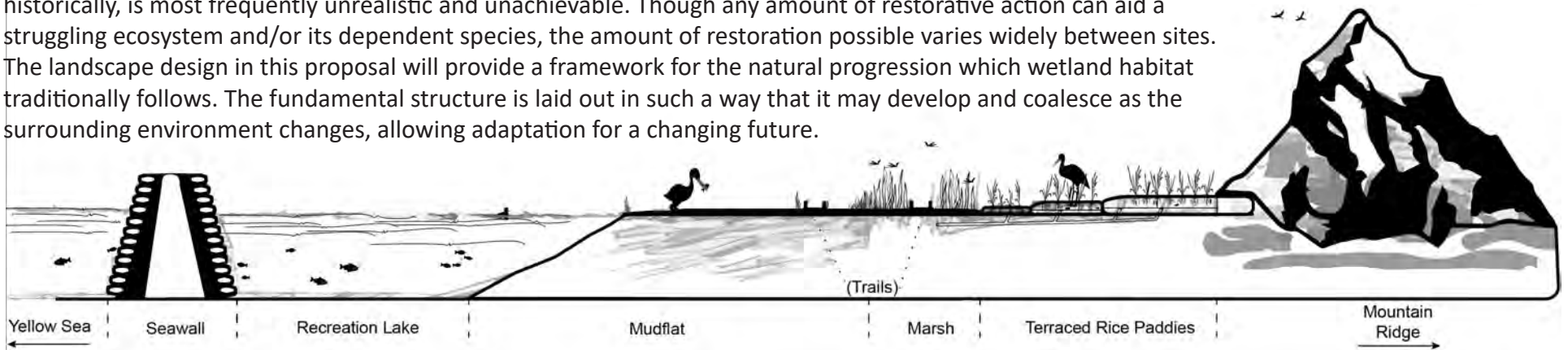
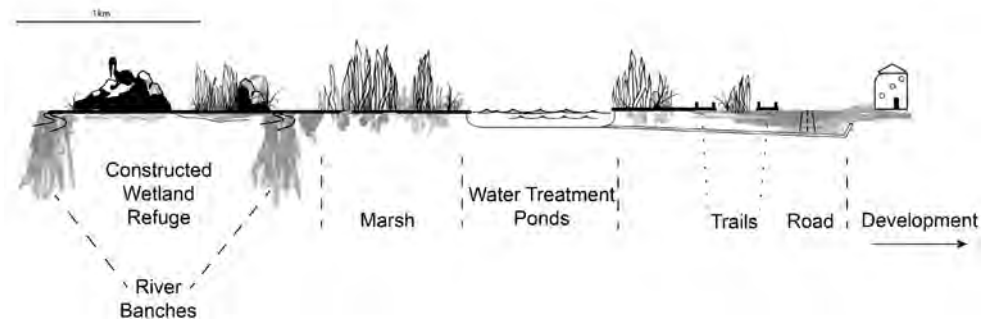


NEW VISION FOR HWASEONG WETLAND



RESILIENT RESTORATION: A MOSAIC OF EVOLVING HABITATS

Hwaseong's historic marsh and mudflats are a unique environment that support numerous threatened and near-threatened species - a type of environment that is increasingly limited across the globe due to human reclamation and degradation. A compilation of diverse habitats provide ample foraging and rest areas for flora and fauna, which is particularly relevant to the threatened migratory bird species that congregate in globally significant proportions in this region. Outright restoration, while the most positive outcome ecologically, is often difficult to achieve politically, financially, or even practically; human degradation is both ubiquitous and severe. A "pristine nature", which functions as it did historically, is most frequently unrealistic and unachievable. Though any amount of restorative action can aid a struggling ecosystem and/or its dependent species, the amount of restoration possible varies widely between sites. The landscape design in this proposal will provide a framework for the natural progression which wetland habitat traditionally follows. The fundamental structure is laid out in such a way that it may develop and coalesce as the surrounding environment changes, allowing adaptation for a changing future.



The gradual succession of intertidal mudflats to marsh increases the available habitat to local species compared to the status quo, both spatially (amount of physical habitat) and in diversity (variety of habitat types). A variety of habitat encourages more robust populations, as well as greater species richness in an area, which poses numerous benefits ecologically. The preservation of several iconic bird species of this region also creates an opportunity to reinforce and revitalize the local identity of Hwaseong - a vital underlying component of the proposal's success.

The first component of intermingled habitat reaches into the traditional roots of Korea; the integration of terraced rice paddies as a multifunctional habitat provides a means for both community engagement and habitat expansion to be achieved simultaneously. The spatial redesign of the fields, paired with new management strategies, creates a unique opportunity synthesize our project goals, serving as a cultural anchor in identity, suitable habitat for vulnerable migratory shorebird species, as well as a means for sustainable eco-tourism to develop. To compensate for the potential pollution related to the adjacent new development, upstream water treatment pools would be distributed along the river channel to improve water quality site-wide. This water treatment is only augmented by the constructed wetlands just downstream of the pools. While the proposal has these wetlands as manifesting in a braided-island formation, we provide only the framework for these wetlands to develop in a more natural manner.

The constructed wetlands slow the rate of water flow in the river to allow for more effective filtration, conducive for both water quality and stream conditions favorable for mudflat and marsh development. While initially labor intensive, these formations gain efficiency in filtration over time, as well as resilience which permits less stringent management.

RICE FARMING AND HABITAT

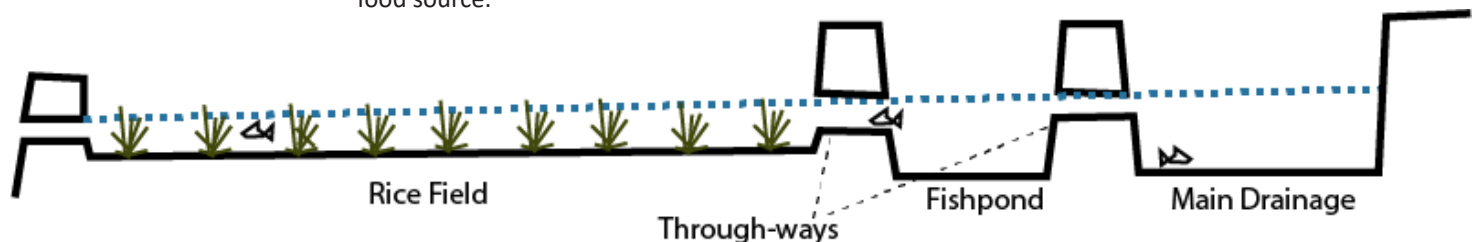
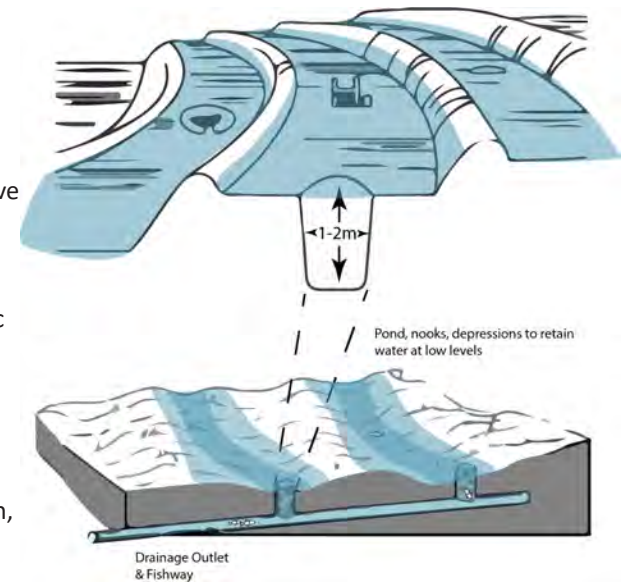
Terraced rice paddies are an iconic landscape formation which easily relates back to historical cultivation of the staple; rice has been a leading agricultural product for the entirety of modern human existence, archaeological remnants of rice cultivation have dated as far back as 5000 BC. Rice, as historically and currently the most consumed food item throughout Asia, holds deeply rooted meaning in history, culture, food specialties, lore, and recreation. Rice production has mechanized through modernization, which has caused the prevalence of terraced rice paddies to steadily declined over recent decades. This phenomenon is exacerbated further through demographic changes in the community, as family-led farming begins to dissipate. The traditional customs tend to fall on aging and/or senior members of family units as the younger members seek alternative lifestyles away from home.

ENDANGERED SPECIES HABITAT

Regarding species habitat, the rice paddies provide a serendipitous opportunity to observe an alternative-stable state in action. The Oriental White Stork (OWS) is an iconic migratory bird which once occupied habitat across all of Asia. The OWS was nearly driven to extinction through the excess of human-driven wetland destruction, overfishing, deforestation, and general disturbance of habitat, despite its cultural significance. The global OWS population declined to nearly irreparable levels; captive breeding programs began to work in supplementing the wild population but was met with limited success. Eventually, through a combination of regional habitat conservation and improved breeding success, a slow stabilization of the population was achieved (currently resting at under 2000 wild individuals worldwide). An opportune relationship between the OWS and rice paddies would be discovered, as the threatened species began utilizing rice paddy fields as alternative habitat to the wetlands which had been overtaken.

INDICATOR SPECIES

The OWS only adopt the most productive and uncontaminated rice fields due to their and their prey's sensitivity to pollution and selective habitat conditions (i.e. water depth, quality, etc.) Thus a specific requirement of the rice paddy design must be integrated in order to achieve the intended balance of goals: organic agriculture. The agricultural production, specifically geared toward stork-friendly practice, systematically ensures the rice fields will provide suitable and safe habitat to the OWS as well as the many other migratory shorebirds. Initiatives throughout China, Japan, and Korea to assist in the rehabilitation of the OWS have encountered significant stork population improvement following conversion to organic farming; rice field owners were encouraged to reduce agrochemical use (minimally by 75%) through monetary incentives. Management, beyond organic policy, is also vital in creating OWS suitable habitat. The inundation associated with rice cultivation provides suitable foraging, as their prey depend on aquatic conditions. This becomes particularly vital in the winter; rice fields are often left dry after harvesting, killing off food sources for the stork as well as encouraging weed growth in the bed. Sustained inundation of the fields is often sufficient to create fish refuge, but having ~5-6% of the field dedicated to deeper fish ponds allows for adequate wintering habitat for prey while maximizing agricultural yield vs habitat conditions. The proximity of these refuge ponds are imperative to account for in construction: the adjacency of fish ponds to the nearest drainage channel is proportional to the level of functional habitat it provides. The continued inundation of the fields (~20cm), as well as locating fish ponds or throughways for fish refuge adjacent to drainage (~5-6% of total field area), are vital components to integrate into the field construction and management to best serve the vulnerable bird species which increasingly rely on these alternative habitats as their primary food source. The OWS act as a key indicator species of wetland health, which signifies the process of ecological improvement as well as a defining characteristic of the quality of rice produced (a positive outcome for sale and export price point). serve the vulnerable bird species which increasingly rely on these alternative habitats as their primary food source.



Terraced Organic Rice Paddies Logistics

Short-Term Investment

Terrace construction itself is a monumental undertaking. The excavation and redesign of over 1000 ha of land is very labor intensive. Labor cost for a project this scale with the given landscape topography is estimated at ~200M USD, with a timeline of at least 8 - 10 years. This project would create immediate job availability to the local community from the substantial upfront labor needs during construction.

Long-Term Profit

Despite its magnitude of investment, terracing the fields is quantitatively feasible to turn profit after this initial cost, without even accounting for the eco-tourism revenue associated with the terraced fields. Long-term employment opportunities are created due to the high level of maintenance required for terrace function, organic quality control and monitoring, and associate tourism-related employment (field tours, rural bungalow renting, farm-to-table restaurant partnerships, etc.). Furthermore, this large initial investment largely

redistributes the city or federal cost as economic benefit to the local community who would be involved in the construction and maintenance of the fields (and eventually through the sales of the product).

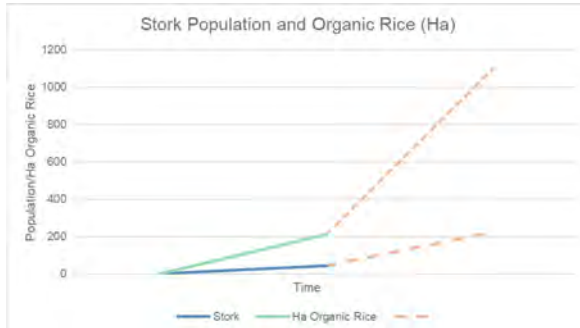
Some may hold concern that organic production of rice is less fruitful; organic farming tends to produce 70-75% compared to non-organic outputs, as the use of pesticides or fertilizers encourage greater yield. Organic goods, however, can be sold for significantly more per unit of product. This is even more accentuated in specifically “stork-friendly” branding, which can be sold for up to 50% more than traditionally grown rice. With the price point of this product sitting far above the product of the agrochemical fields which exist now, the ~1100 ha of field following the redesign of this area poses to be a significant boon to the local economy and farmers. The estimates for the given area are only ~400K USD per annum for traditional agriculture, while organic, stork-friendly production totals 430K USD per annum. The cultural mystique and following surrounding the stork increases the ability to attract tourists to Hwaseong through eco-tourism. Stork reintroduction in Japan raised municipal income by 1.3% - equivalent to \$73M USD (8bil JYen total, ~1Bil JYen attributed to ecotourism). This economic benefit is a conservative estimate, as tourism is indicated to increase over time.

The rice fields as a component of the dynamic mosaic creates economic gain for the area, habitat for culturally significant species on the brink of extinction, as well as embody a key component in the tourism allure of Hwaseong in its re-imagining -- a city breakaway experience in nature.

Return on Investment



Species Projection

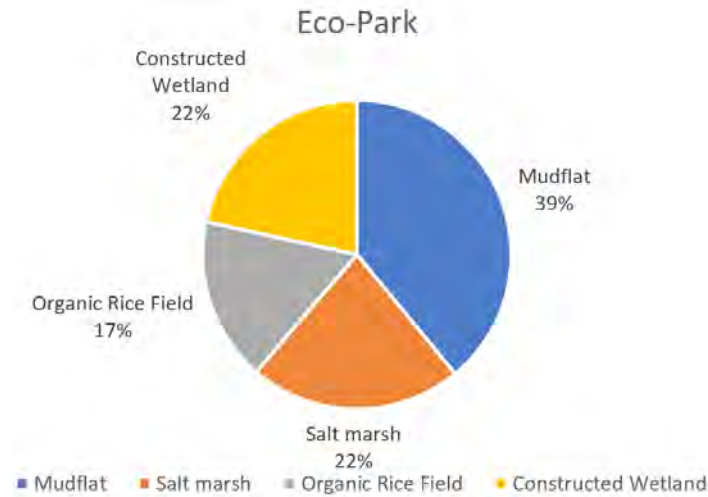


	USD/Ha	Total
Construction Labor	~192000	~206M
Maintenance	~USD/year	USD/Ha
Labor	270,000	255
Cost	930,000	875
Profit(Organic, net)	430,000	400
Profit(Traditional, net)	400,000	240

	SRI	Trad
	7208	17190
USD/ha	40	100

Diverse Habitats

In the interest of evaluating our proposal's success in developing diverse habitats across the site holistically, we evaluated how habitat diversity was impacted between the possible future scenarios of the site. Examining the proportion of critical habitats present, our proposal objectively bests the other possibilities regarding the successful intermingling of different habitats, creating the greatest diversity of ecosystems and the experiences which go along with them.

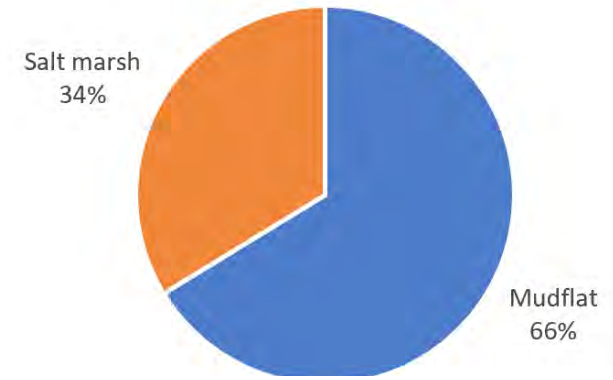


Optimally designing the rice fields as a multifunctional, productive space requires the balance of physical characteristics, consistent management, and large-scale policy initiatives. Installing fish ladders to aid in fish travel, as well as sufficient ponding area near drainage, ensures the availability of diverse prey for the migratory

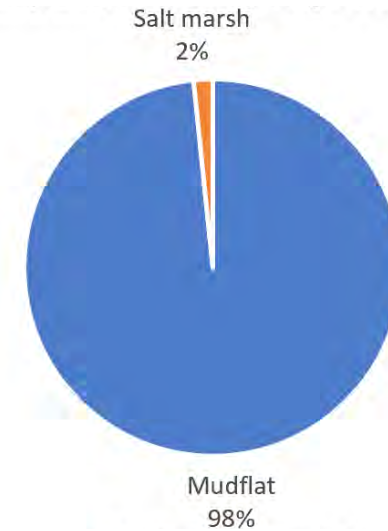
bird species to utilize. Managing the upkeep of the terraces, adhering to organic cultivation practices, ensuring appropriate water levels remain consistent, enforcing wintertime inundation, and cautious weed prevention are key to facilitating the fields to develop into the most productive and ecologically sound space over time - serving the greatest amount of stakeholders possible.

While less within the scope of this project, local, regional, or federal policy over the use of agrochemicals is worth noting, as economic incentives have been found to be effective in regional conversion organic farm practices. The enforcement of a larger-scale organic farming policy would have the ability to deal with adjacent non-point source agricultural pollution which could serve as an ongoing obstacle to restoration.

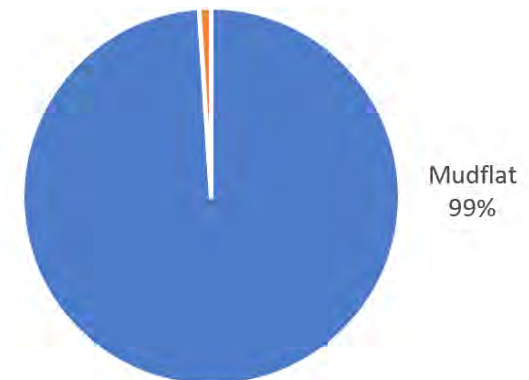
Pre-Impoundment



Industry Expansion



Current Preservation




Waste Water Management


After talking with Bob Gearheart, the mastermind and creator of the Arcata Marsh, one of the most famous natural waste treatment systems in the world, he recommended modeling our waste water management systems on the Columbia, Missouri, treatment center. Columbia, Missouri has a similar climate to Hwaseong, South Korea which includes subfreezing temperatures for over two months of the year. Therefore, the ponds and marsh will be able to filter agricultural pollution coming downstream all year around.



HWASEONG
South Korea



ARCATA,
California



COLUMBIA,
Missouri

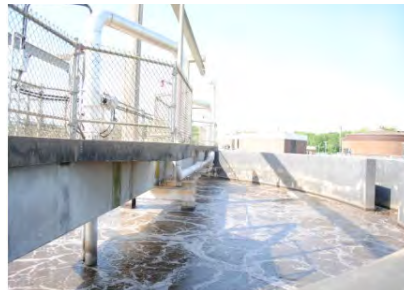
Waste Water Treatment Breakdown

This waste water treatment plan we suggest is heavily modeled on the one from Columbia, Missouri. It is our aim that this treatment plant will be adequate to support all the waste from the new development as well as local runoff. There are several filtration steps which are intensive before the wetland filtration happens. The waste first goes through bar screens, hydrocyclone grit separator before entering the first settling basin. The secondary treatment is all basins, first with aeration basins and then with final settling basins. And lastly, there is a sludge thickener and a two stage digester. With heating from captured methane, the machinery and basins do not freeze even in subzero temperatures.

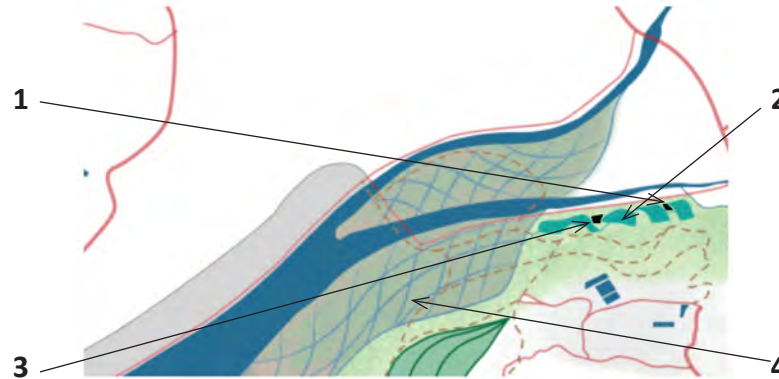
1. Primary Treatment



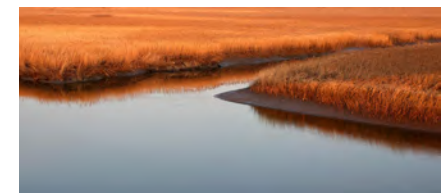
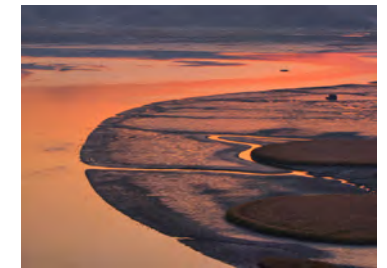
2. Secondary Treatment



3. Tertiary Treatment



4. Wetland Filtration



Current Seawall Management

The current seawall has one opening with six, ten meter wide gates which open 5-10 days a month. The fisherman and farmers are unhappy with the current management because the water inside the seawall has too much pollution build up, making it a less than ideal environment ecologically. Despite the local discontentment, the government who paid and engineered for the seawall are against the removal or destruction of the seawall as they are not ready to accept failure of their project.



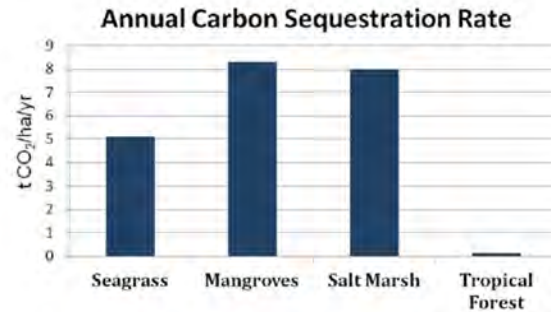
Proposed Seawall Operations

We suggest adding six more gates in the form of three pairs of two gates. To be consistent with existing design, each gate would be 10 meters wide to add up to 20 meters which is the minimum width for proper mixing. Suggested placement of the gates would be evenly spread out beginning after the widened portion of the seawall and stopping before the mudflat. We recommend keeping gates open to increase porosity and avoid pollution build up inside the seawall.



Kia Partnership

The Kia factory is the largest industry in the Hwaseong region and provides a unique partnership opportunity. For several years Kia has been interested in building a new port in the mudflats adjacent to their factory to save on shipping costs and possibly expand manufacturing. In order to prevent this loss of important habitat, we invite Kia to participate in the conservation of Hwaseong wetland. By supporting this project or becoming a sponsor Kia has an opportunity to become internationally recognized as a green energy leader. Tours of their facility could also be incorporated to the eco-tourist experience. Additional incentives to invest in wetland conservation are carbon offsetting programs. Salt marshes are one of the world's most effective sinks for carbon sequestration and investment in this project could offset Kia's global carbon footprint. We believe partnering with the conservation of this wetland would be of greater benefit to the company than port expansion.



Source: The Climate Trust



Community Engagement

Community engagement is central to our design strategy. Along each step of the planning phase incorporating community feedback and recommendations will be a priority. This eco-tourism plan will not only bring economic benefits to the local community, it will also provide education opportunities for children and professionals. Ultimately we strive for a plan that improves the quality of life of local residents and places the future in the hands of the community.



Source: Nial Moores

Local Stakeholder Impacts

Eco-tourism

Eco-tourism studies have shown that planners need to involve local stakeholders as much as possible to ensure that locals have awareness and ownership of the project's ecological goals and can benefit from the development. We predict that the proposed wetland eco-park would have the following impacts on local stakeholder groups:

Fisherfolk

- + Economic
 - Sales to restaurants
 - Fish market
 - Boat tours
- + Clean water

Hwaseong Government

- +/- Economic
 - Taxes
 - Federal preservation funds?
 - Up-front investment
- + Prestige
 - Green economy leader
 - Mundok partnership

Rice Farmers

- + Economic
 - Sales to restaurants
 - Farmers' market
- + Clean water

Kia (if it supports preservation)

- +/- Economic
 - Green economy leader
 - More visitors to factory
 - No manufacturing and port expansion

Hwaseong Residents

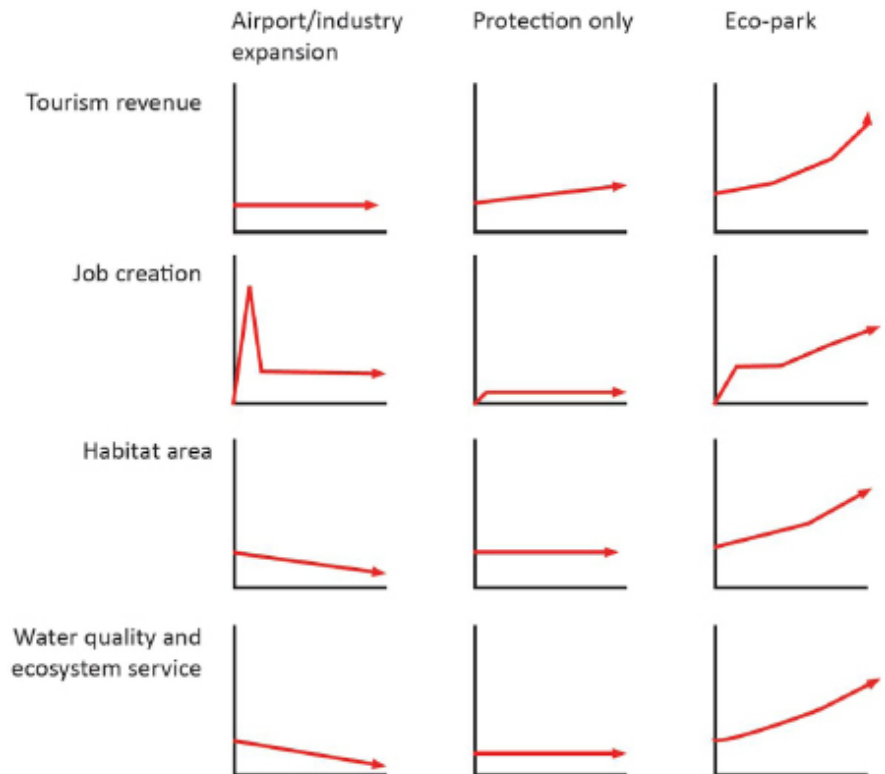
- + Economic
 - Employment

Local Businesses

- + Economic
 - Tourist spending

The only negative impacts of the wetland eco-park that we identified were for Kia, if their proposed expansion were permanently shelved – which it may be anyway due to regulatory and economic factors – and for the Hwaseong government, which may need to make up-front investments in the eco-park's development. However, case studies of nearby tidal wetland parks in South Korea estimated economic benefits of approximately USD 70 million per year to the surrounding areas.

Conceptual Projection: Impacts of Development Alternatives over Time

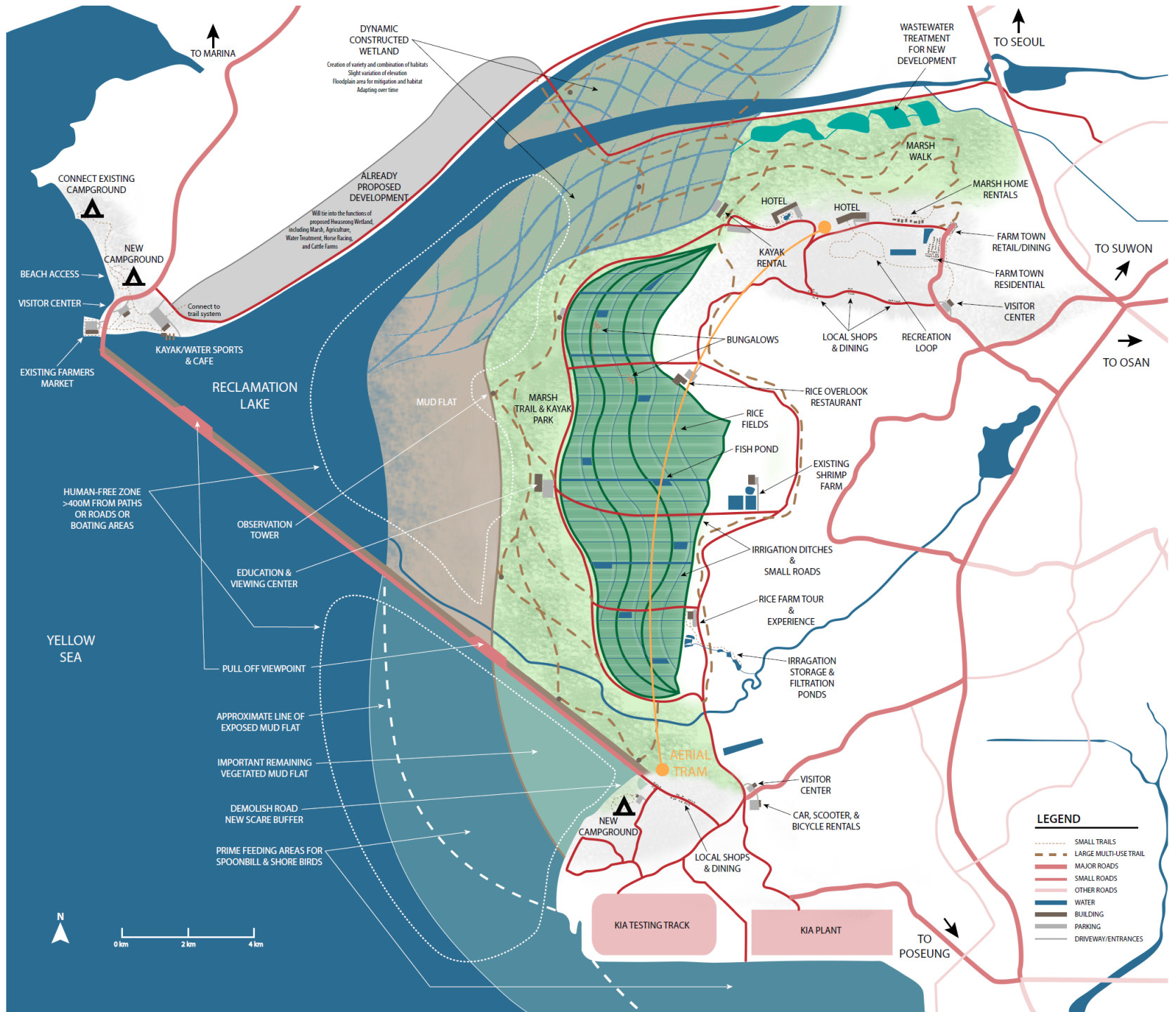


Plan

To the right, a detailed and labeled plan of the overall site is shown. Some of the major dimensions are noted to give a reference to the large scale of this project.

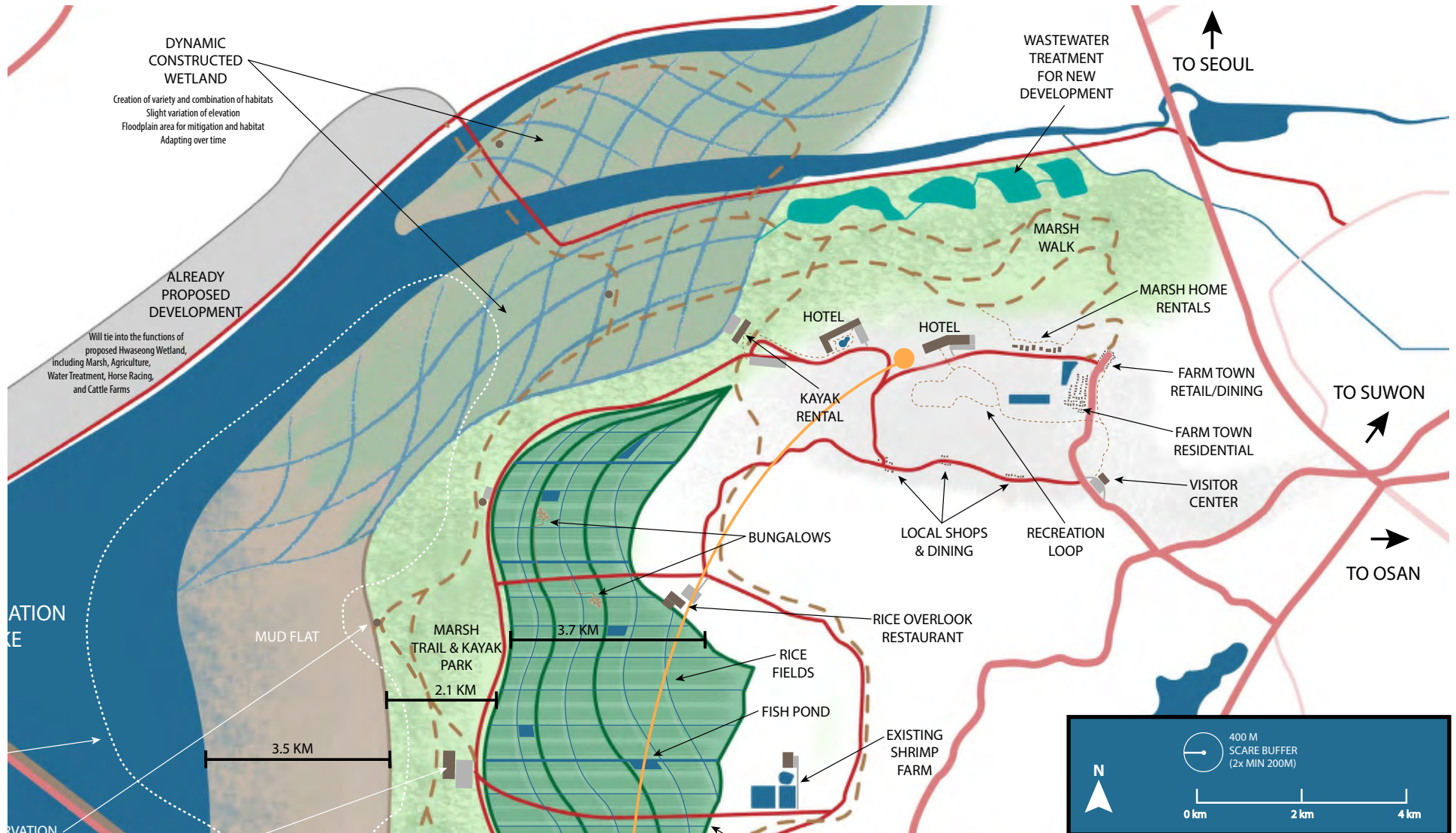
SCARE DISTANCE

Note the diagram in the bottom left showing the scare distance to scale. A spoonbill scare distance is 200 meters, but according to SAVE, 400 meters is recommended to encourage spoonbill and other shorebird habitat. A dotted white line is shown on the map to designate the human-free zones that would be designated at primary bird habitat with no human access.



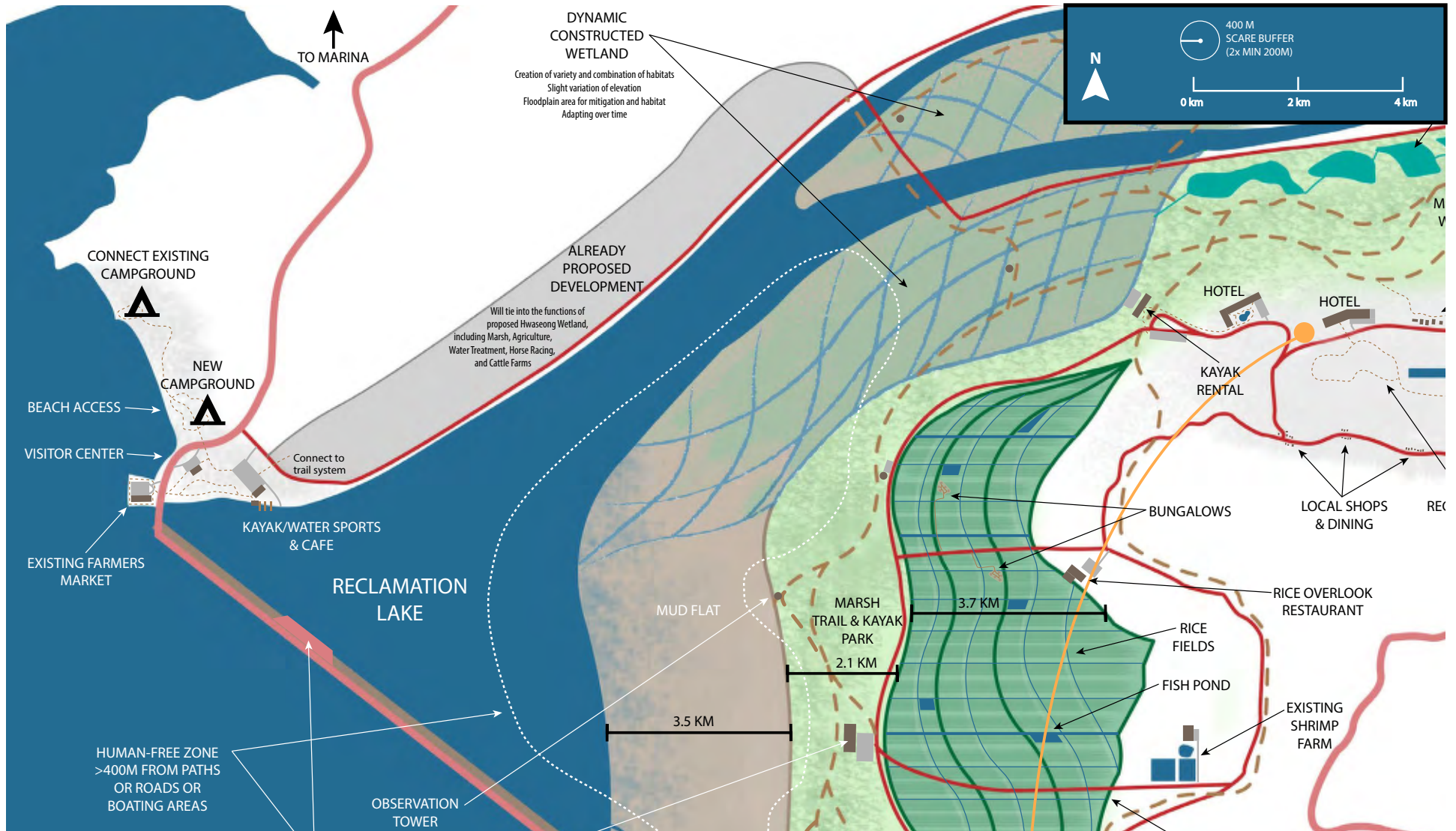
Plan Details North

The Northeast area of the site is where the primary development would be. While connecting with and expanding on the existing towns and infrastructure, this would be where hotels, retail, restaurants and centralized activities would be concentrated. The goal would be to support existing local business as well as encouraging more local business and development in this area. With tourism in the area, there is a lot of opportunity for the local economy to expand. With this new development, a wastewater treatment pond system would be created to handle all of the wastewater from this new development. The dynamic wetland creates a diversity of habitat and allows further filtration of the water from the streams. Kayak routes and walking trails run throughout portions of this dynamic area while other areas are reserved for habitat restoration.



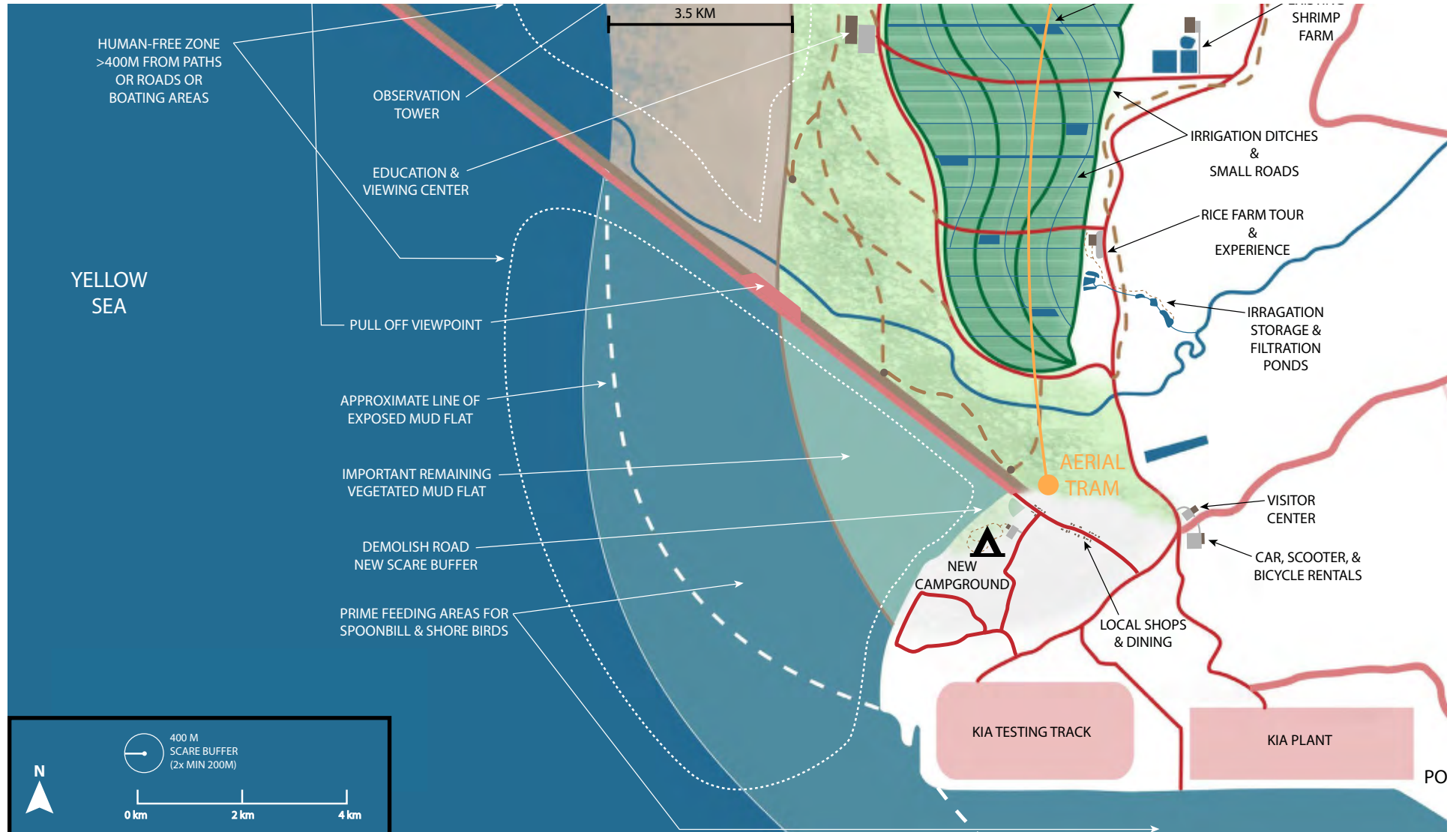
Plan Details West

On the Northwest side of the river and reclamation lake, there is already proposed development that will closely tie into our plan. Additionally, an existing campground on the West coast could be expanded to allow beach-side camping closer to the wetland area, with access to recreation and trails within the wetland. Other activities include a farmers market, lookouts along the seawall, water sports in designated areas away from primary bird habitat, and connection to the marina. With numerous activities and fishing access for local fisherfolk, there is still a clearly defined human-free zone of the mudflat and wetland area that is reserved for birds and other wildlife. The road through the farming towns with access to the rice paddies and overlooks will be the primary route through the wetland as well as a lower drive along the edge of the rice paddies.



Plan Details South

The main route through the farming towns continues, passing opportunities for rice farming tours, access to bungalows in rice paddies, and hiking trails to filtration and diversion ponds for irrigation. Another key feature is the primary bird habitat located outside of the seawall, both in the corner area as well as the area located South of KIA, which adapt and change dramatically with the tides, functioning as essential areas for shorebirds. A campsite is located in the corner area near the end of the seawall, setback off the mudflat to avoid scare distance range and the existing coastal road has been restored to a marsh and nature area. The surrounding development and town just East of this campsite could be the site of a future festival celebrating the migration of shorebirds. The connection to KIA occurs here with opportunities for tours.



Transportation

As we intend to bring tourism and greater access to this area, transportation is a key factor in our plan and how the wetland area functions. With more visitors, we need to ensure the site is accessible as well as providing routes through the site once visitors are there. The major roads running from Seoul and other cities in the area are Highway 15 and Highway 153. There are two main access points to the site. Highway 153 passes close to the main entrance to the site, where visitors can exit at highway 310, to enter the site from the East into the primary development area and visitor center. The second major access is from the North, also from Highway 153, using Highway 309 to enter the site by the reclamation lake and second visitor center. The 309 connects to the 301, which crosses over the seawall, and then connects to 310, completing the full loop of access for vehicles. Although much of visiting population is expected to come from the North, there is an additional access point is from the South, from Highway 15 to the 315 and 302 or via the Poseunghyangnam-ro, which actually connects back up to Highway 153 near the East entrance. The City of Hwaseong may need to expand bus service to the site from Byeongjeom Station on the Seoul Metropolitan Subway, however tourism revenue will likely offset the costs of this expansion.

Since the majority of land areas and activities are on the East side of the site, the East side will be the focus on additional transportation routes. Currently, there are a number of small rural roads through farmland up on the dry land, as well as a network of dirt roads through the rice paddies. A main route will be determined through these existing rural roads and expanded as necessary to connect key points of interesting, including rice farm, farming town shops, restaurants, hiking, and places to stay. The public driving roads through the lower wetland area will be limited, allowing sufficient access through the site, but not interfering with local farmers, fisherfolk, or primary bird habitat areas. The main road through the wetland will run between the rice paddies and the marshland and three connecting roads will run through the rice paddies. The existing road along the edge of the reclaimed land will be eliminated, as this area will be allow to become more dynamic and natural as part of wildlife habitat with no human access.

In addition to roads, there will be a system of trails and boardwalks through the site to allow pedestrian and designated bicycle access. The system of trails will connect to local hiking in the area and allow visitors staying at hotels and campsites to access the trails from these accommodations.

In order to preserve bird and other species' habitat, it is important to designate specific areas where people can and cannot go. Although we do have areas within the wetland for walking, biking, and kayaking, there are "human-free" zones designated on the map and would be clearly marked on site, allowing bird species to have private habitat areas, including a buffer scare distance.

Conclusion

In creating this plan, we hope that Hwaseong will be able to use the ideas developed in this project to progress further with the design and restoration of the wetland. The next steps would include the following:

DETAILED MAPPING

Our plan is intended to be conceptual, with general land use areas separated out, transportation routes, and specific areas and uses called out. To continue this plan, very detailed mapping would need to be produced to understand the specific relationships of each of the areas and what is necessary for the function of these areas and activities. Careful mapping and planning with collaboration from bird specialists, local farmers and fisherfolk that know the area the best, and other experts in area specific fields, will be crucial to creating a wetland that serves locals, tourists, and birds. With this integrated and community-driven approach, the Hwaseong wetland will be able to maximize its impact, economically, socially, and ecologically.

ECOLOGICAL BALANCE

The underlying principles of our proposal are the creation of an ecologically diverse, multi-functional, and dynamically adapting landscape which allows the local wildlife, as well as the surrounding community, to prosper into the future. By laying the framework for distinct ecological spheres to develop and eventually coalesce, it is important to note that maintaining balance between these respective zones is imperative for the dynamic's longevity. Diverse niche space through varied habitat encourages the specialized population of species which currently, and will increasingly, utilize this landscape to congregate and prosper. An additional balance element to note is the complimentary proposal design: anthro-centric development. This proposal views this investment into Hwaseong's identity and supplemental urban center as a leading objective in implementation. Promoting eco-tourism is the primary way this goal is expected to manifest, which is inherently developed on a fine line of balancing ecological integrity and economic profit which itself, supports preserving that ecological integrity. By diligently monitoring this landscape throughout its development and progression, this balance can be better understood and maintained through informed decision-making for the evolving needs of this landscape and the community of Hwaseong.

SCARE DISTANCE

To ensure the proposed eco-park meets the goals of preserving and restoring habitat for migratory birds, developers will need further research on the birds' scare distances to allow tourists to appreciate the birds without harming them. Of particular concern is kayaking and other watersports in the reclamation lake and wetland. In addition to empirical scientific research, this might be another opportunity to involve fisherfolk and rice farmers, who already have an intimate knowledge of the region, in the planning process to further their sense of ownership of the area and pride in its ecological value.

BROADER APPLICATION

Although this masterplan has been developed for the specific characteristics of Hwaseong Wetland, the design process and many of the strategies could be applicable for similar coastal wetland revitalization plans in South Korea, where an estimated 65% of the country's wetlands have been reclaimed. Additionally, we hope that Hwaseong could serve as another example of how to use economic and cultural co-benefits to achieve ecological goals.

Hwaseong

Where traditional lifestyle meets Korea's green future

Incheon Int'l Airport (2 Hours)

Seoul (1 Hour)



Hwaseong

- Wetland Eco-park
- Universal Studios
- Royal Tombs
- Hwaseong Fortress
- Fossil Hike
- Kia Plant
- Hwaseong Businesses



Hwaseong (pop. 640,000) has capitalized on its abundance of natural and historic attractions, including an internationally significant migratory bird stopover, to remake itself into a dynamic green city.

Entertainment

Home to Universal Studios Korea, traditional farm villages, free guided tours of the largest Kia manufacturing facility in the world, and all types of watersports, Hwaseong has fun for visitors of all ages!



Culture

Follow paradegoers 59km from Seoul to Hwaseong's historic Yungneung Royal Tombs or celebrate the city's rich culture at the Hwaseong Bird Festival, when thousands of migratory birds stop in the Hwaseong Wetland Eco-park on their way up the East Asian - Australasian Flyway.

Green economy

Hwaseong's rural charm lives in harmony with its role as a growing center of industry: a solar-powered airtram offers breathtaking views of terraced organic rice paddies peacefully coexisting alongside Kia's eco-friendly manufacturing facility and flocks of rare endangered birds.



Nature

Whether you want to hike to dinosaur fossils and a historic fortress, camp by the sea, do world-class birdwatching at a Ramsar-designated wetland, take kayak tours of organic rice paddies, or simply want to unplug from the stress of city life, the beauty of Hwaseong is not to be missed!



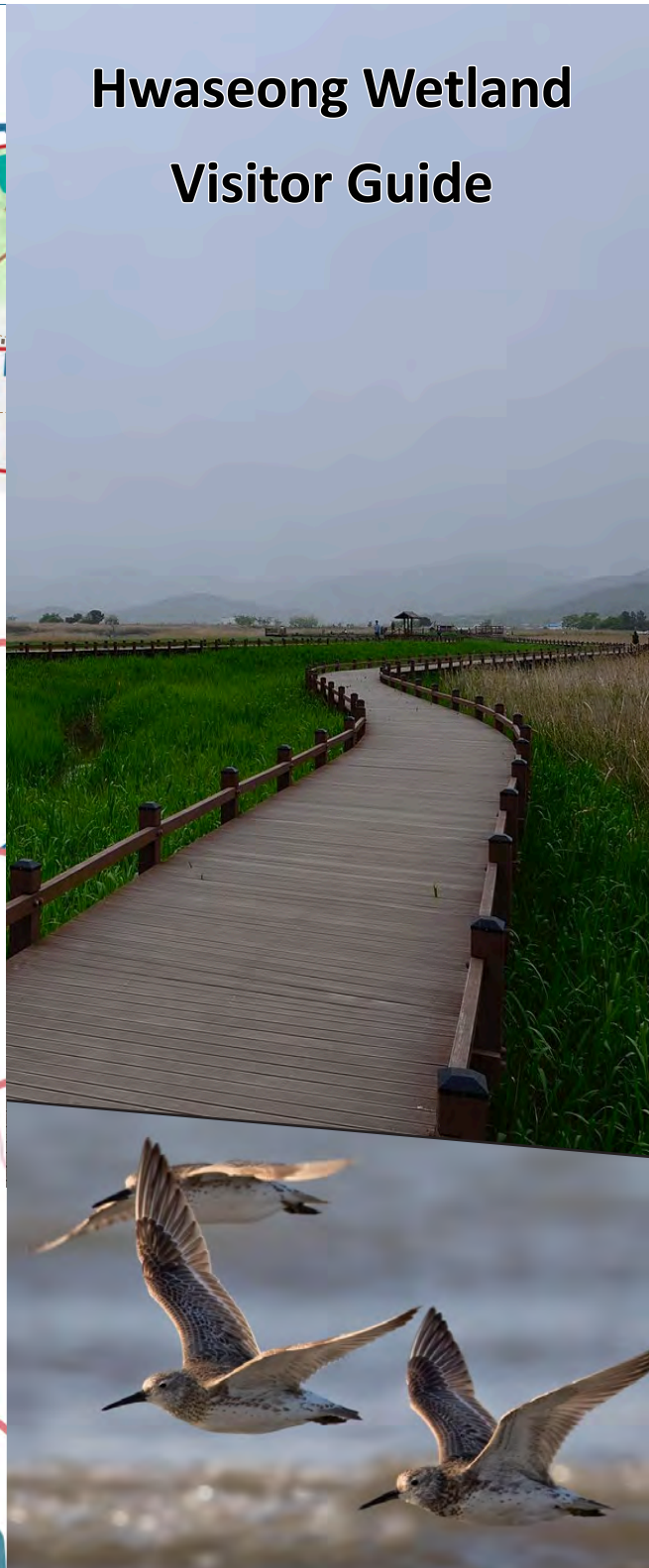
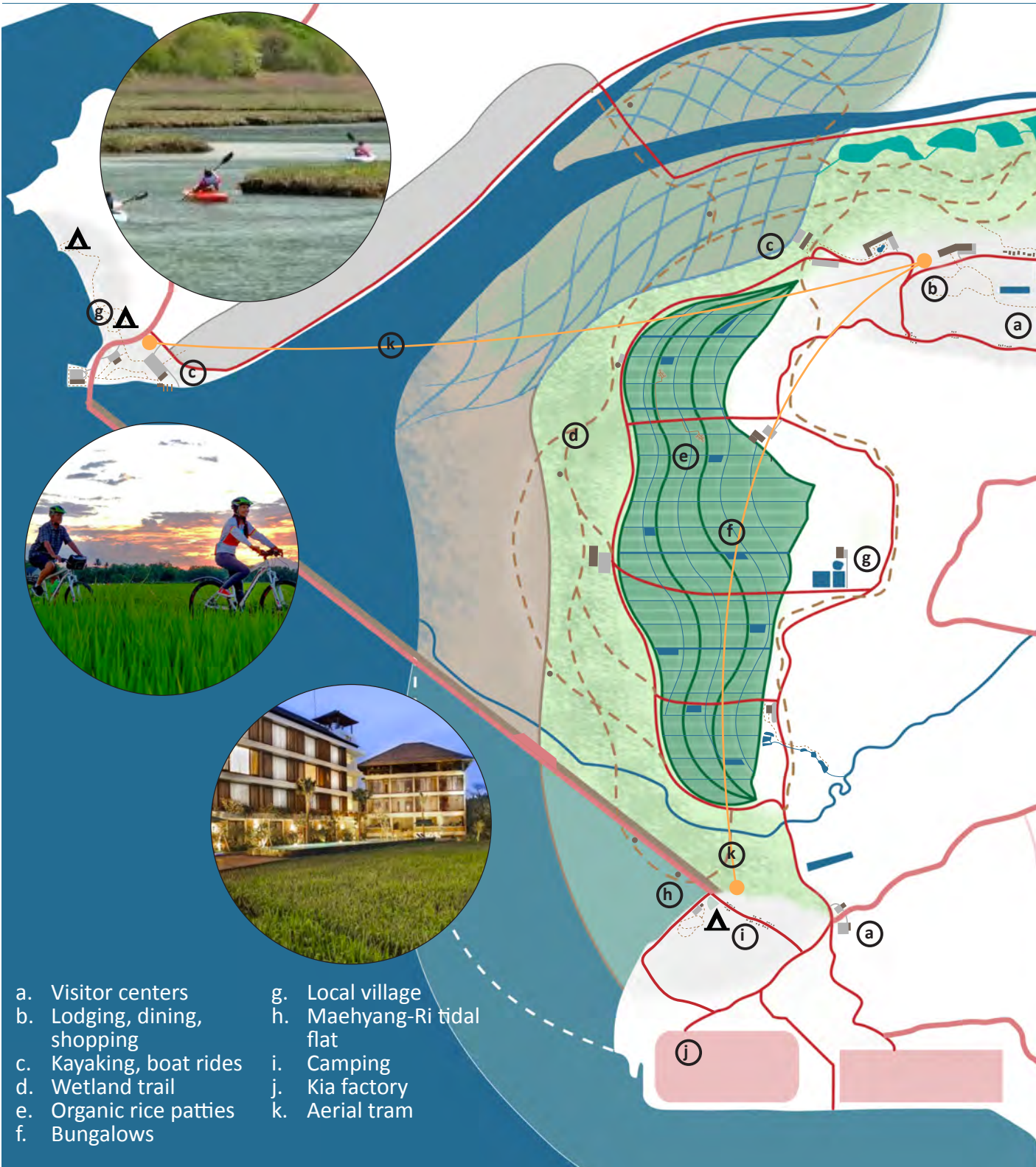
Tourism Packages

Only one hour from Seoul by car or public transit, Hwaseong has the perfect mix of adventure, relaxation, and rustic beauty. Come for the day or stay for a week with these exciting tourism packages:



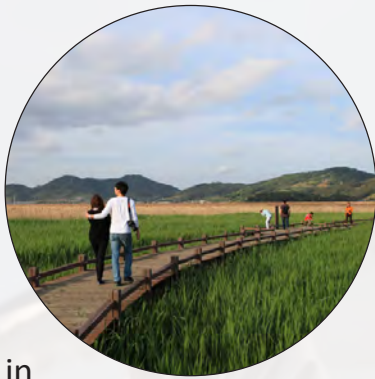
Package	Days	Highlights
Quaint Saturday	1	Organic rice paddies Fish and farmers' market Farm-to-table restaurant
Green Economy	2	Kia factory Working wetland Solar-powered airtram
Weekend Getaway	2	Universal Studios Fishing boat tours Drive through eco-park
Historic Hwaseong	2-3	Royal tombs Hwaseong Fortress Traditional village
Outdoor Adventure	2-5	Fossil hike Horseback ride Camping
EAAF Birdwatcher	2-7	Birdwatching Kayak Rice paddy bird feeding ponds

Hwaseong Wetland Visitor Guide



Hiking

Walk through the wetland on an extensive boardwalk trail network or take a trek through the organic rice paddies. Collect shells in the expansive mudflats.



Water adventure

Rent kayaks and explore the meandering wetland channels or hire a local boat guide and enjoy the open water. Thrill seekers sign up for windsurfing lessons and set sail!

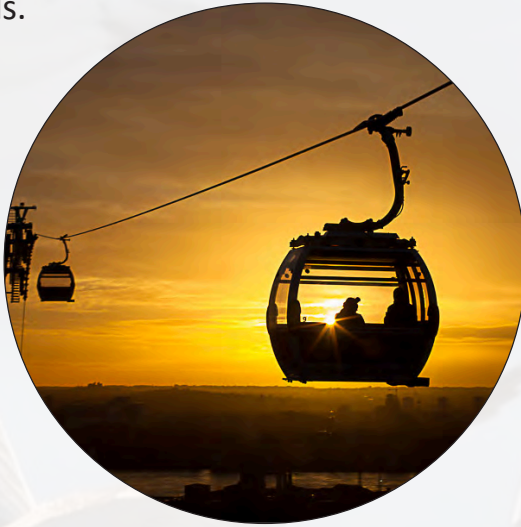


Bird watching

Part of the East Asian Australasian Flyway Hwaseong wetland is home to thousands of shorebirds throughout the year. The area provides critical habitat to endangered species including the Great Knot and the Black-faced Spoonbill. Sign up for a guided tour at the visitor center or set out with your binoculars!

Getting around

Want to cover more ground? Rent an electric vehicle, bicycles, or a moped and explore the greater area. For breathtaking views hop on one of the aerial trams to Maehyang-Ri or Gungpyeong-Ri headlands.



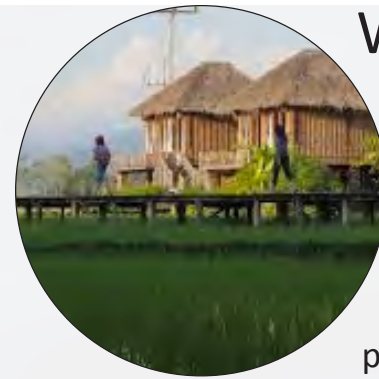
Where to eat

Choose from a number of restaurants in the park town center specializing in local cuisine or have authentic farm to table dining experience in the local village. In the morning, head to Maehyang-Ri fish market for the day's fresh catch!



Where to stay

Spend the night at a luxury hotel in the park town center or book a romantic weekend in one of the bungalows perched above the rice fields. If you're looking to get away, pitch a tent at the scenic point campground and watch the sunset over the Yellow Sea.



Education and outreach

Students can learn about local ecology, hydrology, and marine science. Classes in organic bird-friendly agriculture and water treatment systems are also available. Take a tour of the Kia factory and learn about green industry and state-of-the-art transportation technology.



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