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Airfield Manual: Field Guide to the Transformation of Abandoned Airports

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RESEARCH REPORT

Airfield Manual: Field Guide to the Transformation of Abandoned Airports

EDITION

2017

Harvard University
Graduate School of Design

AIRFIELD MANUAL

Field Guide to the Transformation of Abandoned Airports

Airfield Manual: Field Guide to the Transformation of Abandoned Airports

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Harvard University Graduate School of Design
Office for Urbanization

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Field Guide to the Transformation of Abandoned Airports

Airport Landscape Initiative

The Harvard Graduate School of Design (GSD) is a global center of knowledge and innovation on the subject of airport landscapes. Over the past several years, this topic has been a focus of intensive research and scholarship, articulated through a range of courses, exhibitions, conferences, and publications. The School recently published a definitive volume on the subject, *Airport Landscape: Urban Ecologies in the Aerial Age* (2016), co-edited by Prof. Sonja Dümpelmann and the Office for Urbanization's founding director Prof. Charles Waldheim. This publication of *Airfield Manual: Field Guide to the Transformation of Abandoned Airports* builds directly upon the knowledge produced through the Airport Landscape conference, exhibition, and catalog, as well as the research of Professors Dümpelmann and Waldheim.

The *Airfield Manual* compiles case study strategies and best practices for the conversion of decommissioned airports for a variety of new uses. Written for an audience of civic, business, and political leaders as well as for directors of aviation, engineers, and managers, *Airfield Manual* offers an executive summary of the issues and options attendant to the ownership, management, deactivation, and decommissioning of the airport site. The first half of the *Manual* describes five discrete strategies for the responsible transformation of the airport site through adaptation, conservation, conversion, redevelopment, and regrowth. The second half of the *Manual* describes in greater technical and operational detail the tools and techniques available for the transformation of the airport site relative to its hydrology and ecology, infrastructure and engineering.

Contents

Introduction

Instructions for Use

Since the advent of powered flight over a century ago thousands of airports have been built around the world. The majority of these facilities have been planned for sites close to rapidly growing cities in North America and Europe. Given the rapid growth of air travel that paralleled the great expansion of cities over the course of the previous century, many airports have become obsolete and subsequently abandoned. Reasons for this include insufficient size of facilities, location in sites that became unfavorable for airport operations, decommissioning of military uses, and the functional outmoding of buildings. In Europe alone there are over 750 abandoned airports; in North America there are over 1,000.[1] The abandonment of airports is a pervasive phenomenon worldwide that is more likely to accelerate before it abates. Over the next decade, hundreds of urban airports will cease operations. What will become of these vast, valuable, and very complex sites—many of them in the center of cities—once they are redundant for air travel?

The modern airport presents a unique type of urban infrastructure. Urban airports are typically enormous sites possessing great cultural significance, economic influence, and ecological impact. When an airport is abandoned, it offers rare opportunities for the development of new urban landscapes. The burgeoning phenomenon of airfield obsolescence suggests the need to imagine, plan, design, and construct these new landscapes. This work typically requires the careful consideration and adequate knowledge of many stakeholders and professionals, as well as political and civic leaders. This *Airfield Manual* serves as a guide for those considering the transformation of airport sites through a variety of strategies and tactics, values and visions. It offers an examination of international precedents and processes for the transformation of abandoned airports, as well as best practices for the enhanced economic and ecological functioning of airports presently on-hold or those anticipating transformations in the future.

In the United States alone there are nearly 20,000 airports in public, private, and military use. Over 5000 of these are currently in various forms of public use. This number includes the 389 primary airports serving domestic and international air travel, of which 138 are considered hubs.[2] There are at least 281 unclassified airports with no clearly defined function, including 227 publicly owned airports with little or no activity as well as a number of privately owned airports that do not meet minimum activity levels required to maintain their designation.[3] This study addresses the status of those underutilized and potentially redundant airports across the United States, and around the world, as they possess enormous potential for new forms of productive use.

In Europe there are approximately 2,000 airports, of which over 750 are abandoned, on hold, or underutilized.[4] Several civic and political leaders have recently claimed that the number of airports is inflated and economically unsustainable in many European countries. In fact several European nations are currently reevaluating their national plans for airport development after finding that more than half of European airports are at risk of closure or uncertain futures.[5]

The term “airport” confers a certain status upon an aviation facility and identifies it as an active site for aviation activities. An airport is legally defined as any area of land or water used or intended for the takeoff or landing of aircraft, including any pertinent areas used or intended for airport buildings, facilities, and associated rights-of-way.[6] “Airfield” on the other hand implies a broader definition embodying the idea of a “field” as a synthesis of technical, cultural, and ecological dimensions. The *Oxford English Dictionary* defines the term as an area of land reserved for the takeoff, landing, and maintenance of aircraft.[7] This expansive definition of the term refers to the extents of the land and includes vast natural areas (buffer zones, water retention areas, meadows), precise technical surfaces (runways, aprons, taxiways, parking lots), and numerous buildings for aviation activities (terminals, control towers, hangars). This broader understanding of the airfield implicates systems, networks, and connections, in addition to the visible features and structures on the site. The design—and redesign—of an airfield therefore comprises not only aviation activity but touches on a broader set of issues that implicate sites and subjects far beyond the airport itself.

Airfield Manual aims to fill a current gap in the available knowledge on the topic, where there is an absence of in-depth studies of the transformation of airports. *Airfield Manual* illustrates case studies, strategies, and best practices for the conversion of abandoned airports to a variety of new uses, from public parks and ecological corridors to energy farms and new urban districts. It is a field guide to the transformation of abandoned, decommissioned, underutilized, and deactivated airports. The aims of the *Airfield Manual* are twofold. First, it illustrates strategies for diversifying airfield operations and preparing airfields for transformation. Second, it provides a set of tools and techniques to guide the design and planning process for such a transformation.

Airfield Manual proposes a new “industry standard” and reference document for the transformation of abandoned airfields. The *Manual* is written for civic, business, and political leaders as well as for directors of aviation, engineers, and managers. National and international aviation agencies can use this document as reference for the transformation of abandoned airfields. Communities can use this document as a model for developing their own airfield plans and proposals. Part I: Options is specifically targeted to mayors and civic leaders, directors of urban planning, and community leaders. Part II: Operations is addressed to a wider range of professionals and consultants in the fields of urban planning, urban design, engineering, architecture, landscape architecture, and environmental sciences. The projects referenced in the *Manual* were conceived and proposed in response to the specific conditions of a given airfield. They are gathered here to make their lessons accessible to broad audiences internationally.

Airfield Manual presents a practical guide to successful strategies, compelling cases, and best practices assembled from the transformation of airport sites around the world over the past quarter century. The *Manual* draws from both built and unbuilt case studies, deriving relevant knowledge not only from implemented projects but also from notable and innovative competition entry proposals and community planning processes. Part I offers a summary of the issues and options attendant to the ownership, operation, management, deactivation, and decommissioning of airport sites. This section describes five discrete strategies for the responsible transformation of the airport site through adaptation, conservation, conversion, redevelopment, and regrowth. Part II describes the tools and techniques available for the transformation of airport sites for a variety of uses in greater technical and operational detail. This section describes techniques for the transformation of airfield hydrology and ecology, infrastructure and engineering. *Airfield Manual* concludes with a summary of constituents, consultants, and communities to be considered when embarking upon such a project.

Airfields

Fig. 0.1 Airfields in the World, 2017. 48,556 Total Airfields.

0 2000km

Decommissioned Airfields

Fig. 0.2 Decommissioned Airfields in the World, 2017. 1,786 Total Airfields.

0 2000km

North America

AHT	CA-0046	CA-0105	CA-0163	CA-0222	CA-0279	CA-0338	CA-0396	CA-0544	CKK5	JM-0001	MD16	SCR	X-KDEN
ARX	CA-0047	CA-0106	CA-0164	CA-0223	CA-0280	CA-0339	CA-0397	CA-0545	CKL4	JM-0012	MDHE	SFR	X-MMTG
AUS	CA-0048	CA-0107	CA-0165	CA-0224	CA-0281	CA-0340	CA-0398	CA-0546	CKN6	JM-0013	MDSJ	SKJ	X-TRPM
AYZ	CA-0049	CA-0108	CA-0166	CA-0225	CA-0282	CA-0341	CA-0399	CA-0547	CKR5	JM-0017	MGI	SRF	X-US001
BCJ	CA-0050	CA-0109	CA-0167	CA-0226	CA-0283	CA-0342	CA-0400	CA-0548	CKT2	JPB	MGRA	SRU	XYMY
BGDU	CA-0051	CA-0110	CA-0168	CA-0227	CA-0284	CA-0343	CA-0401	CA-0557	CKW7	K22W	MHCL	SSU	YTU
BGFH	CA-0052	CA-0111	CA-0169	CA-0228	CA-0285	CA-0344	CA-0402	CA-0559	CKX3	K3V5	MHCT	TJCG	00UT
BLW	CA-0053	CA-0112	CA-0170	CA-0229	CA-0286	CA-0345	CA-0403	CA-0560	CKY6	KAAP	MHLN	TMJG	01C
BM-0001	CA-0054	CA-0113	CA-0171	CA-0230	CA-0287	CA-0346	CA-0404	CA-0569	CLC	KAIY	MHRS	US-0002	03VA
BM-0002	CA-0055	CA-0114	CA-0172	CA-0231	CA-0288	CA-0347	CA-0405	CA-0570	CLG	KAYE	MKPE	US-0003	04MA
BRG	CA-0056	CA-0115	CA-0173	CA-0232	CA-0289	CA-0348	CA-0406	CA80	CNA8	KBDX	MM21	US-0004	05TN
BS-0001	CA-0057	CA-0116	CA-0174	CA-0233	CA-0290	CA-0349	CA-0407	CAB5	CND3	KCG	MM27	US-0005	07AZ
BS-0006	CA-0058	CA-0117	CA-0175	CA-0234	CA-0291	CA-0350	CA-0408	CAC3	CNH3	KCGX	MMPE	US-0006	07CT
BZS	CA-0059	CA-0118	CA-0176	CA-0235	CA-0292	CA-0351	CA-0410	CAH5	CNK2	KCHC	MMSC	US-0007	08WI
CA-0001	CA-0060	CA-0119	CA-0177	CA-0236	CA-0293	CA-0352	CA-0411	CAH8	CNN4	KCWN	MRPB	US-0008	0CA1
CA-0003	CA-0061	CA-0121	CA-0179	CA-0237	CA-0294	CA-0353	CA-0412	CAL8	CPD8	KCWS	MUML	US-0012	0D9
CA-0004	CA-0063	CA-0122	CA-0180	CA-0238	CA-0295	CA-0354	CA-0413	CAM7	CPE7	KDWF	MUOC	US-0054	0Q6
CA-0005	CA-0064	CA-0123	CA-0181	CA-0239	CA-0296	CA-0355	CA-0414	CAN8	CPH8	KEHT	MUPL	US-0057	1W5
CA-0006	CA-0065	CA-0124	CA-0182	CA-0240	CA-0297	CA-0356	CA-0415	CAP8	CPQ4	KFLR	MVJ	US-0097	29NC
CA-0007	CA-0066	CA-0125	CA-0183	CA-0241	CA-0298	CA-0357	CA-0417	CAV2	CPW3	KFLU	MX-0023	US-0099	2I2
CA-0008	CA-0067	CA-0126	CA-0184	CA-0242	CA-0299	CA-0358	CA-0418	CAW7	CPX3	KGRM	MX-0031	US-0112	2ID4
CA-0009	CA-0068	CA-0127	CA-0185	CA-0243	CA-0300	CA-0359	CA-0419	CAX3	CPX5	KGSW	MX-0037	US-0133	2OK3
CA-0010	CA-0070	CA-0128	CA-0186	CA-0244	CA-0301	CA-0360	CA-0420	CBD3	CPY4	KGVW	MX-0049	US-0164	34CA
CA-0011	CA-0071	CA-0129	CA-0188	CA-0245	CA-0302	CA-0361	CA-0421	CBD5	CSG8	KHAX	MX-0057	US-0174	39ID
CA-0012	CA-0072	CA-0130	CA-0189	CA-0246	CA-0303	CA-0362	CA-0422	CBM5	CSM4	KHMJ	MX-0062	US-0213	3C5
CA-0013	CA-0073	CA-0131	CA-0190	CA-0247	CA-0304	CA-0363	CA-0423	CBU6	CSR4	KHWC	MX-0065	US-0215	3FD1
CA-0014	CA-0074	CA-0132	CA-0191	CA-0248	CA-0305	CA-0364	CA-0426	CBW5	CST9	KILL	MX-0080	US-0217	44FD
CA-0016	CA-0075	CA-0133	CA-0192	CA-0250	CA-0306	CA-0365	CA-0429	CCA9	CTH4	KISZ	MX-0095	US-0226	4TE8
CA-0017	CA-0076	CA-0134	CA-0193	CA-0251	CA-0308	CA-0366	CA-0434	CCN3	CTQ4	KL67	MX-0112	US-0246	4W6
CA-0018	CA-0077	CA-0135	CA-0194	CA-0252	CA-0309	CA-0367	CA-0436	CCRH	CTR5	KLHC	MX-0142	US-0250	51MO
CA-0019	CA-0078	CA-0136	CA-0195	CA-0253	CA-0310	CA-0368	CA-0437	CDS6	CTT2	KM88	MX-PNO	US-0251	59TE
CA-0020	CA-0079	CA-0137	CA-0196	CA-0254	CA-0311	CA-0369	CA-0438	CDU9	CTU4	KMLK	MYZ2	US-0255	63IN
CA-0021	CA-0080	CA-0138	CA-0197	CA-0255	CA-0312	CA-0370	CA-0439	CDY2	CU-0015	KMNG	N04	US-0260	65GA
CA-0022	CA-0081	CA-0139	CA-0198	CA-0256	CA-0313	CA-0371	CA-0441	CEA8	CVR	KMQT	N75	US-0263	6B3
CA-0023	CA-0082	CA-0140	CA-0199	CA-0257	CA-0314	CA-0372	CA-0467	CEB3	CYCV	KMSA	NRC	US-0266	6R4
CA-0024	CA-0083	CA-0141	CA-0201	CA-0258	CA-0315	CA-0373	CA-0483	CED2	CYHS	KMUF	O07	US-0267	71XS
CA-0025	CA-0084	CA-0142	CA-0202	CA-0259	CA-0316	CA-0374	CA-0484	CEH7	CYKM	KNGZ	O62	US-0269	77T
CA-0026	CA-0085	CA-0143	CA-0203	CA-0260	CA-0317	CA-0375	CA-0485	CEJ2	CYSR	KNJP	OBK	US-0270	7IL2
CA-0027	CA-0086	CA-0144	CA-0204	CA-0261	CA-0318	CA-0376	CA-0486	CEJ5	CYXD	KNOP	OK03	US-0273	83R
CA-0028	CA-0087	CA-0145	CA-0205	CA-0262	CA-0319	CA-0377	CA-0487	CEJ7	CYXI	KNTK	OR01	US-0274	8OH7
CA-0029	CA-0089	CA-0146	CA-0206	CA-0263	CA-0320	CA-0378	CA-0488	CER5	DCR	KNZJ	OR80	US-0275	
CA-0030	CA-0090	CA-0147	CA-0207	CA-0264	CA-0321	CA-0379	CA-0489	CEX5	DO-0001	KNZW	PA-0020	US-0276	
CA-0031	CA-0091	CA-0148	CA-0208	CA-0265	CA-0322	CA-0381	CA-0490	CFE6	DO-0002	KOIL	PA-AML	US-0277	
CA-0032	CA-0092	CA-0149	CA-0209	CA-0266	CA-0324	CA-0382	CA-0491	CFK3	DPK	KOVK	PAAT	US-0280	
CA-0033	CA-0093	CA-0150	CA-0210	CA-0267	CA-0325	CA-0383	CA-0494	CFN2	DWS	KPCU	PATJ	US-0281	
CA-0034	CA-0094	CA-0151	CA-0211	CA-0268	CA-0326	CA-0384	CA-0496	CFN4	ESP	KPLB	PCK	US-0283	
CA-0035	CA-0095	CA-0152	CA-0212	CA-0269	CA-0327	CA-0385	CA-0499	CFQ2	F04	KPTG	PHKP	US-2N8	
CA-0036	CA-0096	CA-0153	CA-0213	CA-0270	CA-0328	CA-0386	CA-0501	CFY8	F50	KPVZ	PM64	US-3NJ9	
CA-0037	CA-0097	CA-0154	CA-0214	CA-0271	CA-0329	CA-0387	CA-0509	CGN1	FAL	KRZZ	PR-0004	US-59S	
CA-0038	CA-0098	CA-0155	CA-0215	CA-0272	CA-0330	CA-0388	CA-0519	CGV4	FLE	KSKY	PR-0005	US-BPA	
CA-0039	CA-0099	CA-0156	CA-0216	CA-0273	CA-0331	CA-0389	CA-0532	CHC2	FSN	KSPX	PR-DDP	UT59	
CA-0040	CA-0100	CA-0157	CA-0217	CA-0274	CA-0332	CA-0390	CA-0539	CHQ2	GL-0008	KUCA	PR-PPD	VIB	
CA-0041	CA-0101	CA-0158	CA-0218	CA-0275	CA-0333	CA-0391	CA-0540	CJC9	GT-0011	KUIZ	REH	W79	
CA-0042	CA-0102	CA-0160	CA-0219	CA-0276	CA-0334	CA-0392	CA-0541	CJH7	HN-0004	KYL	RZH	WJBK	
CA-0044	CA-0103	CA-0161	CA-0220	CA-0277	CA-0335	CA-0394	CA-0542	CJX7	I32	LRO	SAG	WN04	
CA-0045	CA-0104	CA-0162	CA-0221	CA-0278	CA-0336	CA-0395	CA-0543	CJZ5	IVH	LTH	SBT	X-CBG6	

Fig. 0.3 Decommissioned Airfields in North America, 2017. 803 Total Airfields.

Europe

ABE	EETR	ESKS	GB-0107	GB-0173	LKHO	RU-0009	RU-0419	UA-0071
ABL	EGAL	ESKT	GB-0108	GB-0178	LKHR	RU-0011	RU-0425	UA-0072
ADJ	EGCD	ESMD	GB-0109	GB-0244	LKVL	RU-0012	RU-0437	UA-0080
BE-0001	EGCE	ESMN	GB-0110	GB-0299	LKZC	RU-0031	RU-0440	UA-0084
BE-0002	EGCP	ESMR	GB-0111	GB-0307	LR81	RU-0039	RU-0441	UA-1901
BE-0005	EGDA	ESMW	GB-0112	GB-0312	LSMI	RU-0047	RU-0444	UA-6709
BE-0007	EGGH	ESNF	GB-0113	GB-0313	LSMJ	RU-0049	RU-0446	UKRR
BER	EGKM	ESNH	GB-0114	GR-0006	LSXV	RU-0053	RU-0447	ULMN
BG-0034	EGLG	ESNI	GB-0115	GR-0007	LSZD	RU-0055	RU-0448	ULMO
BG-0035	EGMH	ESPG	GB-0116	GR-0013	LSZY	RU-0066	RU-0804	ULNM
BITF	EGMK	ESPJ	GB-0117	GWW	LT-0001	RU-0067	RU-0892	ULNN
BITH	EGNA	ESSQ	GB-0118	HU-0011	LU-0002	RU-0078	RU-1241	ULNP
BY-0002	EGOY	ESTO	GB-0119	IE-0003	LV-0005	RU-0091	RU-1480	ULSL
BY-0007	EGSB	ESUA	GB-0120	IE-0006	LW76	RU-0092	RU-2098	ULSS
BY-1210	EGSK	ESUF	GB-0121	IE-0007	LYDK	RU-0106	RU-2504	ULWT
BY-7836	EGTG	ETAS	GB-0122	IM-0002	LYSO	RU-0107	RU-3463	URMP
CZ-0076	EGTI	ETEU	GB-0123	IT-0077	LZVB	RU-0127	RU-400	US-0214
DE-0003	EGUA	ETNP	GB-0124	IT-0237	ME-0001	RU-0130	RU-4388	US-0216
DE-0007	EGUT	ETUR	GB-0125	LB43	MJG	RU-0131	RU-6099	US-0218
DE-0008	EGUV	EWY	GB-0126	LBBR	MT-0001	RU-0138	RU-6313	US-0219
DE-0009	EGVG	EYKR	GB-0127	LBPS	MT-0002	RU-0145	RU-6699	US-0220
DE-0010	EGVJ	FR-0325	GB-0128	LBRS	MT-0003	RU-0153	RU-6960	US-0221
DE-0011	EGVL	GB-0001	GB-0130	LBSD	MT-0004	RU-0154	RU-7519	US-0222
DE-0012	EGWZ	GB-0003	GB-0131	LDDP	MT-0005	RU-0159	RU-7612	UUBB
DE-0013	EGXA	GB-0004	GB-0132	LDVK	NL-0038	RU-0161	RU-7673	WID
DE-0028	EGXB	GB-0020	GB-0133	LDZC	NL-0039	RU-0182	RU-9300	XMUC
DE-0076	EGXN	GB-0021	GB-0134	LDZU	NL-0040	RU-0183	RU-9561	X-VIE
DE-0157	EGXQ	GB-0039	GB-0135	LERL	NL-0042	RU-0194	RU-9587	ZA-0102
DE-0166	EGXS	GB-0040	GB-0136	LFAH	NL-0043	RU-0221	SI-0008	
DE-0181	EGYC	GB-0067	GB-0137	LFAN	NL-0044	RU-0227	SM-0001	
DE-0186	EGYI	GB-0074	GB-0138	LFBV	NL-0045	RU-0233	UA-0001	
DE-0209	EHSB	GB-0081	GB-0139	LFGV	NO-0004	RU-0275	UA-0004	
DE-0257	EHVB	GB-0082	GB-0140	LFIO	NO-0005	RU-0278	UA-0006	
DE-0350	EIGM	GB-0083	GB-0141	LFJM	NO-0006	RU-0306	UA-0007	
EBBG	EIKI	GB-0085	GB-0142	LFPR	NO-0028	RU-0311	UA-0008	
EBBW	EKAL	GB-0086	GB-0143	LFQR	NO-0034	RU-0318	UA-0014	
EBCR	EKRR	GB-0087	GB-0144	LFRA	NO-0035	RU-0319	UA-0015	
EBHE	EKVL	GB-0088	GB-0145	LFSC	NO-0037	RU-0320	UA-0017	
EBLI	ENFB	GB-0089	GB-0147	LFSL	NO-0046	RU-0321	UA-0019	
EBNO	ENFR	GB-0090	GB-0148	LFSQ	PL-0004	RU-0324	UA-0023	
EBOT	ENVY	GB-0091	GB-0149	LFTR	PL-0005	RU-0326	UA-0024	
EBZM	ENXQ	GB-0092	GB-0152	LFTU	PL-0006	RU-0328	UA-0026	
EDAL	ENXX	GB-0093	GB-0153	LFXG	PL-0007	RU-0334	UA-0030	
EDDI	EPSK	GB-0094	GB-0154	LFXR	PL-0010	RU-0371	UA-0033	
EDGN	EPSY	GB-0095	GB-0155	LFYM	PL-0011	RU-0374	UA-0035	
EDQA	ESCK	GB-0096	GB-0156	LFYT	PL-0012	RU-0392	UA-0036	
EDTK	ESCN	GB-0097	GB-0158	LGAG	PL-0068	RU-0394	UA-0040	
EDUT	ESCY	GB-0098	GB-0159	LGVO	PL-0071	RU-0395	UA-0041	
EDVP	ESFH	GB-0099	GB-0160	LH58	PL-0073	RU-0410	UA-0045	
EDWB	ESFI	GB-0100	GB-0161	LHTE	PL-0074	RU-0411	UA-0047	
EDWD	ESFJ	GB-0101	GB-0162	LIDI	PL-0082	RU-0413	UA-0053	
EE-0001	ESFQ	GB-0102	GB-0163	LILT	RS-0004	RU-0414	UA-0054	
EE-0004	ESFU	GB-0103	GB-0164	LIPT	RS-0005	RU-0415	UA-0060	
EE-1612	ESFY	GB-0104	GB-0165	LIVV	RS-0006	RU-0416	UA-0061	
EE-4931	ESGL	GB-0105	GB-0167	LKBC	RU-0002	RU-0417	UA-0068	
EE-7685	ESKB	GB-0106	GB-0170	LKCL	RU-0007	RU-0418	UA-0069	

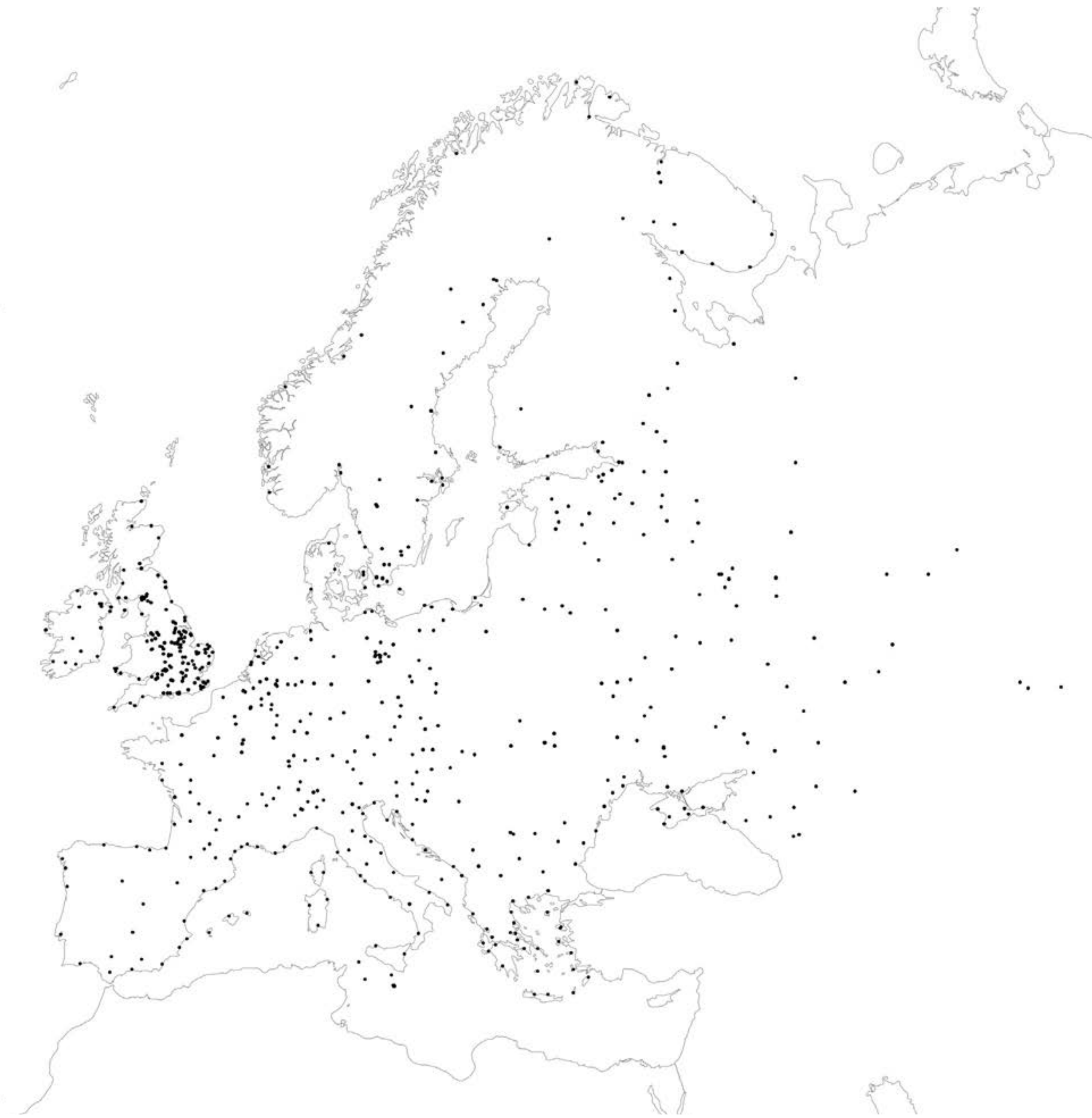


Fig. 0.4 Decommissioned Airfields in Europe, 2017. 477 Total Airfields.

0 1000km

Asia

AM-0001	IR-0017	OTBD
AM-0005	JP-0003	PK-0018
AM-0006	JP-0006	PK-0019
AM-0007	KG-0024	PK-SWV
AZ-0007	KG-0025	RKB1
AZ-0020	KG-0026	RPMY
BNQ	KG-0027	RU-0004
CN-0001	KG-0028	RU-0020
CN-0011	KG-0029	RU-0038
CN-0019	KG-0030	RU-0088
CN-0032	KG-0031	RU-0111
CN-0042	KG-0032	RU-0118
CN-0044	KG-0033	RU-0967
CN-0047	KG-0034	RU-1777
CN-0058	KG-0035	RU-2510
CN-0084	KG-0036	RU-3106
CN-0171	KG-0037	RU-3869
CN-0173	KG-0038	RU-4972
CN-0212	KG-0039	RU-5302
CY-NIC	KG-0040	RU-5537
GE-0001	KG-0041	RU-6153
GE-0002	KG-0042	RU-6553
GE-0003	KHL	RU-7565
GE-0004	KMT	RU-8226
GE-0005	KP-0001	RU-8914
GE-0012	KP-0041	SA-0004
HK-0001	KQSA	SA-0008
ID-0001	KZ-0001	TH-0002
ID-0002	KZ-0024	TM-0002
ID-0018	KZ-0026	TR-0013
ID-0125	KZ-0065	TR-0020
ID-0132	KZ-0066	TR-0022
ID-AHI	KZ-0071	TW-0001
IN-0005	KZ-0072	TW-0003
IN-0006	KZ-0073	TW-0005
IN-0014	KZ-0074	UG25
IN-0016	KZ-0077	UHMH
IN-0017	KZ-0078	UHPO
IN-0018	KZ-0079	UNBA
IN-0019	KZ-6022	UNBR
IN-0020	LA-0001	UNKK
IN-0054	LA-0002	USNR
IN-0055	LA-0003	USSE
IN-0056	LA-0004	UZ-0040
IN-0057	LLAZ	UZ-0053
IN-0058	LTAK	VANR
IN-0059	LTAM	VHHX
IN-0063	LTAX	VN-0002
IN-0068	LTBZ	VN-0003
IN-0077	LVGZ	VN-0010
IN-0078	MY-GTB	VODK
IN-0079	OHE	WAAI
IN-0080	OIBI	WASS
IN-0084	OJJR	WBGY
IN-0094	OMAC	WRLL
IR-0006	OS73	WRSP

Fig. 0.5 Decommissioned Airfields in Asia, 2017. 172 Total Airfields.

0 2000km

South America

AR-0006
AR-0015
AR-0016
AR-0389
AR-0409
AR-0428
AR-0430
AR-0435
AR-0443
AR-0484
BR-0002
BR-0003
BR-0004
BR-0005
BR-0006
BR-0007
BR-0008
BR-0009
BR-0010
BR-0011
BR-0012
BR-0013
BR-0014
BR-0015
BR-0020
BR-0029
BR-0030
BR-0036
BR-0041
BR-0048
BR-SWM
CL-0001
CL-0002
CL-0003
EC-0002
GY-0001
LVB
PY-0026
SA30
SACT
SADD
SARD
SARO
SB03
SB04
SB06
SB26
SB29
SBAV
SBRQ
SCMB
SCMN
SCTI
SDAL
SDBP
SDCC
SDDC
SDDU
SDEB
SDFI
SDIJ
SDJE
SDLM
SDLT
SDNC
SDOS
SDPF
SDPJ
SDQF
SDSY
SDTL
SDUG
SDVK
SEQU
SIEI
SION
SITI
SIWD
SIXT
SJDB
SJEE
SJEO
SJJD
SJJI
SJOB
SJPR
SJPT
SJYC
SK-204
SKOT
SKSF
SNBK
SNDG
SNDY
SNDZ
SNEP
SNFC
SNHA
SNMH
SNOA
SNPG
SNPH
SNRT
SNSK
SNSN
SNWX
SSAC
SSCZ
SSEA
SSFT
SSFV
SSGL
SSGQ
SSMA
SSNE
SSPZ
SSSF
SSVR
SSVV
SSWB
SSWD
SVRF
SWBS
SWEJ
SWEQ
SWES
SWEV
SWFJ
SWGR
SWKK
SWNP
SWNU
SWTM
SWUO
SWXF
SWYD
SWYL
TUZ
URB

Fig. 0.6 Decommissioned Airfields in South America, 2017. 139 Total Airfields.

0 1000km

Oceania

AGGQ
ANH
AOA
AU-0001
AU-0031
AU-0042
AU-0051
AU-0075
AU-BCK
AU-BFC
AU-BVW
AU-CQP
AU-CTR
AU-EDD
AU-EKD
AU-HAT
AU-HIG
AU-KOH
AU-KYF
AU-MNW
AU-MUP
AU-NKB
AU-WRW
AU-WSY
AWR
AYLA
AYRB
BAP
BEA
BIJ
BIZ
BNV
BNZ
BOQ
BVP
DGG
DOS
DPU
GWN
ILX
IUS
KIA
KIZ
KJU
KNL
KSG
KTK
KWV
KWX
LGM
LNQ
LOF
LTB
MGG
MNP
MVI
NFBG
NFNU
NTA
NZ-0006
NZHB
NZPK
NZTZ
NZWG
OML
PBAR
PF-0001
PG-0061
PG-0062
PG-0063
PG-0075
PG-0076
PG-0077
PG-0078
PG-0080
PG-0081
PG-0082
PG-0084
PG-0085
PG-0086
PG-0087
PG-0088
PG-0089
PG-0090
PG-KXR
PJON
PUI
RCN
RGE
RNR
SUZ
TAA
TBA
TIG
TSK
TUT
UM-0001
USO
WAB
WGU
YBER
YBIK
YBML
YCAA
YEDH
YELR
YGAT
YHOX
YLCI
YLPR
YLVT
YLZR
YMQD
YOOB
YPAK
YPLE
YWAN
YWDR
YWKH
YWLE
YWMD
YXKE
YYCN
YYWE

Fig. 0.7 Decommissioned Airfields in Oceania, 2017. 124 Total Airfields.

0 1000km

Africa

AO-0009
AO-0010
AO-0013
AO-0014
AO-0015
AO-0018
AO-0026
AO-0031
AO-0036
BW-0010
BW-0032
DABP
DZ-0003
ET-0001
FAAD
FABN
FAHM
FAIO
FAQR
FBML
FBNW
FBSR
FBTE
FDSK
FHSH
FWDZ
FWKB
FYRP
FZJA
GMMC
HADB
HUKC
KE-0006
KE-6155
KOL
LAD
MA-0001
MR-0001
MR-0002
MZ-0004
MZ-0015
NA-0007
NA-0077
NA-0163
NG-0001
PAF
SC-0001
SC-0002
TZ-0002
TZ-0019
TZ-0038
TZ-0040
WGY
ZA-0107
ZA-0118
ZA-0121
ZA-0128
ZA-0135
ZLG
ZM-CGJ

Fig. 0.8 Decommissioned Airfields in Africa, 2017. 60 Total Airfields.

Part I: Options

Buying Time

Holding Ground

Recycling

Transforming

Part I of *Airfield Manual* summarizes issues attendant to the management, deactivation, and reimagining of airport sites. It enumerates options for those engaged in these activities—owners, government agencies, designers, and planners, among others—in order to allow them to evaluate opportunities and conceptualize new possibilities for abandoned airport sites. This section describes the conditions of abandoned and underutilized airports according to ownership (Buying Time), occupation (Holding Ground), condition (Recycling), and potential for adaptive reuse (Transformation).

These chapters follow a careful assessment of a site as found from operating airport through decommissioning and transition to redevelopment. These chapters offer a layered reading of an airport site as the synthesis of many systems, flows, surfaces, and structures. Part I concludes with the description of five discrete strategies for the responsible transformation of airport sites: Adapt, Conserve, Convert, Develop, Regrow. These sections offer a diverse range of scenarios for the informed, imaginative, and realizable redevelopment of an airport site.

Case Studies and Keys

Fig. 1.1	JFO:	Crissy Field, San Francisco, United States.
Fig. 1.2	DEN:	Stapleton International Airport, Denver, United States.
Fig. 1.3	THF:	Berlin Tempelhof Airport, Berlin, Germany.
Fig. 1.4	THF:	Berlin Tempelhof Airport, Berlin, Germany.
Fig. 1.5	ATH:	Hellinikon International Airport, Athens, Greece.
Fig. 1.6	RKV:	Reykjavik Airport, Vatnsmyri, Iceland.
Fig. 1.7	RKV:	Reykjavik Airport, Vatnsmyri, Iceland.
Fig. 2.1	XXX:	Johannisthal Airfield, Berlin, Germany.
Fig. 2.2	YZD:	Downsview Airport, Toronto, Canada.
Fig. 2.3	YZD:	Downsview Airport, Toronto, Canada.
Fig. 2.4	NZJ:	Marine Corps Air Station El Toro, Orange County, United States.
Fig. 2.5	NZJ:	Marine Corps Air Station El Toro, Orange County, United States.
Fig. 2.6	GWW:	Royal Airforce Station, Gatow, Germany.
Fig. 3.1	UIO:	Mariscal Sucre International Airport, Quito, Ecuador.
Fig. 3.2	UIO:	Mariscal Sucre International Airport, Quito, Ecuador.
Fig. 3.3	UIO:	Mariscal Sucre International Airport, Quito, Ecuador.
Fig. 3.4	SRF:	Hamilton Army Airfield, Novato, United States.
Fig. 3.5	TXG:	Taichung Airport, Taichung, Taiwan.
Fig. 3.6	TXG:	Taichung Airport, Taichung, Taiwan.
Fig. 3.7	MDY:	Henderson Field Airport, Sand Island, Midway Atoll, United States Territory.
Fig. 4.1	NOP:	Floyd Bennett Field, New York, United States.
Fig. 4.2	XXX:	Naval Air Station Squantum, Quincy, United States.
Fig. 4.3	EDNO:	Fliegerhorst Oldenburg, Oldenburg, Germany.
Fig. 4.4	CGX:	Merrill C. Meigs Field Airport, Chicago, United States.
Fig. 4.5	XXX:	Francisco de Miranda Airbase, Caracas, Venezuela.
Fig. 4.6	CAS:	Anfa Airport, Casablanca, Morocco.

Airfield Perimeter

Permeable Surface

Impermeable Surface

Hydrology

Ecology

Production

Urbanization

Buying Time

During the past decade, processes of economic restructuring related to production have led to less stable and predictable demand for airport facilities. Airport plans, which typically project a 20- or 30-year horizon, cannot keep pace with the rapid dynamics of the current aviation market. In 2008 and 2009 the economic downturn reduced demand for air service, general aviation, and cargo services in both North America and Europe and led many airport administrators to reconsider their strategies and plans. To address a higher level of risk, they strived to more fully utilize their land and facilities by diversifying their non-aviation activities.[8] In many cases, however, this diversification failed to adequately reignite activity and did not prevent the ultimate closure of a number of airports.

Own

For many mayors and airport owners, abandoned airports pose problems related to urban contamination, wasted land, and economic decline. These sites embody great risk to their owners, who must assess issues of political, legal, economic, ecological, and urban liability. As a result, these stakeholders do not immediately see a benefit to making technical or physical improvements to their underused facilities or to increasing the number of scheduled flights. Instead, the governing bodies of abandoned and underused airfields must evaluate the most feasible strategies of reuse and take deliberate action to capitalize on new and as yet unforeseen opportunities to create new landscapes from these grounds.[9]

Operate

The closure of an airport, even if temporary, has multiple implications. First of all are the changes that it brings to the uses of the ground and the mobility and circulation that connect the site. Second, the relocation of airport activities has significant impacts on the zone immediately surrounding the airport as well as on the larger urban region. Third, the closure of an airport presents an “urban vacuum” of great proportions within a metropolitan area.

The land made available when an airport closes is often large enough to warrant subdivision into parcels for various kinds of planning and development including general aviation development, air cargo and logistics centers, hotels, convention centers, office parks, intermodal transit centers, retail malls, industrial parks, golf courses, and sports arenas. Such multi-use developments are inevitably complex, involving public and private partnerships, FAA assurances and obligations, extensive site preparation, as well as financing through an assortment of grants, bonds, private capital, and tax abatements.[10]

Inventory

When considering the transformation of a closed airport, one of the first steps is to evaluate the site’s state of conservation and comprehensively inventory its existing natural and artificial elements. Identifying the “raw materials” of the site allows owners to accurately characterize the airport as found. This takes account of ecological resources and features (hydrologic, topographic, wildlife, vegetation) as well as manmade assets (buildings, vehicles, infrastructures, utilities, surfaces). The act of inventorying is especially imperative in cases where ownership of an airport has been taken over or inherited from another party.

Inventorying is the first step in determining which of these resources to save and which to reject. Owners should consider the short- and long-term value of each site element and ask what can be used as is, what can assume new use, what can be repaired, adapted, moved offsite, sold for revenue, recycled, and demolished.

Analyze

Airports are characterized by seemingly paradoxical conditions. They act centripetally and centrifugally because they are planned for peripheries but often become geographically central to their cities. They are composed of generic and specific elements, which must afford numerous activities and highly specialized operations. They possess vast horizontal spaces (largely empty spaces that are engineered for margins of error or accidents) while they are among the most economically productive—and environmentally impactful—sites in the cities that they serve. This combination of centrality, vastness, and productivity makes a strong case for investment in these sites. It is already common for airport administrations to conduct market analysis or reuse assessment even before their facilities become redundant.

Situate

Cities around the world are now facing the question of what to do with enormous, highly contaminated, airfields that no longer serve their original purpose. Some of these sites have relationships with their cities that cannot simply be denied or erased. “Airports are now more concerned about the landscape and may even become laboratories for how the cities of the future will operate, since airports have complex environments of intensive energy consumption, water use, waste generation, security concerns, transportation pressures, and commercial enterprise.”[11] Before any transformation can occur on a site, however, it is first necessary to understand the site’s state of contamination and the kinds of programs and operations that are possible there as a result.

Airports in the United States can be categorized according to seven standard environmental condition categories with respect to the requirements of Section 120(h) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Community Environmental Response Facilitation Act (CERFA) of 1992, and Section 331 of the National Defense Authorization Act for Fiscal Year 1997.[12] This classification is intended to permit airport owners to classify properties into seven area types in order to facilitate and support Findings of Suitability to Transfer (FOSTs), Findings of Suitability to Lease (FOSLs), and Clean Parcel Determinations pursuant to the requirements of CERFA. In other words, this allows airport owners to determine which properties on closing airports are suitable or unsuitable for transfer by lease or deed based on the existence of various pollutants on the site.[13] The designation of an area type signals that an airport owner has conducted sufficient studies to establish the environmental condition of the property or has complied with the identification requirements of uncontaminated property under CERFA.

The areas types are ranked 1 through 7, in order of their suitability for transfer. Areas classified as Type 1 through Type 4 are considered suitable for transfer by deed. Areas classified as Type 5 and Type 6 are considered unsuitable for transfer by deed until all remedial actions have been completed or until the remedy has been demonstrated to be operating properly and successfully. Areas classified as Type 7 have not been evaluated or require additional study before being assigned a Type.

JFO

Fig. 1.1a. Crissy Field, San Francisco, United States.

Area: 55 ha
Pervious Surface: 8 ha
Impervious Surface: 47 ha
Runway Length: 0.6 kms
Perimeter: 4.6 kms

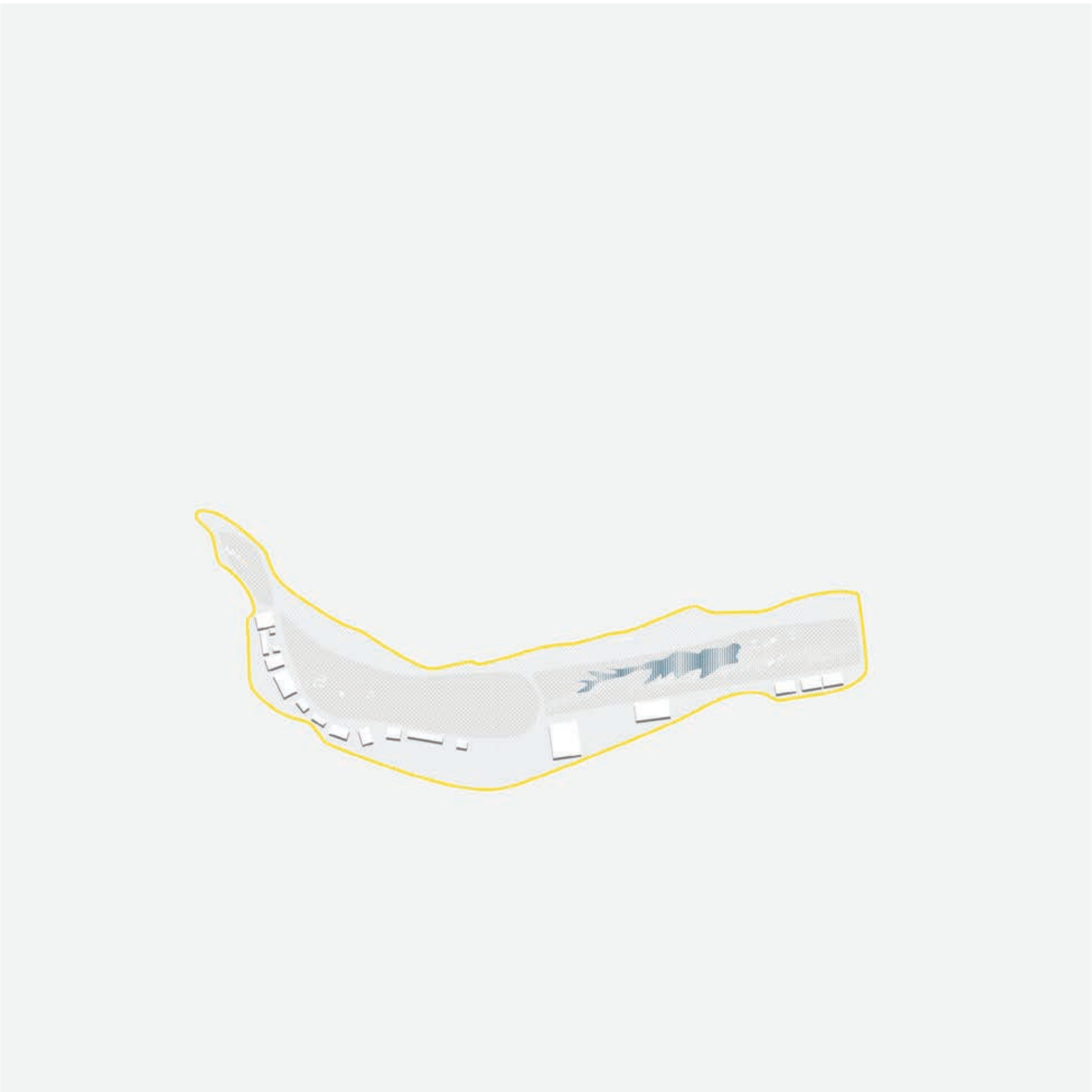


Fig. 1.1b. Hargreaves Associates, et al., Crissy Field, 2001.

0 500m Scale: 1:25,000

Area: 55 ha
Open Area: 25 ha
Built Area: 30 ha
Water Area: 13 ha
Perimeter: 4.6 kms

DEN

Fig. 1.2a. Stapleton International Airport, Denver, United States.

Area: 596 ha
Pervious Surface: 221 ha
Impervious Surface: 375 ha
Runway Length: 5.8 kms
Perimeter: 12 kms

Fig. 1.2b. AECOM, et al., Stapleton Redevelopment, 1997.

0 500m Scale: 1:25,000

Area: 619 ha
Open Area: 247 ha
Built Area: 372 ha
Water Area: 20 ha
Perimeter: 12 kms

THF

Fig. 1.3a. Berlin Tempelhof Airport, Berlin, Germany.

Area: 368 ha
Pervious Surface: 248 ha
Impervious Surface: 120 ha
Runway Length: 4.2 kms
Perimeter: 7.7 kms

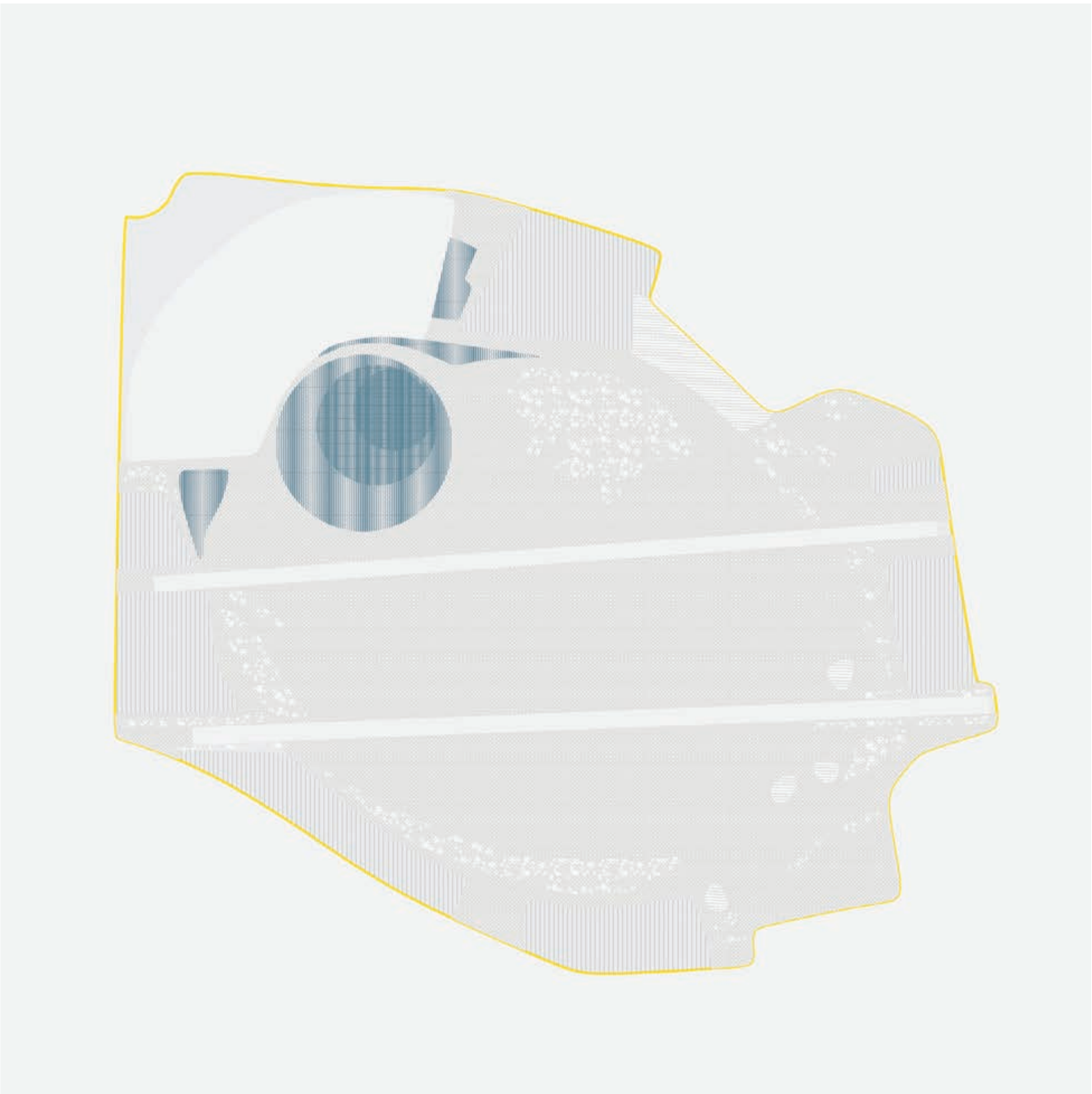


Fig. 1.3b. Gross.Max and Sutherland Hussey Architects, et al., Parklandschaft Tempelhof, 2010.

Area: 368 ha
Open Area: 233 ha
Built Area: 135 ha
Water Area: 26 ha
Perimeter: 7.7 kms

0 500m Scale: 1:25,000

THF

Fig. 1.4a. Berlin Tempelhof Airport, Berlin, Germany.

Area: 368 ha
Pervious Surface: 248 ha
Impervious Surface: 120 ha
Runway Length: 4.2 kms
Perimeter: 7.7 kms

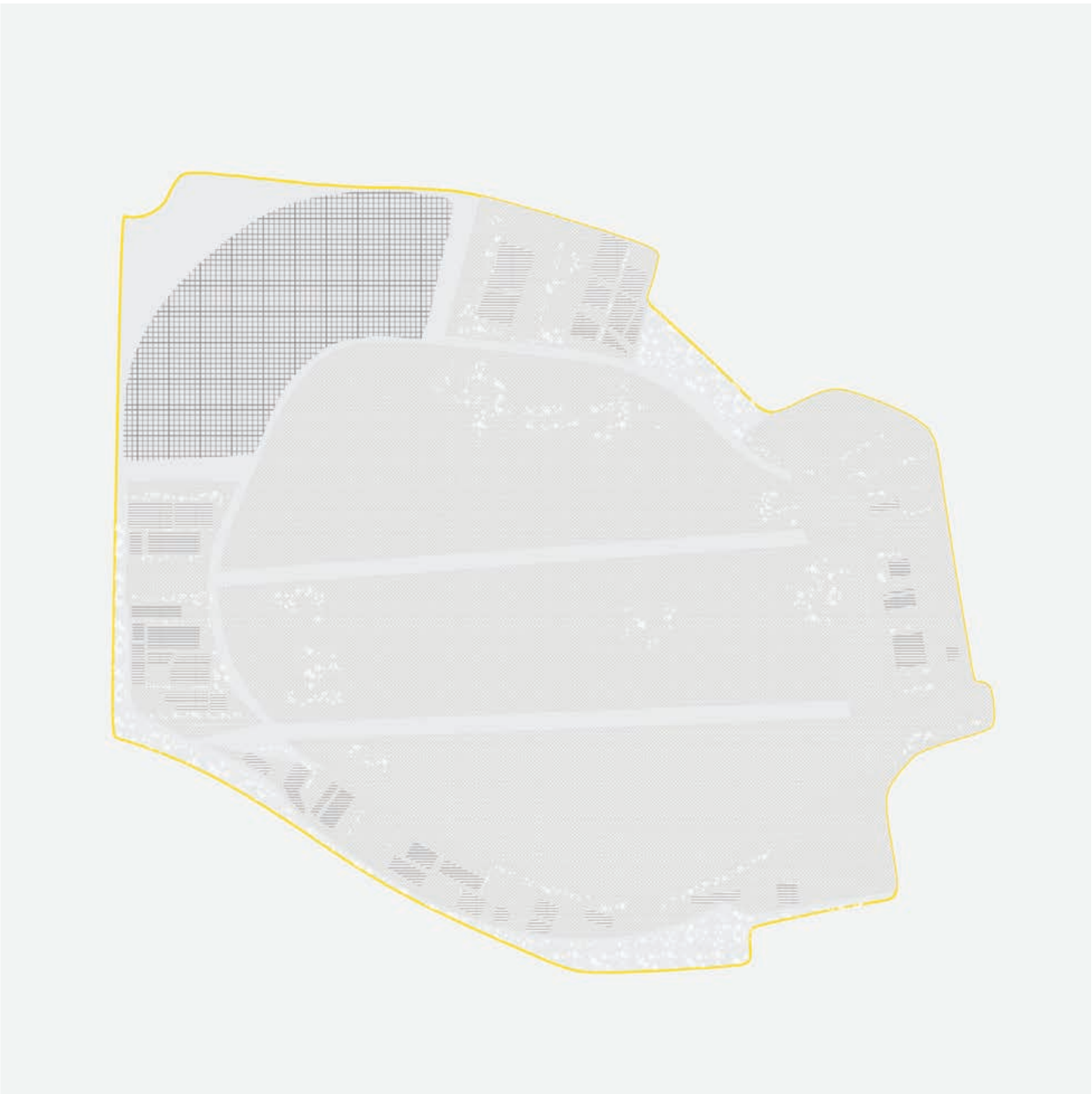


Fig. 1.4b. Topotek 1 and Durig AG, et al., Parklandschaft Tempelhof, 2010.

0 500m Scale: 1:25,000

Area: 368 ha
Open Area: 260 ha
Built Area: 108 ha
Water Area: 15 ha
Perimeter: 7.7 kms

ATH

Fig. 1.5a. Hellinikon International Airport, Athens, Greece.

Area: 362 ha
Pervious Surface: 122 ha
Impervious Surface: 238 ha
Runway Length: 1.96 kms
Perimeter: 11.5 kms

Fig. 1.5b. Philippe Coignet, et al., Hellinikon Metropolitan Park and Urban Development, 2005.

0 500m Scale: 1:25,000

Area: 559 ha
Open Area: 273 ha
Built Area: 286 ha
Water Area: 8.7 ha
Perimeter: 18.3 kms

RKV

Fig. 1.6a. Reykjavik Airport, Vatnsmyri, Iceland.

Area: 136 ha
Pervious Surface: 79 ha
Impervious Surface: 57 ha
Runway Length: 4.1 kms
Perimeter: 6 kms

Fig. 1.6b. Lateral Office, et al., From Runways to Greenways, 2007.

0 500m Scale: 1:25,000

Area: 184 ha
Open Area: 64 ha
Built Area: 120 ha
Water Area: 4 ha
Perimeter: 9.9 kms

RKV

Fig. 1.7a. Reykjavik Airport, Vatnsmyri, Iceland.

Area: 136 ha
Pervious Surface: 79 ha
Impervious Surface: 57 ha
Runway Length: 4.1 kms
Perimeter: 6 kms

Fig. 1.7b. Agence Ter and Reichen et Robert & Associes, et al., Reciprocity: Shaping of a Capital City, 2007.

0 500m Scale: 1:25,000

Area: 274 ha
Open Area: 72 ha
Built Area: 202 ha
Water Area: 0 ha
Perimeter: 8 kms

Holding Ground

The decision to close an underutilized airfield is not readily obvious to owners, so it may take an owner several years to choose to definitively shut down an airport. Likewise, the subsequent process of the site's transformation will require an extended period of gestation, preparation, and construction before it is achieved. During the period of time between the airport's peak use, disuse, decommissioning, and transformation, owners must decide how to utilize their infrastructures in the meantime. By using the airport as a reserve for new activities, the site will undergo gradual transformation and generate new and unexpected uses. This phase is a transitional condition in which airports reveal latent patterns for new lifecycles. For airports on-hold, as such, this period of diversifying operations prepares the field for future transformation.[14] Therefore it is not uncommon for underutilized airports to remain in a transitional state of limbo for some time while possible alternative scenarios are discovered and evaluated.

Survey

Airports on-hold include those that never reached their full productivity or that prematurely lost the primary role that they once served in a region. In many cases an underused airport may diversify its activities in order to increase its sources of revenue. The planning and selection of these activities may directly function to fill a service gap or address unmet demand, offer cost-saving incentives to an airline, or cater to a particular market niche.[15] On the other hand, diversification may even involve suspending aviation services in order to allow investment into alternative activities. In that case, an airport may generate revenue by serving as an infrastructural space that promotes and develops other local economic activities. In this capacity, an airport on-hold may help to catalyze local economies while finding ways to sustain itself during its own processes of transition.

Remove

When an airport goes on-hold in its transitions between use, decommissioning, and transformation, elements on site may be reconfigured or removed. In order to adapt to short-term or provisional solutions on site, existing structures and infrastructures may need to be modified or rearranged. Ultimately, however, it is likely that many elements on site will be removed in order to eliminate certain site functions and accommodate new ones. Deliberate planning and consideration of the temporary or permanent nature of various elements on site will be necessary to manage the site's transitions between uses.

Clean

An abandoned airport can be thought of as a brownfield. Landscape ecology strategies may be used to clean contaminated air, water, and soil on these sites over time. Compared to most brownfields, however, abandoned airports are often much larger, more peripheral, and more highly contaminated. As a result, they may require additional efforts before they can be redeveloped.

Unlike most brownfields, many airports are publicly owned. Airport administrators can manage the dangers and liabilities of contamination with much less risk than the private owners of most brownfield sites. Fear of litigation and other unanticipated expenses and schedule setbacks may prevent private owners of brownfields from initiating remediation. The ability of public agencies to mitigate risk, however, makes remediation a viable strategy for abandoned airport sites.

The airport lands themselves—previously used for industry, aviation, and commercial purposes—may range from harmless to acute levels of contamination. Sites with low concentrations of hazardous waste or pollution have the potential to be reused as soon as they are remediated. In San Francisco (Crissy Field, fig. 1.1) for example, marshlands that were largely destroyed by the dumping of toxins have been restored. In Denver (Stapleton Redevelopment, fig. 1.2) significant efforts have been taken to remove high levels of aircraft fuel and cleaning chemicals from the ground. In cases such as Berlin (Tempelhofer Park, figs. 1.3, 1.4), however, no remediation was proposed. It was determined that, despite the presence of contaminated soils, air quality was not affected by the ground contaminants and the site posed no danger to visitors.

Occupy

One possible stage in the conversion and reactivation of an airfield may involve using the site for temporary activities and public events. This kind of site occupation can take place at the same time that administrators and owners are considering their options for the site's future. Public events also provide opportunities for citizen engagement in the site's reshaping.

The case of Athens (Hellinikon Metropolitan Park, fig. 1.5) illustrates a successful example of a short-term management project. In the summer of 2004 the northwest area of the airport was used to host events for the Olympic games. This use contributed to a local desire to preserve the airfield as an open site for the community, which led a regional coalition to take action to keep the airfield open as a public park after the games. This began in 2007 with the re-appropriation of the Agios Kosmas Beach adjacent to the airport site. In 2008, locals were engaged in a tree-planting effort on the site. In a similar way to Berlin (Tempelhofer Park, figs. 1.3, 1.4), "urban pioneers" were allowed to occupy parts of the site and become active agents in its transformation. This strategy of "temporary urbanism" based on the initiative and action of entrepreneurial locals represents one of the new models of public-oriented urban development engendered by the conversion of former airport sites.[16] Through the successes of these experiments in Athens's public realm, a referendum passed in 2010 to make the airfield open to the public as parkland.

Brand

The transformation of the airport landscape creates new environmental, touristic, cultural, and recreational dynamics on the site. The redevelopment of airport sites provides opportunities to strengthen local identity and increase appeal as an international destination by becoming more attractive to residents, tourists, and businesses alike. That ambition is leading the way in redevelopment projects for cities like Vatnsmýri (Reykjavík Airport, figs. 1.6, 1.7).

Some airfields now being used as public parks have generated strong identities within their urban communities. This is the case in Berlin (Tempelhofer Park, figs. 1.3, 1.4) where the airfield is a powerful symbol for locals, embodying a historic and cultural link to the city's past. In San Francisco (Crissy Field, fig. 1.1) the former airfield had served as a landmark of early aviation history and, after being decommissioned, was transformed into a national park.[17] The restoration of wetlands on the site created a new dynamic environment with diverse recreational uses that allowed the identity of the historical landscape to remain visible to visitors. Environmental restoration was also carried out in Berlin (Landscape Park Johannisthal, fig. 2.1) to establish a nature conservation area on the abandoned airport site.[18]

Many airports around the world are also recognized by the iconic image of their terminal buildings. This image should be considered valuable to the brand of an abandoned airport as it undergoes transformation. In Athens (Hellinikon Metropolitan Park, fig. 1.5), the 1960 East Terminal building designed by Eero

Saarinen and Associates was preserved on the site as an architectural landmark. In contrast, many airport projects propose new iconic images as concepts that help to drive transformation. In Toronto (Downsview Park, fig. 2.2), for example, Bernard Tschumi Architects proposed “the digital and the coyote” as a new conception of the natural and the cultural, and offering a new understanding of the site and potentially a new brand for how to live there.

XXX

Fig. 2.1a. Johannisthal Airfield, Berlin, Germany.

Area: 197 ha
Pervious Surface: 153 ha
Impervious Surface: 44 ha
Runway Length: -
Perimeter: 5.9 kms

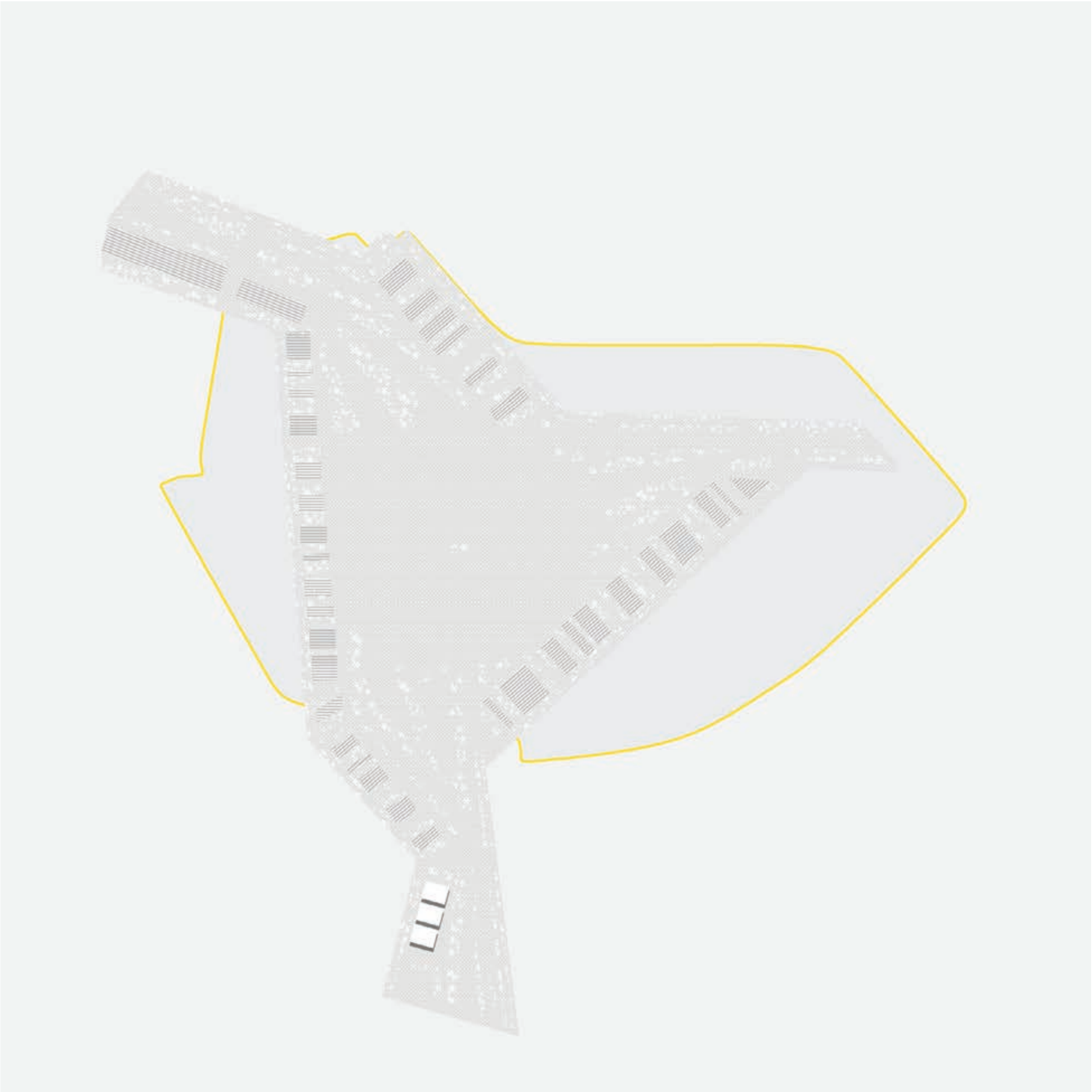


Fig. 2.1b. Buro Kiefer Landschaftsarchitektur Berlin, et al., Landscape Park Johannisthal, 2010.

0 500m Scale: 1:25,000

Area: 312 ha
Open Area: 312 ha
Built Area: 0 ha
Water Area: 15 ha
Perimeter: 15.1 kms

YZD

Fig. 2.2a. Downsview Airport, Toronto, Canada.

Area: 261 ha
Pervious Surface: 137 ha
Impervious Surface: 124 ha
Runway Length: 2.1 kms
Perimeter: 8.6 kms

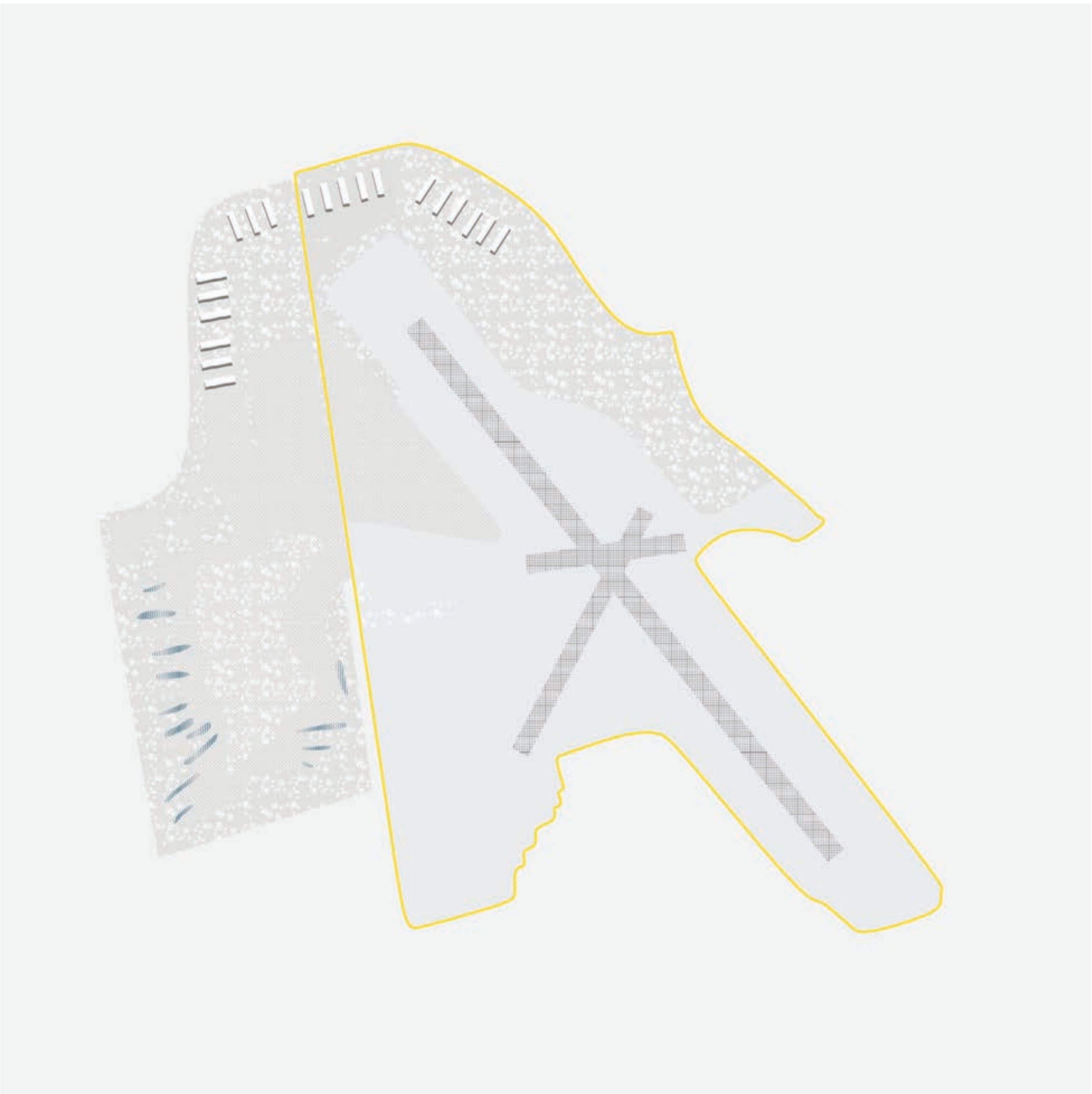


Fig. 2.2b. Bernard Tschumi and Gunta Mackars, et al., Downsview Park, 1999.

0 500m Scale: 1:25,000

Area: 193 ha
Open Area: 193 ha
Built Area: 0 ha
Water Area: 2.3 ha
Perimeter: 9.6 kms

YZD

Fig. 2.3a. Downsview Airport, Toronto, Canada.

Area: 261 ha
Pervious Surface: 137 ha
Impervious Surface: 124 ha
Runway Length: 2.1 kms
Perimeter: 8.6 kms

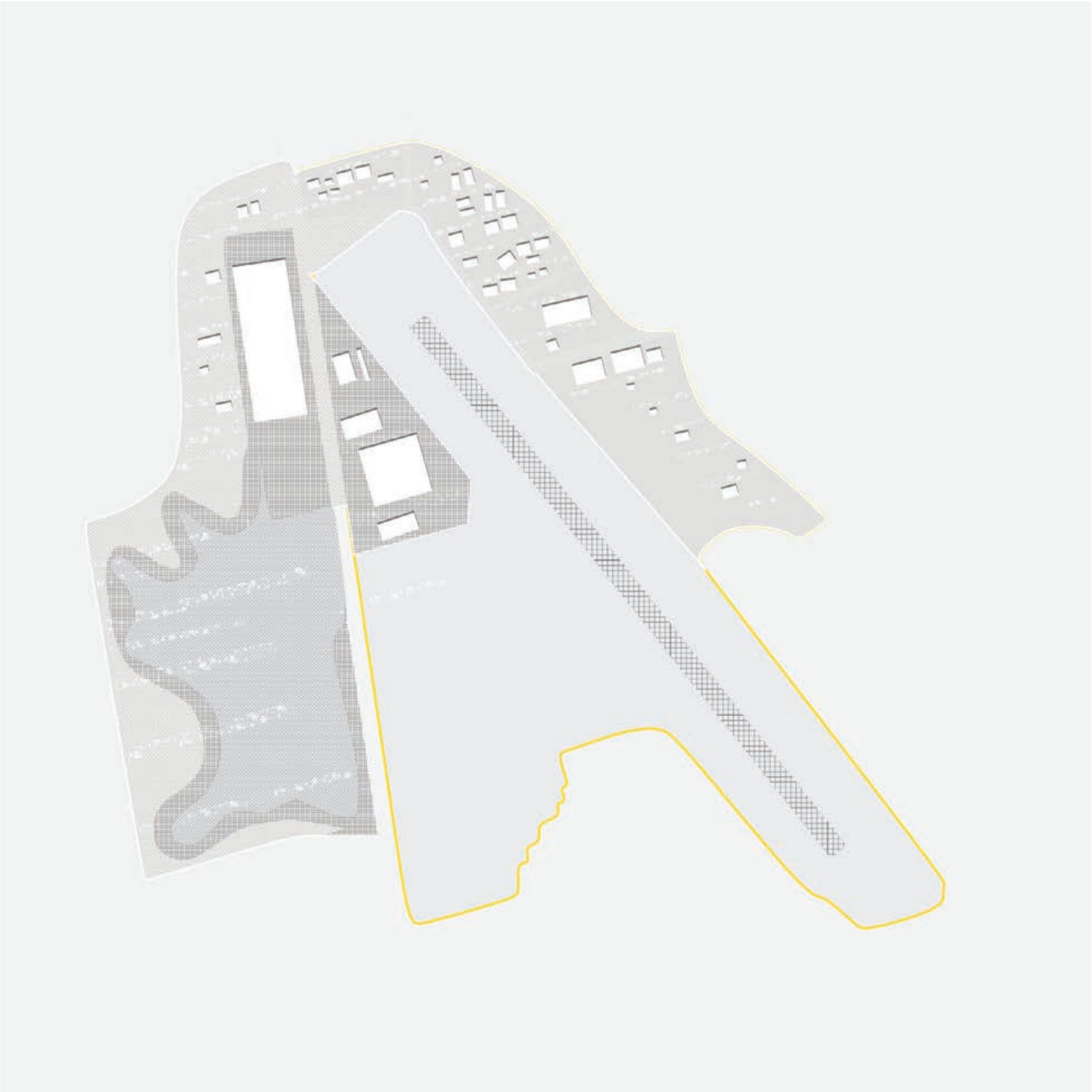


Fig. 2.3b. James Corner Field Operations, Stan Allen, et al., Downsview Park, 1999.

0 500m Scale: 1:25,000

Area: 193 ha
Open Area: 193 ha
Built Area: 0 ha
Water Area: 2.3 ha
Perimeter: 9.6 kms

NZJ

Fig. 2.4a. Marine Corps Air Station El Toro, Orange County, United States.

Area: 1089 ha
Pervious Surface: 530 ha
Impervious Surface: 560 ha
Runway Length: 14.1 kms
Perimeter: 13.6 kms

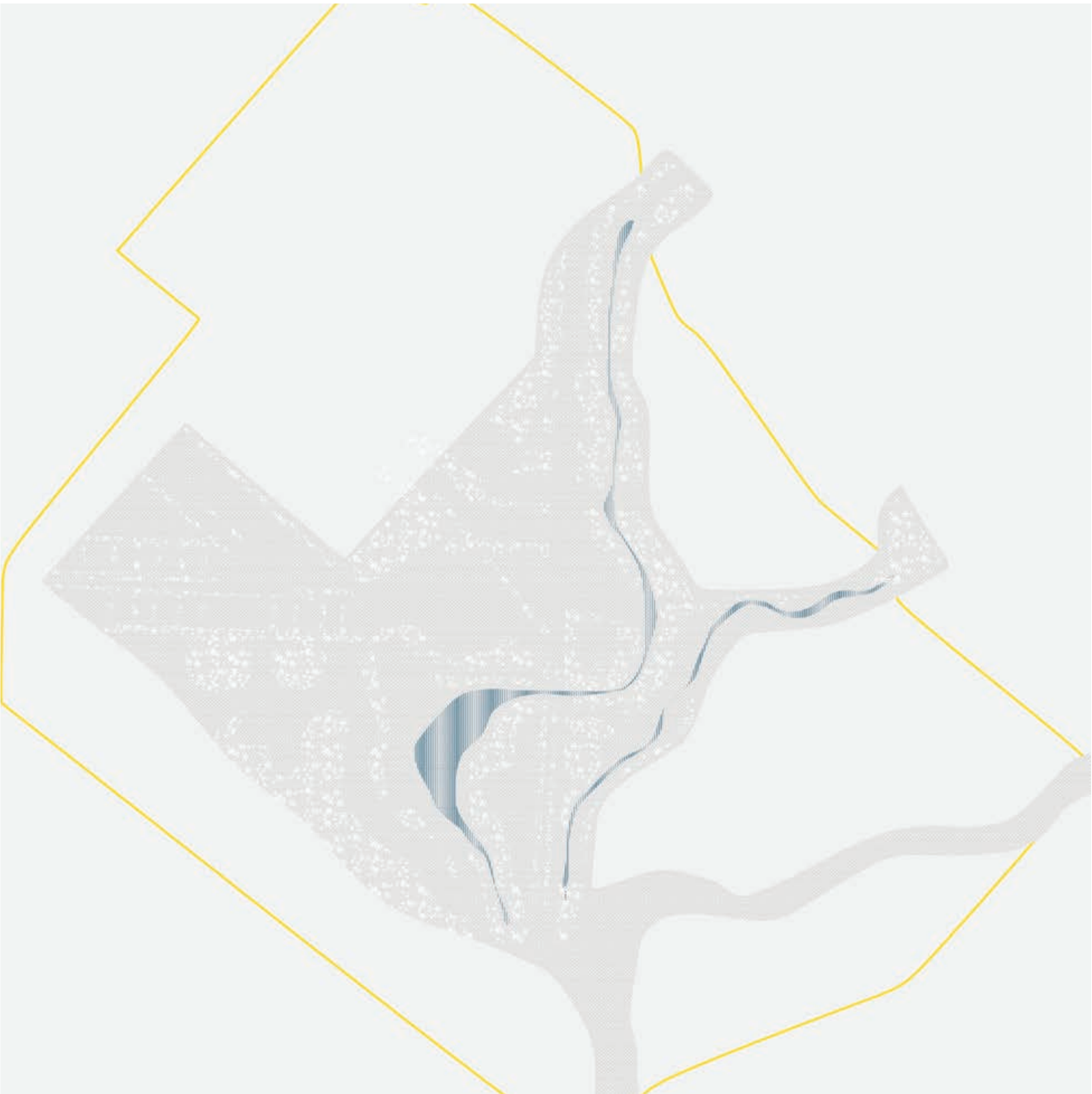


Fig. 2.4b. Ken Smith and Mia Lehrer Associates, et al., Orange County Great Park, 2010.

0 500m Scale: 1:25,000

Area: 1089 ha
Open Area: 616 ha
Built Area: 473 ha
Water Area: 114 ha
Perimeter: 13.6 kms

NZJ

Fig. 2.5a. Marine Corps Air Station El Toro, Orange County, United States.

Area: 1089 ha
Pervious Surface: 530 ha
Impervious Surface: 560 ha
Runway Length: 14.1 kms
Perimeter: 13.6 kms

Fig. 2.5b. Hargreaves Associates, et al., Orange County Great Park, 2005.

0 500m Scale: 1:25,000

Area: 1089 ha
Open Area: 616 ha
Built Area: 473 ha
Water Area: 114 ha
Perimeter: 13.6 kms

GWW

Fig. 2.6a. Royal Airforce Station, Gatow, Germany.

Area: 180 ha
Pervious Surface: 124 ha
Impervious Surface: 56 ha
Runway Length: 7.4 kms
Perimeter: 6.5 kms

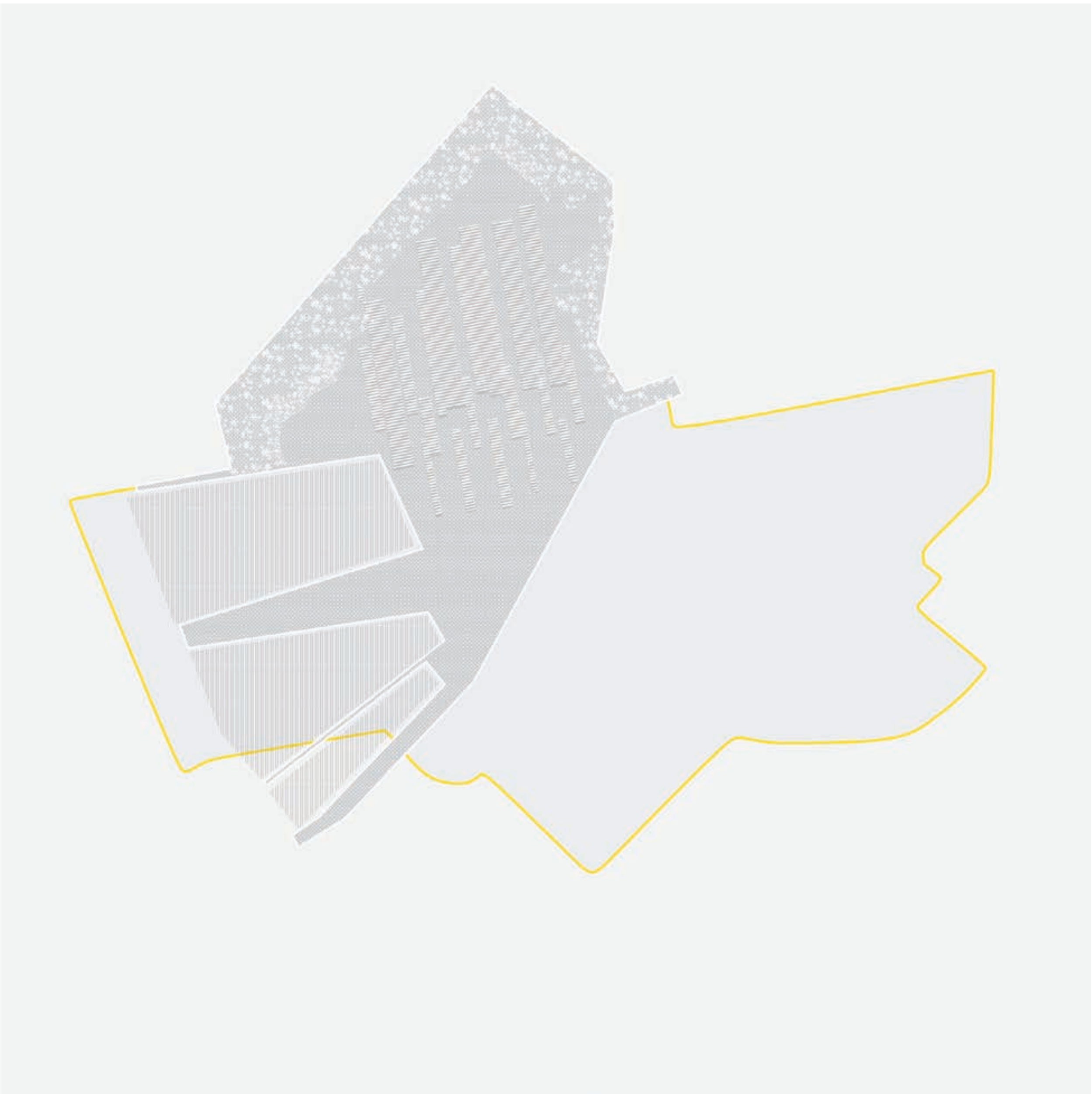


Fig. 2.6b. Buro Kiefer Landschaftsarchitektur Berlin, et al., Park Landscape and Urban Agriculture Gatow, 2011.

0 500m Scale: 1:25,000

Area: 90 ha
Open Area: 74 ha
Built Area: 16 ha
Water Area: 13 ha
Perimeter: 8.2 kms

Recycling

The fact that airfields occupy expansive terrains presents a unique challenge to their reincorporation into the existing structure of the city. To claim the airport as an ecological and environmental territory to be managed, and not simply as a project of engineering or architecture, is already an important conceptual breakthrough: only very recently has the airport been claimed as a site *of* and *for* landscape.[19]

In some cases, airfields are definitively closed and undergo a period of uncertainty before their terrains are completely re-cycled as parks, ecological corridors, or new residential districts. To view the airfield as land that can be revived or renewed means to take under consideration its rhythms, lifecycles, and transformations. This suggests that it is in a constant state of change in which each transition allows continuous regeneration of the site. To activate this re-cycling process, airports must initiate new kinds of rhythms and lifecycles, assume alternative functions, and generate new trade and exchange with cities, landscapes, and territories. Gradually, these terrains can adapt into territorial nodes of ecological, touristic, and recreational activity.

Regenerate

The termination of airport operations undoubtedly has great impact on the urban areas associated with an airport. These effects are a result of the change in dynamics caused by the relocation of economic activities traditionally tied to the airport. Jobs, revenue, investment, and other flows of people and capital are displaced from the urban districts that they had been serving. But the subsequent availability of space constitutes a rare opportunity to regenerate a portion of the city. By taking under consideration changes in land use, improvements to mobility and connectivity, strengthening of infrastructures, allocation of green public spaces, and environmental restoration, designers, developers, and officials can tap the potential of abandoned airport sites to recuperate urban landscapes and elevate the quality of life of current and future residents of the city. Such is the case in Berlin (Tempelhofer Park, figs. 1.3, 1.4) where the abandoned airfield provides an unprecedented outdoor "living room" and events area at a metropolitan scale. On the neighborhood scale, it also offers small park and garden spaces along its edges. In Irvine (Orange County Great Park, fig. 2.4) the airport became a metropolitan park serving the entire Southern California region.

Repurpose

When an airport closes, hundreds of hectares of land are made available for other uses. Access to this land provides new opportunities to reconceptualize a significant portion of the city. For one, it affords new public spaces for recreation, leisure, and gathering at a local/metropolitan scale. It provides the raw material for a recuperated, contemporary landscape on the site. Once airport regulations that for years had restricted certain kinds of development have been lifted, urban connections and the overall transportation network can be adjusted and reconfigured. And, as mentioned above, environmental remediation becomes possible on the land once aviation ceases. These strategies have been employed in Berlin (Park Landscape and Urban Agriculture Gatow, fig. 2.6) where the reimagining of the newly available land built upon the character and qualities of the existing buildings. In Quito (Parque Bicentenario, figs. 3.1, 3.2, 3.3) the project provides visitors the opportunity to experience the vastness of the airfield landscape within its active metropolitan context.

Program

Traditionally the planning process for the transformation of an abandoned airfield begins with a number of suitability studies. With the information gathered by these studies, landowners and authorities invite firms to propose masterplans, very often through open or invited competitions. In many cases, public-private partnerships have been initiated to lead these processes. Such was the case in Athens (Hellinikon Metropolitan Park, fig. 1.5) where in 2005 the International Union of Architects, the Greek Ministry of Environment, and the Organization for the Planning and Environmental Protection of Athens sponsored an open international competition for the design of a large urban park with new housing, office space, and civic infrastructures. In cases like Denver (Stapleton Redevelopment, fig. 1.2), the Stapleton Development Foundation, a private non-profit organization, set the transformation process in place. In Novato, California, outside San Francisco (Hamilton Army Airfield, fig. 3.4), a multiagency group began a long-term management project with a 13-year tide-monitoring plan.

As mentioned above (see Occupy), the participation and engagement of the public is very important over the course of an airport's transformation. Many cases of parks constructed in abandoned airfield sites suggest that public participation has served an integral role in shaping the program and design. Consultations with members of the public, supported by outreach programs, regional opinion polls, and stakeholder planning sessions, can help to ensure that projects will meet the needs of the community. During mini-laboratory sessions held in Irvine (Orange County Great Park, figs. 2.4, 2.5), several strategies that were proposed by the public—such as the reuse of El Toro stone (concrete salvaged from former runways), the use of solar-powered trash compactors, and vegetated swales for storm-water management—were ultimately implemented in the design of the park. In San Francisco (Crissy Field, fig. 1.1) engagement with community members came in the form of the many volunteers who performed work in the preparation and remediation of the site for its redevelopment into an urban park.

Mitigate

Aviation activities directly affect the environment. Aircraft and ground vehicles emit gases into the air and pollutants into the ground. These vehicles and portions of the airfield are treated with various chemicals to enhance visibility, retard icing, and remove wildlife. The effects of this pollution persist for many years in the various surfaces and subsurfaces of the airfield. In some cases, the level of contamination is not sufficiently significant to warrant a cleanup period before transformation can begin on site. If contamination levels are low enough that a site is safely occupiable, gradual mitigation measures can be taken over longer periods of time while other projects of reoccupation are underway on site. This gradual process often involves "deploying green tactics to better manage storm and wastewater, being more thoughtful about open space, and integrating wildlife."[20] Such a landscape might combine new public uses with the protection of natural systems and the conservation and introduction of wildlife.[21]

In 1999, the U.S. Congress authorized an ecosystem restoration project in Northern California (Hamilton Wetland Restoration, fig. 3.4) whose intent was to perform resource mitigation for vegetation and wildlife, threatened species, water and air quality, land use, and public health and safety.[22] Ecological practices very often drive the process of airfield transformation, as in Taiwan (Taichung Gateway Park, fig. 3.6) where an innovative water management strategy that integrated a symbiotic treatment system was central to the project. In Midway Atoll (Henderson Field Airport, fig. 3.7) geological processes informed an essential understanding on the site of the relationship between climate and strategies of carbon sequestration and coral reef development.

Reactivate

The recuperation and transformation of former airports have turned urban voids into catalysts for development and new public realms. The physical enormity of these sites, however, often presents challenges to their adaptation and reuse.[23] Proposals for these expansive voids must ignite a new urban vibrancy and social life on site by reactivating engagement with the local community. Sites must attract a consistent flow of investors, tenants, and visitors in order to construct and maintain their new urbanity. In Toronto (Downsview Park, fig. 2.2), the introduction of new hybrid uses on the site enabled the reconversion of an obsolete military airbase into a metropolitan national park.[24]

UIO

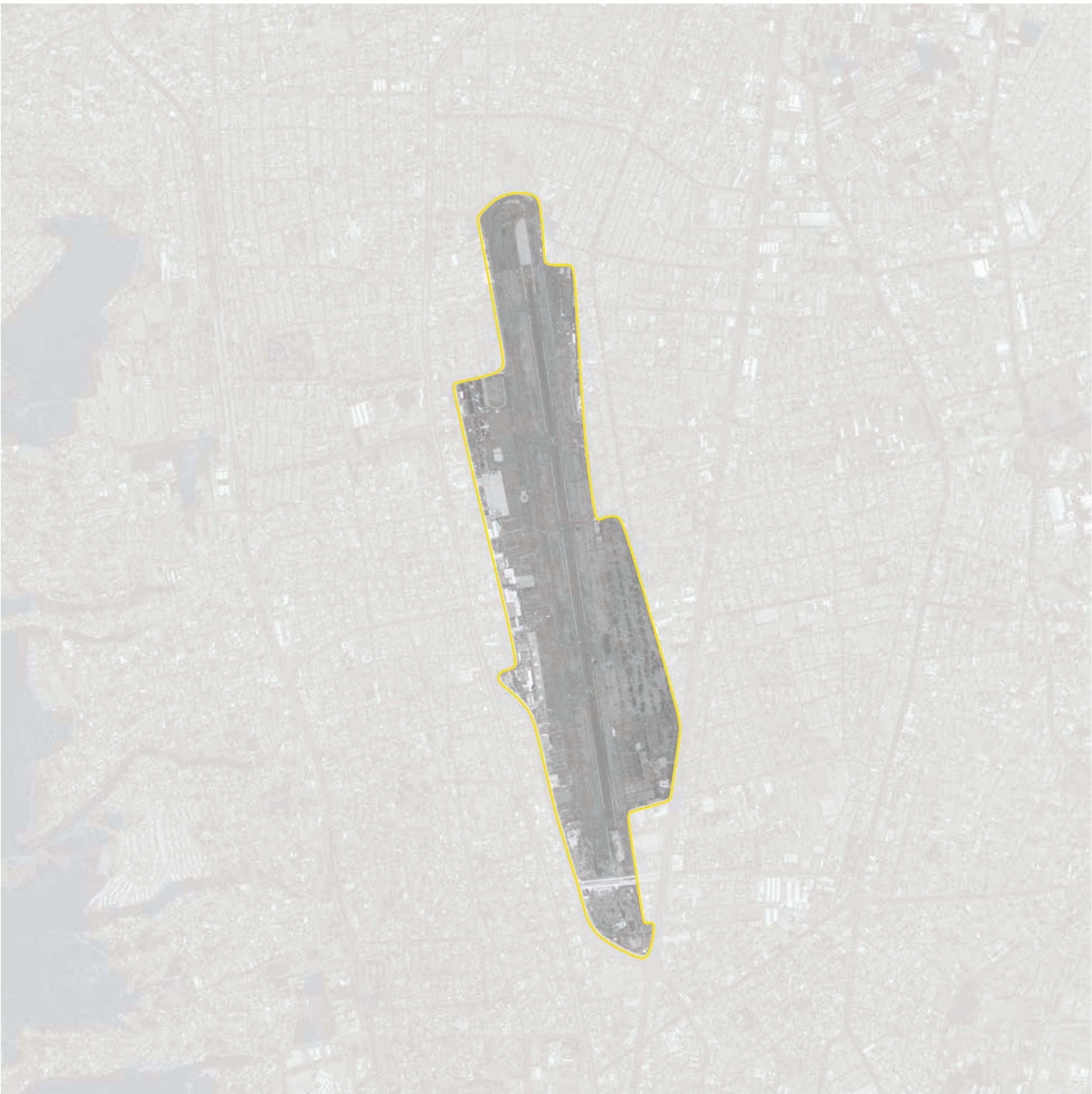


Fig. 3.1a. Mariscal Sucre International Airport, Quito, Ecuador.

Area: 152 ha
Pervious Surface: 82 ha
Impervious Surface: 70 ha
Runway Length: 3.2 kms
Perimeter: 7.7 kms

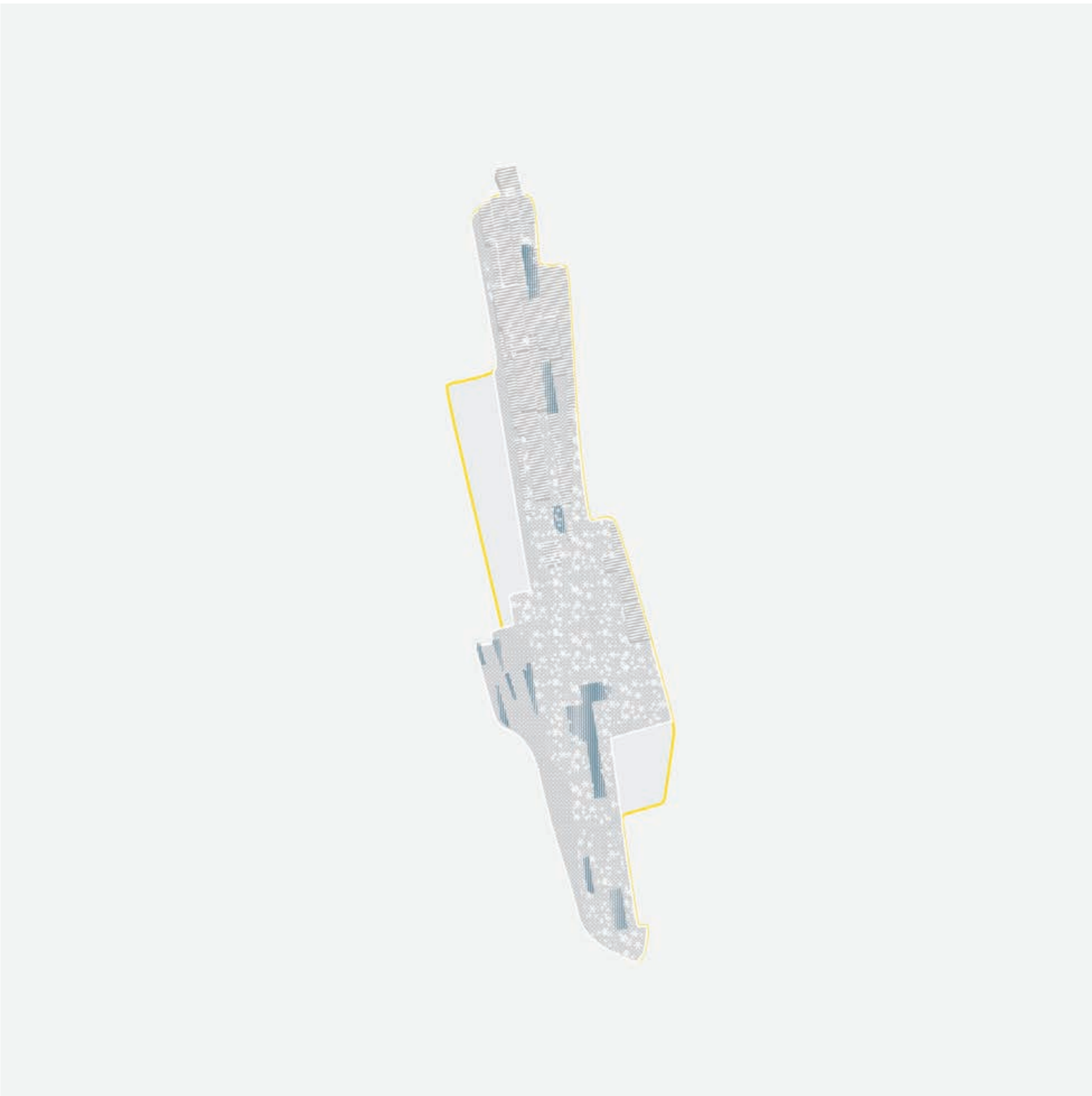


Fig. 3.1b. Ernesto X. Bilbao, Robert A. Sproull, Jr., et al., Parque Bicentenario, 2008.

Area: 130 ha
Open Area: 130 ha
Built Area: 00 ha
Water Area: 10 ha
Perimeter: 8.1 kms

0 500m Scale: 1:25,000

UIO

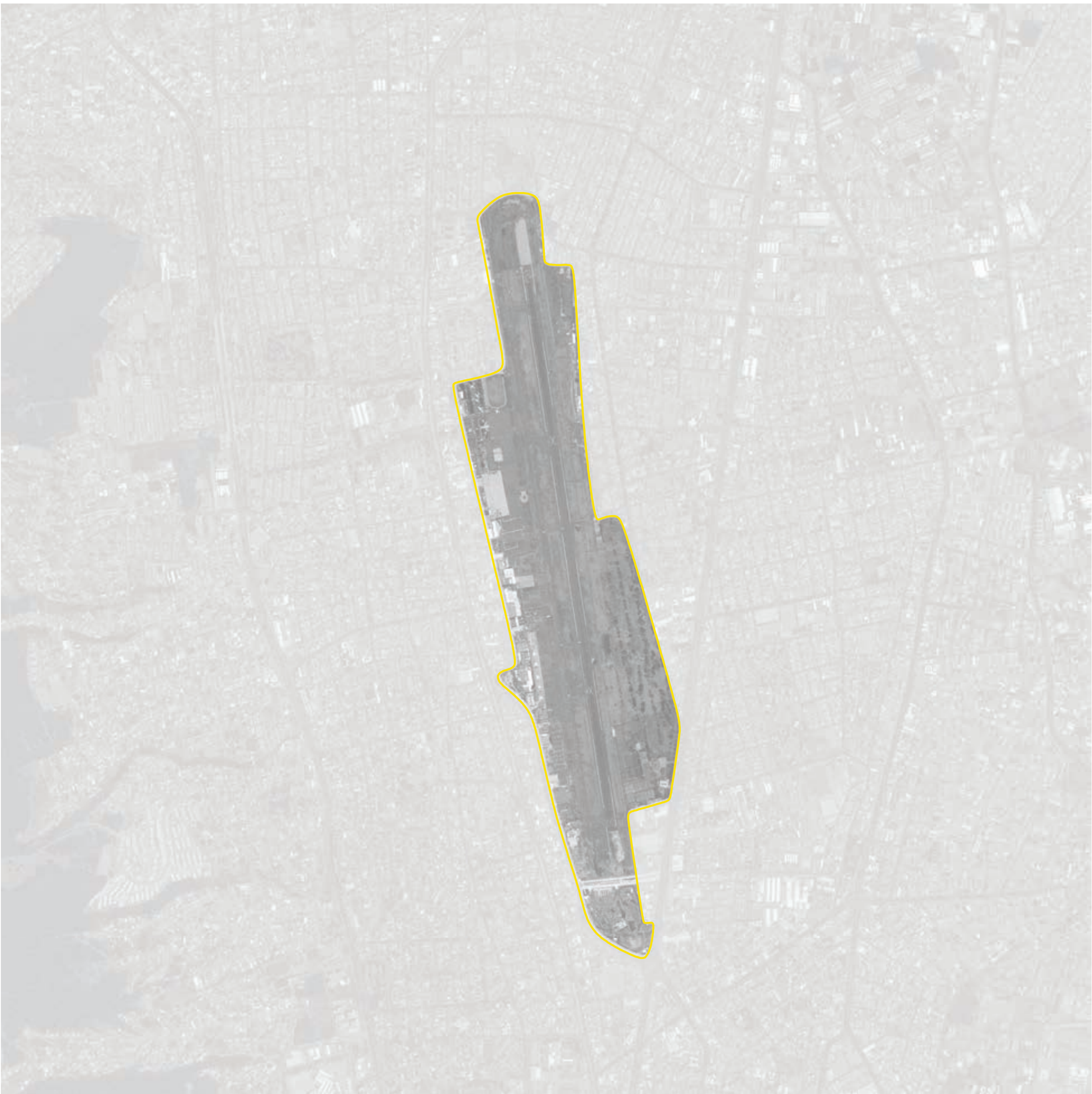


Fig. 3.2a. Mariscal Sucre International Airport, Quito, Ecuador.

Area: 152 ha
Pervious Surface: 82 ha
Impervious Surface: 70 ha
Runway Length: 3.2 kms
Perimeter: 7.7 kms

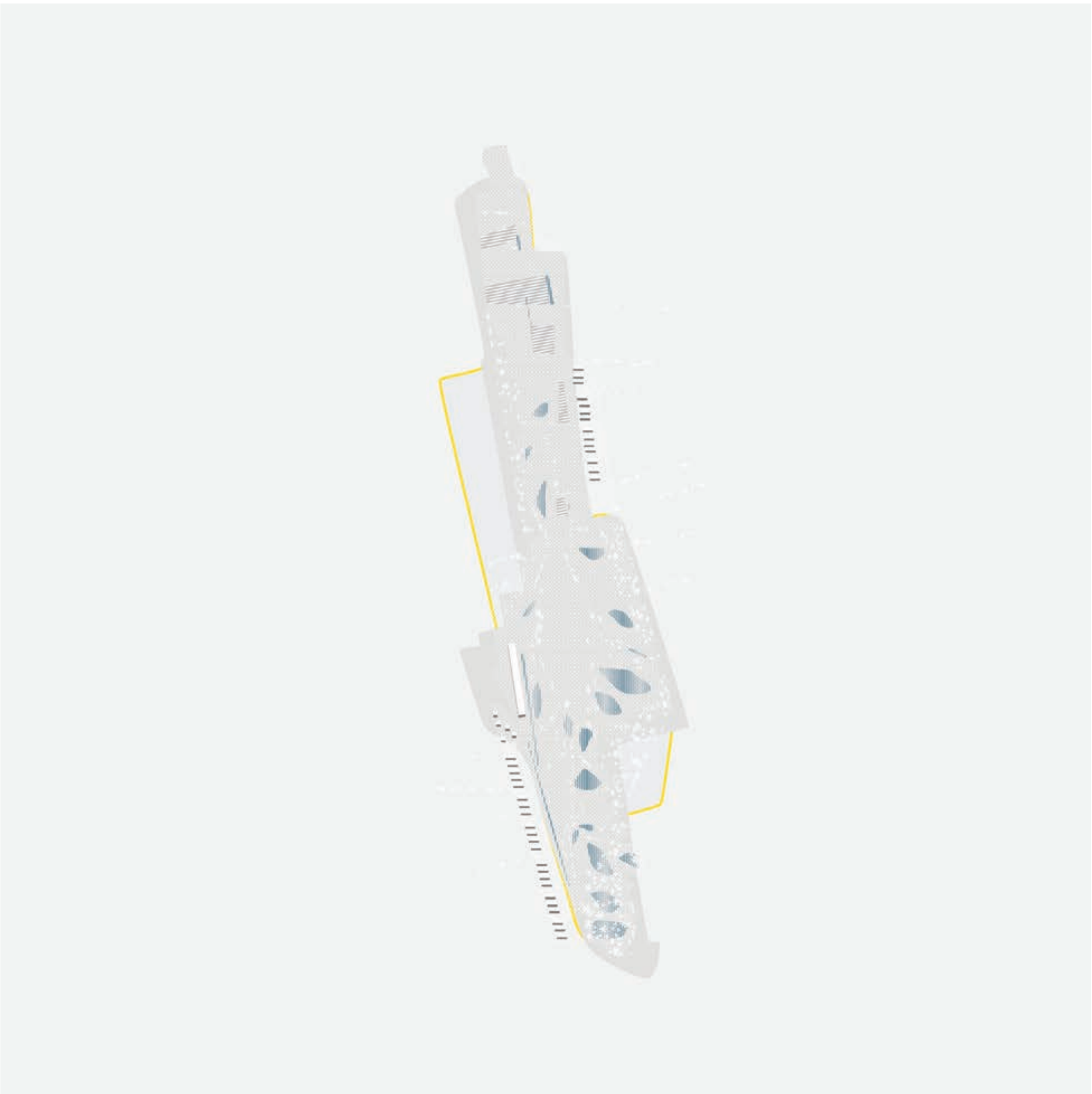


Fig. 3.2b. Anita Berrizbeitia, et al., Parque del Lago, 2008.

0 500m Scale: 1:25,000

Area: 139 ha
Open Area: 139 ha
Built Area: 0 ha
Water Area: 10 ha
Perimeter: 8.9 kms

UIO

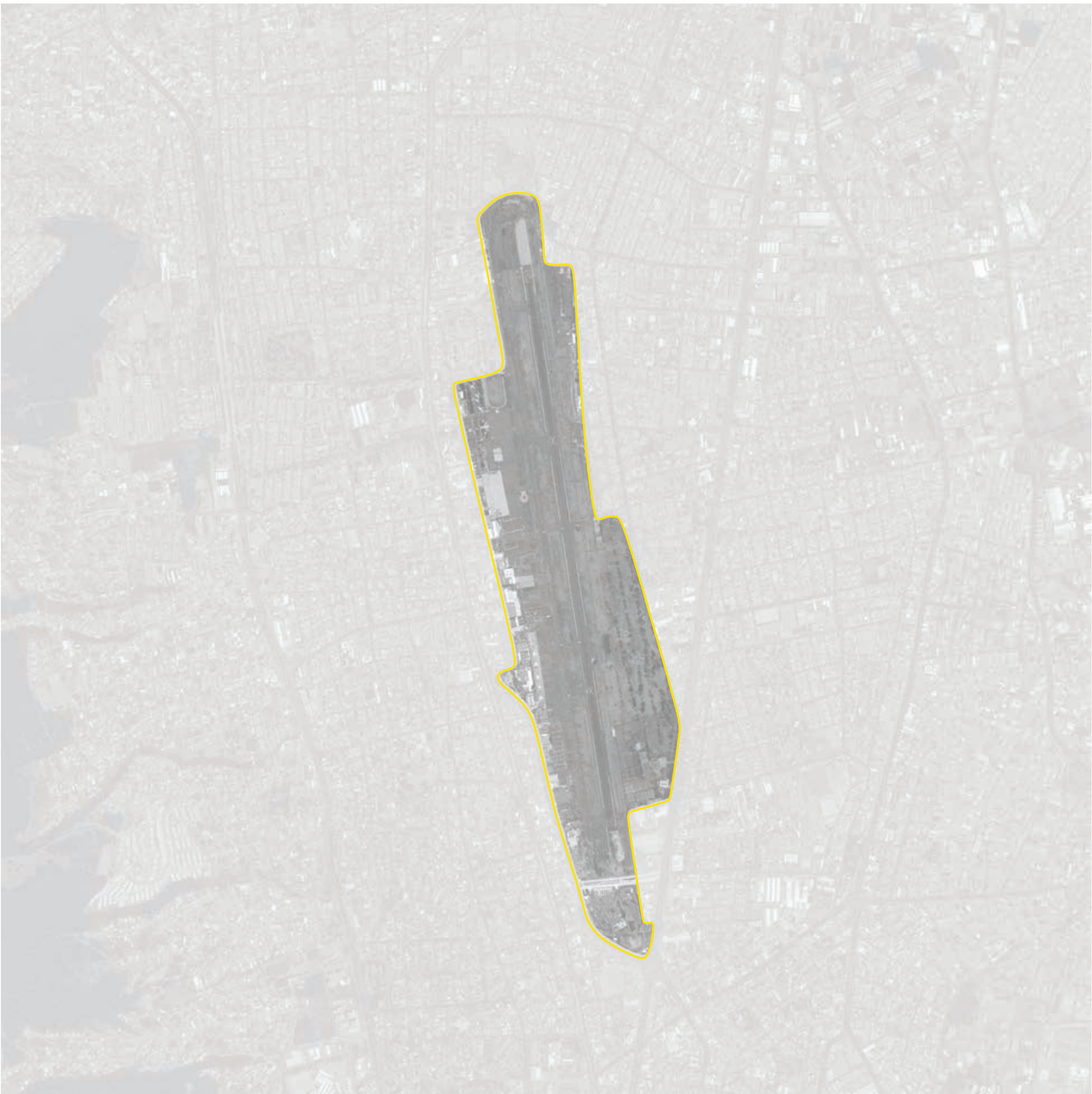


Fig. 3.3a. Mariscal Sucre International Airport, Quito, Ecuador.

Area: 152 ha
Pervious Surface: 82 ha
Impervious Surface: 70 ha
Runway Length: 3.2 kms
Perimeter: 7.7 kms

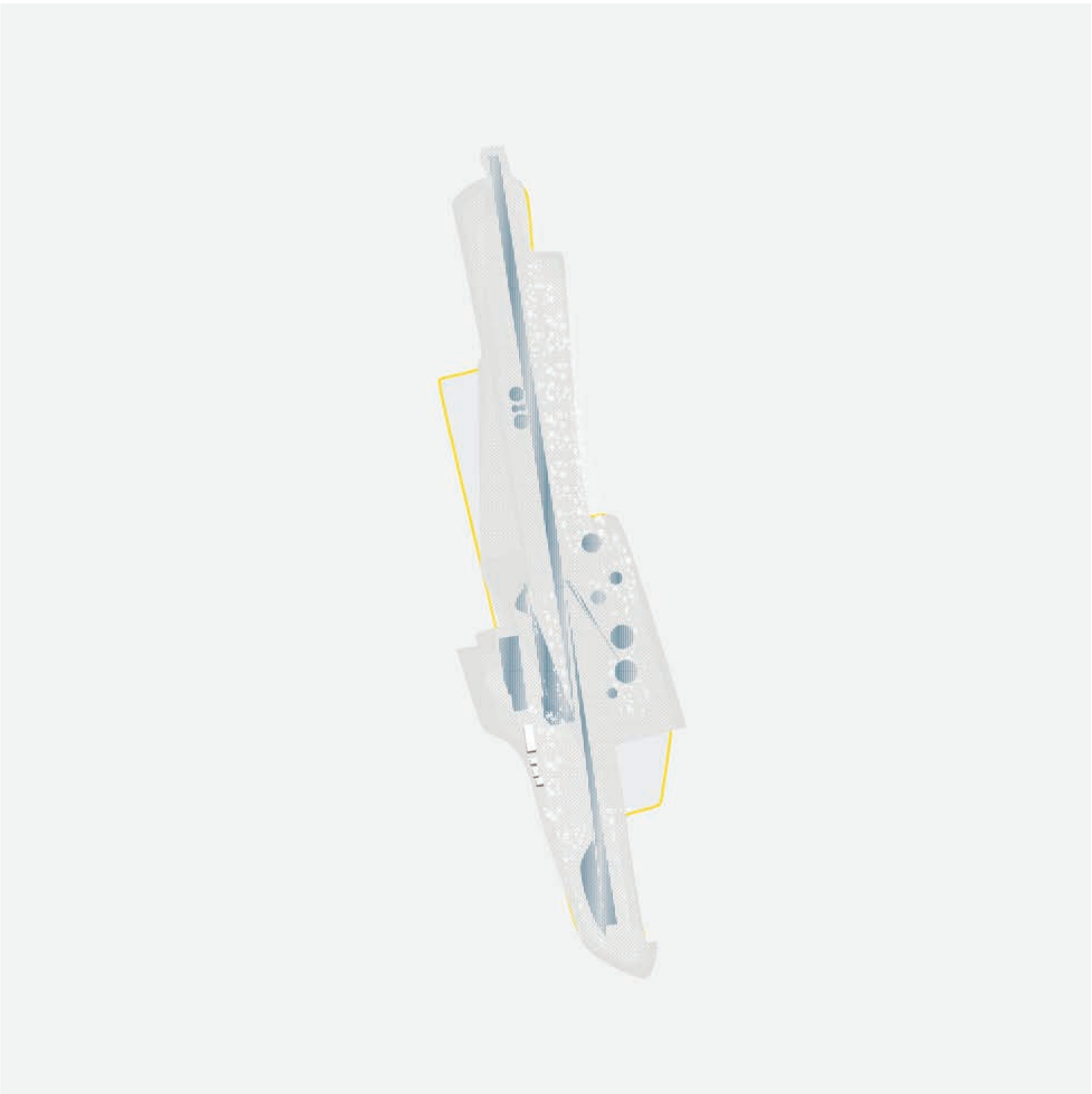


Fig. 3.3b. Paisajes Emergents, et al., Parque del Lago, 2008.

0 500m Scale: 1:25,000

Area: 127 ha
Open Area: 127 ha
Built Area: 0 ha
Water Area: 27 ha
Perimeter: 8.2 kms

SRF

Fig. 3.4a. Hamilton Army Airfield, Novato, United States.

Area: 257 ha
Pervious Surface: 139 ha
Impervious Surface: 118 ha
Runway Length: 5.6 kms
Perimeter: 8.3 kms

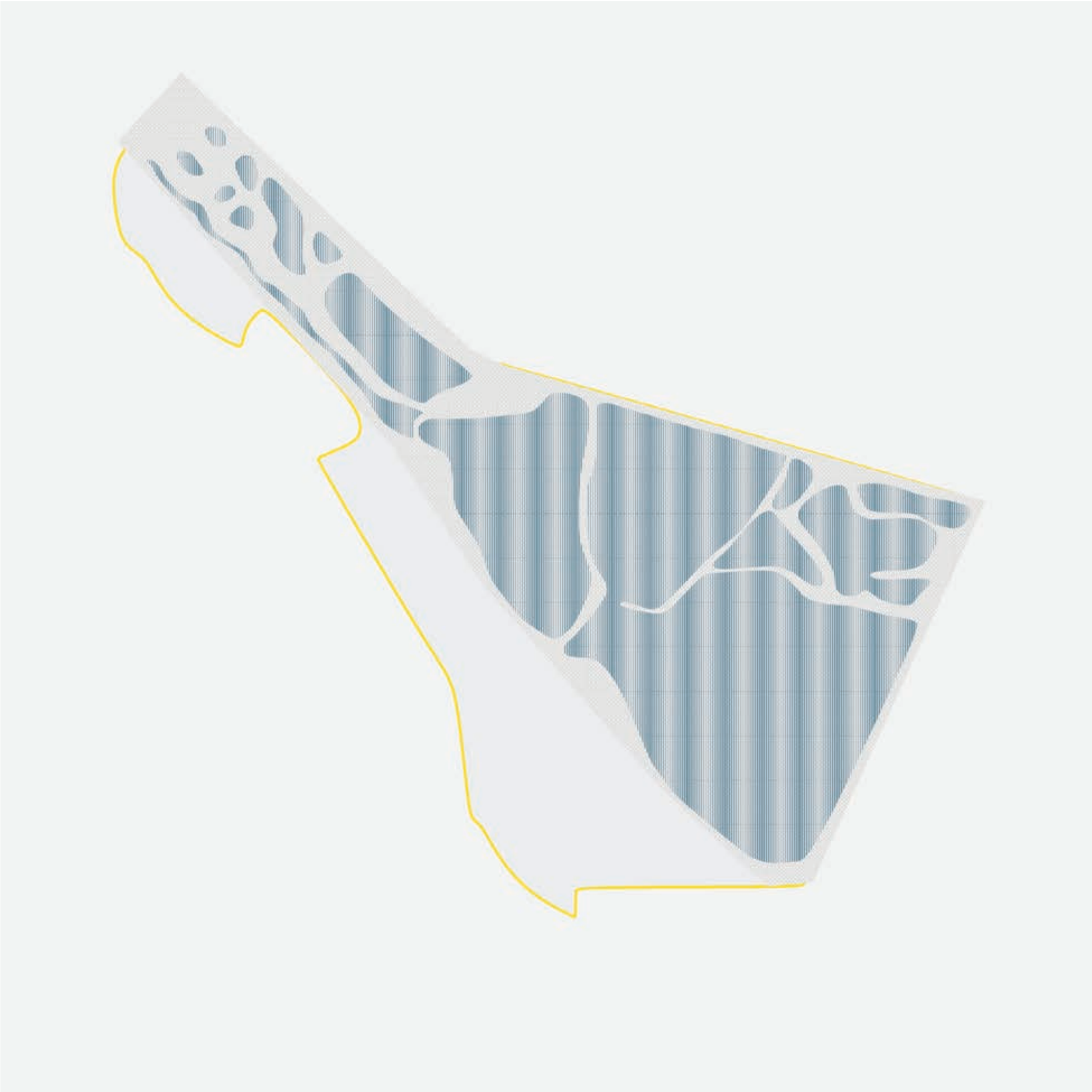


Fig. 3.4b. US Army Corps of Engineers, San Francisco District, et al., Hamilton Wetland Restoration Project, 1999.

0 500m Scale: 1:25,000

Area: 258 ha
Open Area: 193 ha
Built Area: 64 ha
Water Area: 134 ha
Perimeter: 8.3 kms

TXG

Fig. 3.5a. Taichung Airport, Taichung, Taiwan.

Area: 165 ha
Pervious Surface: 77 ha
Impervious Surface: 88 ha
Runway Length: 1.75 kms
Perimeter: 6.65 kms

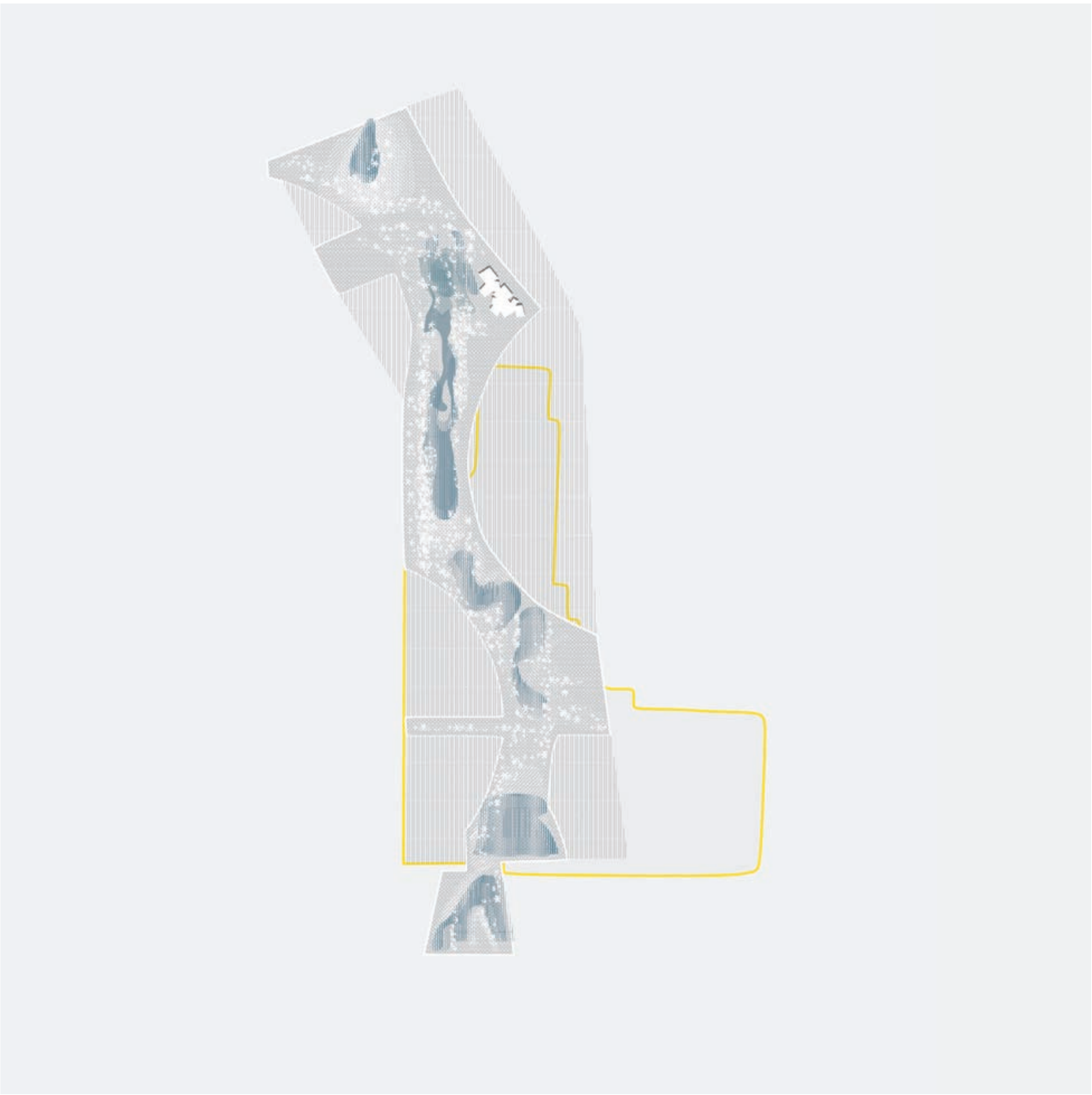


Fig. 3.5b. Mosbach Paysagistes, Philippe Rahm architectes, et al., Taichung Gateway Park, 2001.

0 500m Scale: 1:25,000

Area: 246 ha
Open Area: 132 ha
Built Area: 114 ha
Water Area: 26 ha
Perimeter: 9.2 kms

TXG

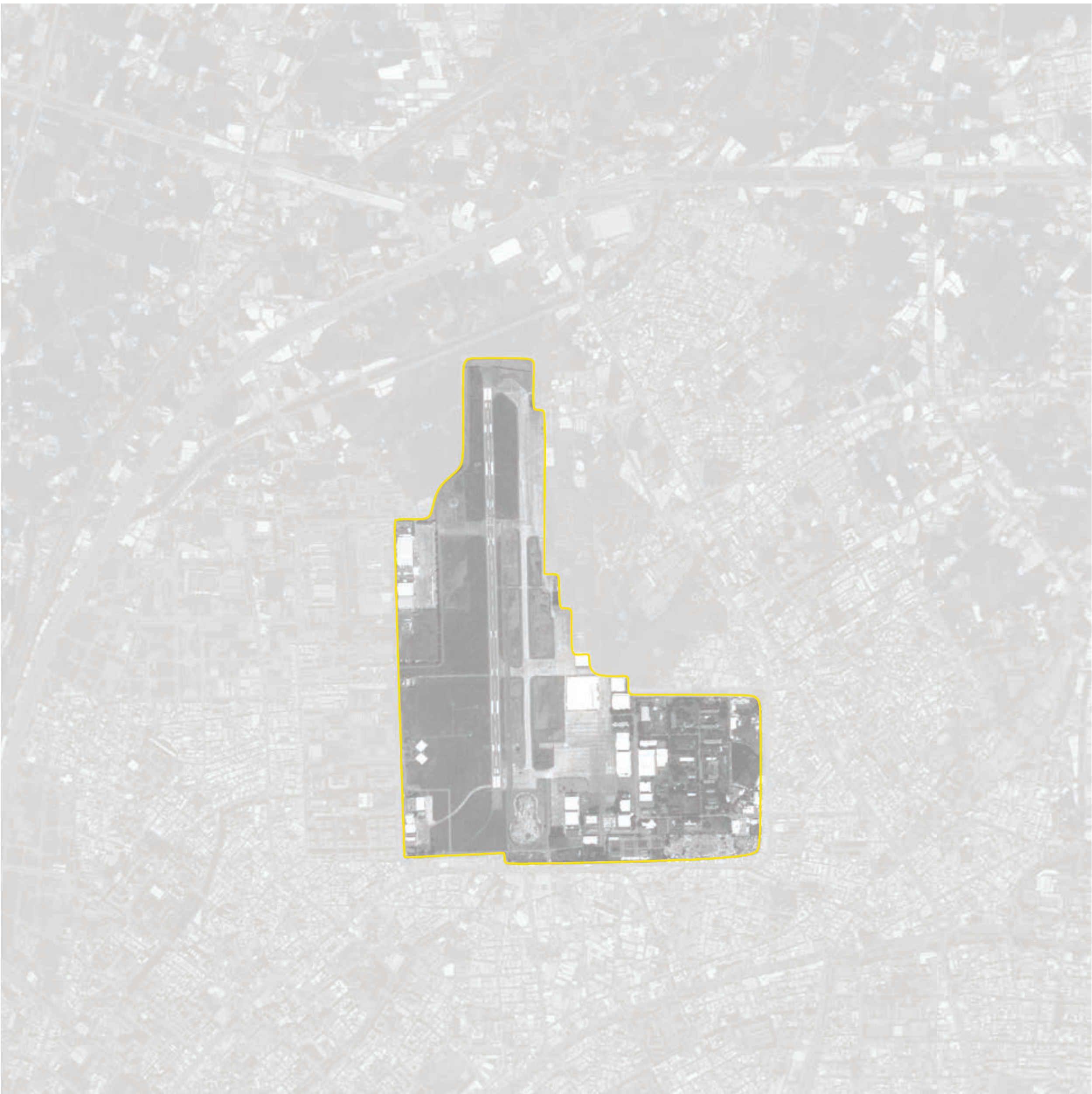


Fig. 3.6a. Taichung Airport, Taichung, Taiwan.

Area: 165 ha
Pervious Surface: 77 ha
Impervious Surface: 88 ha
Runway Length: 1.75 kms
Perimeter: 6.65 kms

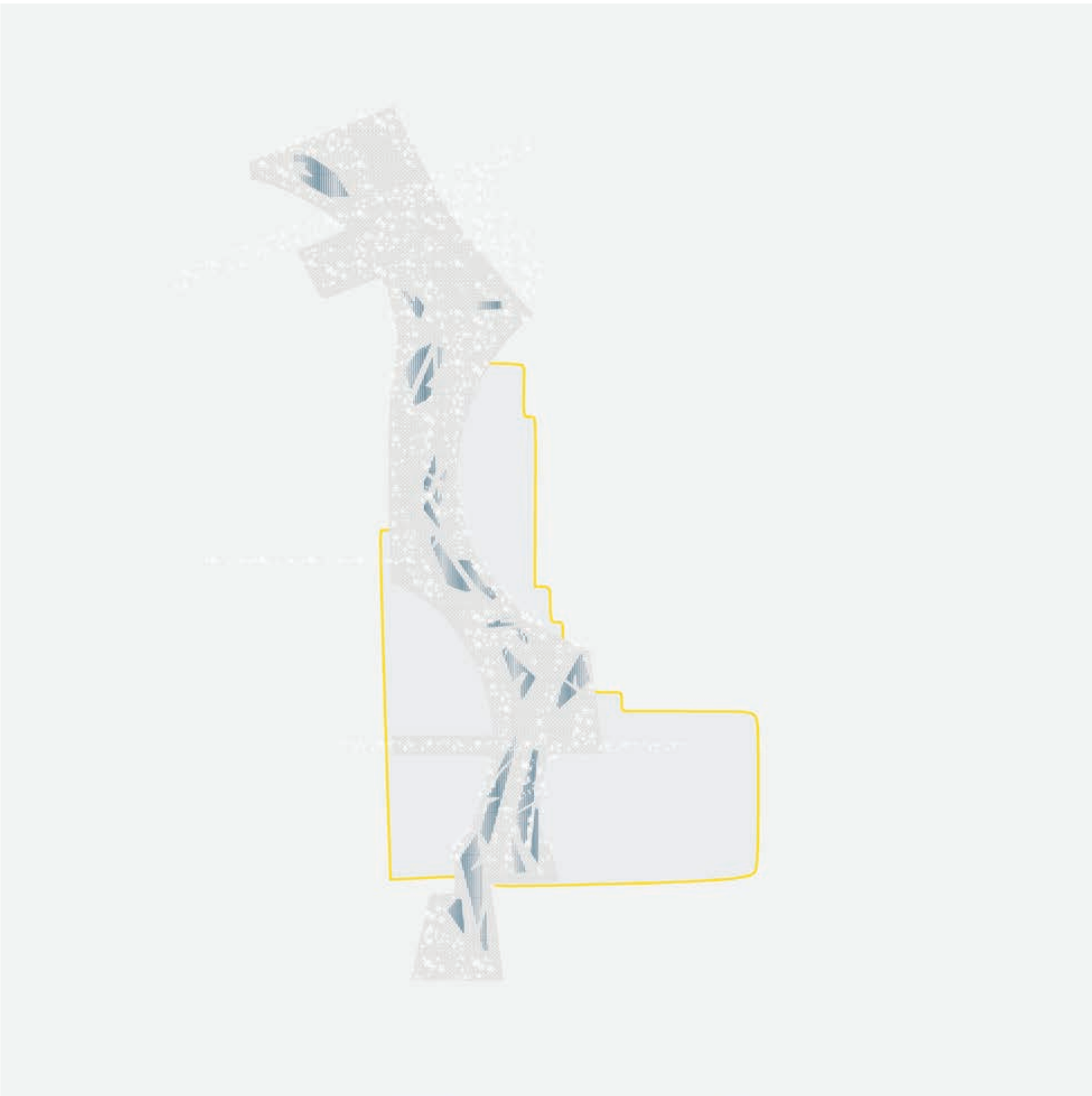


Fig. 3.6b. Stoss Landscape Urbanism, et al., Taichung Gateway Park, 2011.

Area: 198 ha
Open Area: 132 ha
Built Area: 65 ha
Water Area: 14 ha
Perimeter: 14.7 kms

0 500m Scale: 1:25,000

MDY

Fig. 3.7a. Henderson Field Airport, Sand Island, Midway Atoll, United States Territory.

Area: 457 ha
Pervious Surface: 157 ha
Impervious Surface: 300 ha
Runway Length: 4.2 kms
Perimeter: 12 kms

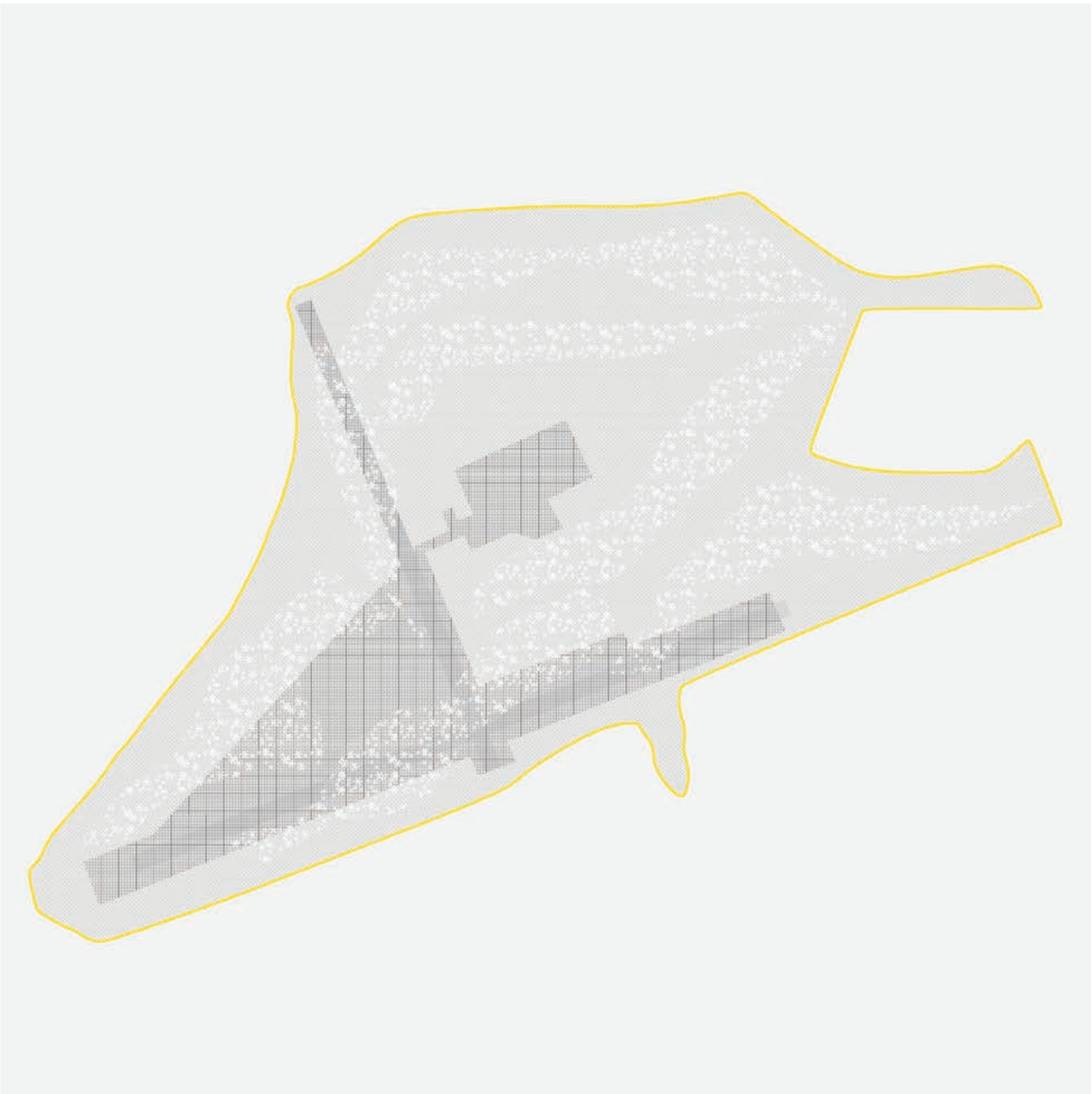


Fig. 3.7b. Jones & Jones Architects and Landscape Architects, et al., Papahanaumokuakea Marine National Monument, 2008.

0 500m Scale: 1:25,000

Area: 457 ha
Open Area: 457 ha
Built Area: 0 ha
Water Area: 0 ha
Perimeter: 12 kms

Transforming

A number of case studies in North America and Europe attest to the possibility of transforming decommissioned airfields into sites of urban agriculture, renewable energy production, urban parks, or expanded urban districts. In these recovered, reimagined forms, airfields offer new environments for human experience within the urban realm.

Five strategies of transformation are evident in the transformation of abandoned airports internationally: adaptation, conservation, conversion, redevelopment, and regrowth. These adaptive approaches allow the transformation of abandoned airports to trigger urban and landscape-based processes. Airport transformation becomes an operative catalyst for other urban transformations by stimulating and intensifying an area's development.

Adapt

Strategies of adaptation are characterized by flexible, open systems that can deform, respond, and develop naturally based on evolving needs over time, feedback from ecological and human processes, and other unforeseeable variables. Adaptive proposals are those that avoid over-determined "designed" states and aim instead for systemic frameworks and protocols.

The competition proposals for Toronto (Downsview Park, figs. 2.2, 2.3) emphasize the disciplinary importance of temporal change, self-organization, and indeterminacy for landscape architecture. The design proposals were characterized by four primary landscape types (native oak grasslands, irrigated fields, riparian corridors, and productive landscapes) that depend variably on the availability of water.[25] The design's framework aims to respond flexibly to unforeseeable future changes in the site's natural systems and cultural programs. Rather than determine them, it seeks to enable and facilitate these self-organizing natural and cultural processes.[26]

During the process of returning the airfield to a state of "nature," and as other long-term processes of transformation on site are underway, the park can serve as a venue for various recreational pursuits (model plane flying, land sailing, biking, camping) as well as for nature observation and environmental education programs, as is the case in New York (Floyd Bennett Field, fig. 4.1). In Berlin (Landscape Park Johannisthal, fig. 2.1), programmatic uses were not determined in the initial proposal of the park in order to allow these uses to develop flexibly according to the needs of citizens and visitors. Forms of "temporary urbanism" are being practiced in Berlin (Tempelhofer Park, figs. 1.3, 1.4) whereby locals have been invited to propose provisional uses for select plots of land within the airfield. The "urban pioneers," as they are called, who occupy and adapt these plots become active agents in the airfield's transformation.[27]

In Irvine (Orange County Great Park, fig. 2.4) architecture and the historic character of aviation have been preserved on site by means of the adaptive reuse of existing buildings. The repurposed military structures of the Palm Court on site form a new cultural campus that plays host to interdisciplinary public arts programming. By minimizing waste, this strategy of preservation also aligns with the park's ecological values.

Adaptive strategies may also be applied to management plans for sites undergoing transformation. To inform such plans, information can be monitored by means of ecological data collection, remote and on-site metering of water, waste, and energy use, visitor surveys, tabulation of visitor volume, and tracking of visitor behavior patterns on site. A sustainability management system (SMS) provides a systematic way to review current operations and improve their environmental, social, and economic performance. An SMS can help an organization not only to more effectively meet its various compliance requirements, but also to create a working environment in which sustainable practices inform every management decision and become a part of everyday operations.

Conserve

Projects that undertake conservation engage in the critical process of preserving certain site elements, modifying others, and erasing still others. These elements belong to ecological, cultural, infrastructural, architectural, and historical categories, among others, and are complexly overlaid on site. Designing with conservation in mind involves mixing the introduction of the new with the protection of the found.

By conserving an airfield's unique urban and ecological heritage, it is possible to create a strong, far-reaching sense of identity for the site. In New York (Floyd Bennett Field, fig. 4.1) the former airfield, acting as one component of the larger Gateway National Recreation Area, is envisioned as a "gateway" to the wider system of National Parks and follows their aspiration to bring parks closer to the populations they serve. Recognizing and expanding upon the diverse social and cultural activities that take place on and around an airfield allows for their conservation and evolution. Very often, this cultural layer of understanding is overlaid upon an assemblage of fragile natural reserves, shorelines, and highly desirable undeveloped land.

In Quincy (Squantum Point Park, fig. 4.2) the design of the park sought to simultaneously preserve wetlands and bird and wildlife habitats, as well as traces of the site's aviation history. In Oslo (Fornebu Airport) administrators and local communities worked together to conserve the natural and ecological assets of the airfield. In Berlin (Landscape Park Johannisthal, fig. 2.1) the park establishes a spatial framework that accommodates nature conservation while introducing new recreational programs. In Toronto (Downsview Park, fig. 2.2) the transformation of the airport aims to create Canada's first urban national park. The emphasis of the competition proposal entitled "The Digital and the Wild" focused on a landscape that would overlay layers of new public use, conservation of wildlife, establishment of new species and habitats, and the protection of other natural systems.[28]

In Berlin (Tempelhofer Park, fig. 1.4) the conservation of the airport's original character and qualities is readily apparent. By layering various uses with old and new structures on the site, an area of transition is generated between the open field and the planned urban neighborhoods adjacent to it.[29] In Irvine (Orange County Great Park, fig. 2.4) a wildlife corridor and new habitat zones are created alongside a veterans memorial and other elements that recall the formal air station's history.[30] In Gatow (Park Landscape and Urban Agriculture Gatow, fig. 2.6) traces of the two former runway paths are maintained and serve to mark transitions between the park's diverse zones. In San Diego (San Diego International Airport) the airfield now accommodates a protected nesting site for the California least tern, an endangered migrating seabird that nests in the region's tidelands before traveling south in the winter.[31] Protected fenced-off nesting grounds are located on sand and gravel between the runway and taxiways.

Convert

In order to create environments suitable for residential development, agriculture, cultural functions, and energy production, many airfields have been converted into parks. The strategy of conversion depends on the fact that the airport is a site—with ample, flat land—that can accommodate a wide array of uses and forms. The airfield serves, in the case of conversion, as a platform or a canvas that can accept modification. Conversion activates a change from one state to another and prioritizes the introduction of the new over either the preservation of existing conditions or the return to a prior state.

In Athens (Hellinikon Metropolitan Park, fig. 1.5) the landscape strategy for the new park and residential district involves topographic modification in the service of rainwater collection.[32] In Oldenburg (Fliegerhorst Oldenburg, fig. 4.3) the surface of the airbase has been converted into a solar farm. This decision represents an outgrowth of Germany's political commitment to sustainable development with a focus on renewable high-efficiency energy sources and an ultimate goal to dramatically reduce its dependence on fossil fuels and nuclear power. In Chicago (Northerly Island Framework Plan, fig. 4.4) some areas of the former airport are converted into new wildlife habitats while others are converted into destinations for recreation and cultural events.[33]

In San Francisco (Crissy Field, fig. 1.1) the conversion of the United States Sixth Army's military installation at the Presidio into a national park encompassed the restoration and rehabilitation of the natural landscape of wetlands and dune fields along the San Francisco Bay waterfront. Crissy Field enables a diversity of recreational uses in the dynamic environment of restored wetlands and within the context of an enduring historical landmark.[34] The design proposal "From Runways to Greenways" in Vatnsmýri (Reykjavík Airport, fig. 1.6) uses landscape and exterior programs as a catalyst for urban development: the three runways were converted into greenways, each with distinctively different qualities. These runway conversions seek to initiate the development and transformation of the Vatnsmýri area from a place of transportation to a place of recreation, learning, and production.[35] In Taiwan (Taichung Gateway Park, fig. 3.6) the proposal "Aqua Cultures" imagines the conversion of the former airfield into a new hybrid type of park that combines the establishment of recreational and cultural amenities with water treatment and the enhancement of biodiversity.[36]

The competition entries by Anita Berrizbeitia et al. (fig. 3.2), and Paisajes Emergentes (fig. 3.3) for the transformation of the Quito Airport both propose the conversion of the airfield through the reshaping of natural and topographical elements. The first project proposes twelve hills throughout the park to recall the landforms of Andean glaciers (U-shaped valleys, *cirques*, and *arêtes*). This topographic system performs several functions. First, it directs and contains water and generates microclimates. Second, it recycles material from the demolition of the runway and other airport infrastructures. Third, it creates a diversity of occupiable spaces. Finally, it offers rare views across the longitudinal axes of the valley.[37] Another proposal for the Quito Airport, on the other hand, aims to convert the former runway into an active hydrological park: a "giant hydric machine" composed of smaller habitable parts.[38]

In Caracas (La Carlota, fig. 4.5) the design proposal focuses on the park as a place where a divided society can share experiences within the context of sports and cultural events. The simple design can be realized quickly, should political conditions become more propitious for the construction of a public space of this scale. The proposal reconfigures the runways into a programmatic spine for the location of stadia, markets, swimming pools, and music shells.[39]

Develop

When former airport sites undergo remediation and conversion they open up the possibility for the development of new urban neighborhoods. Development involves the building-up of a district as a place of long-term occupation and value. To develop a site, it is necessary to bring residents, jobs, capital, infrastructures, and amenities that will attract people to live and work there on a permanent basis. These newly developed urban districts, made up primarily of housing units and workspaces, also generally include convention centers, recreational facilities (for sports as well as shopping and cultural activities), gardens, and parks. In Oslo

(Fornebu Airport), for example, the environmental remediation and conversion of the former airport into a new residential district with 6,000 housing units and workspaces for 15,000 new jobs resulted in one of the largest industrial reclamation projects in the country.[40]

In Denver (Stapleton Redevelopment, fig. 1.2) the redevelopment of the international airport emphasized "defined centers for services and civic uses, walkable scale, access to nearby employment, diverse transportation options, and strong connections to parks and nature."[41] It proposes a mixed-use urban community with neo-historical homes to accommodate 25,000 residents and 30,000 jobs. The design proposes an urban expansion that aims to be economically, socially, and environmentally sustainable and maintain close connections to the existing infrastructure and urban fabric of the city center. Similarly, the competition proposal for Vatnsmýri (Reykjavík Airport, fig. 1.7) aims to create a new, recognizably distinct district that is at once urban in character and closely linked to the landscape. New park areas become a unifying element within the proposal, whose spatial relationships and sightlines tie the historic city center, lake, waterfront, hill, and other landmarks together. The new urban district in Munich (Landschaftspark München Riem) includes a convention center and a park that covers 200 hectares adjacent to the urban development. The park provides open spaces and a variety of planted landscapes.[42]

If parkland serves in the case of Munich to infill spaces of development, then it may on the other hand act as an engine to drive new urban development. In Casablanca (Anfa Airport, fig. 4.6) a park landscape generates a new cultural and business zone for the city. In Gatow (Park Landscape and Urban Agriculture Gatow, fig. 2.6) a public park provides areas not only for residential development but also for agricultural production. The project in Taiwan (Taichung Gateway Park, fig. 3.5) develops a new environment—by modifying localized atmospheric and climatic conditions—to provide visitors with relief from tropical heat and humidity while sheltering them from urban noise and air pollution.[43]

The economic sustainability of a proposal will benefit from a deliberate and imaginative management strategy that acknowledges the hybrid, transformed, complex nature of the development. For example, the financial stability of federally managed parks often depends on the use of concession contracts and commercially operated visitor services such as lodging, food and beverage sales, retail merchandise, and recreation activities. Such business operations generate revenue that can be put directly back into park maintenance or programming costs. Concessions, however, can be harshly criticized (or rejected entirely) by publics when they are perceived as inappropriate in scale or unrelated to a park's primary stated purpose. In the transformation of an abandoned airfield it is therefore necessary to consider the site's need for additional financial resources when developing the site's programmatic elements. Alternative economic strategies like public-private partnerships may bolster a proposal's long-term viability.

Regrow

Former airports located in both peripheral and central urban areas can become new nodes for development and tourism. But following the extended period during which aviation services occupied an airfield site, it will be necessary to replenish many of the site's former qualities, resources, and populations. The strategy of regrowth highlights the importance of repopulating species and habitats that had been diminished, put at risk, or eliminated. It involves the recuperation of a site's productive or agricultural capacity and cultivates the health of its natural systems. Once an airfield site becomes occupied in a new way, it will experience continued growth and development. As a result, a transformed site will need to be equipped for growing communities, offering a variety of activities to an increasing number of residents and visitors.

In New York (Floyd Bennett Field, fig. 4.1) the former airfield, located at the southeastern extreme of the borough of Brooklyn, has become Brooklyn's largest community garden. Over 200,000 people live within 4.8 kilometers of the park. The field's 550 hectares are expected to fulfill some of the future need for open park space in a region that expects 3.8 million new residents by the year 2030.[44] The plan for the restoration of Midway Atoll (Henderson Field Airport, fig. 3.7) envisions the island as a site for limited ecotourism, education, and biological research by the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, the State of Hawaii, and other partners.[45] The proposal aims to reconstruct and regrow native species habitats, specifically focusing on the Laysan albatross and other endangered marine species. The ecosystem restoration project in Novato (Hamilton Wetland Restoration, fig. 3.4) aims to restore the tidal marsh that existed on site before the construction of the former airport as well as the species and habitats that had been lost. The design and planning strategy in Quito (Parque Bicentenario, fig. 3.1) reestablishes a humid forest, a prairie, and a transitional zone (three unique ecologies that previously converged at this site) and weaves a variety of programs into those ecosystems.[46] The park design is built upon a grid that establishes parcels for a variety of crops for local agricultural production. Beyond yielding a harvest, these crops help to produce greater public awareness of the nation's farming industry and culture.

NOP

Fig. 4.1a. Floyd Bennett Field, New York, United States.

Area: 499 ha
Pervious Surface: 299 ha
Impervious Surface: 200 ha
Runway Length: 5.7 kms
Perimeter: 9.2 kms

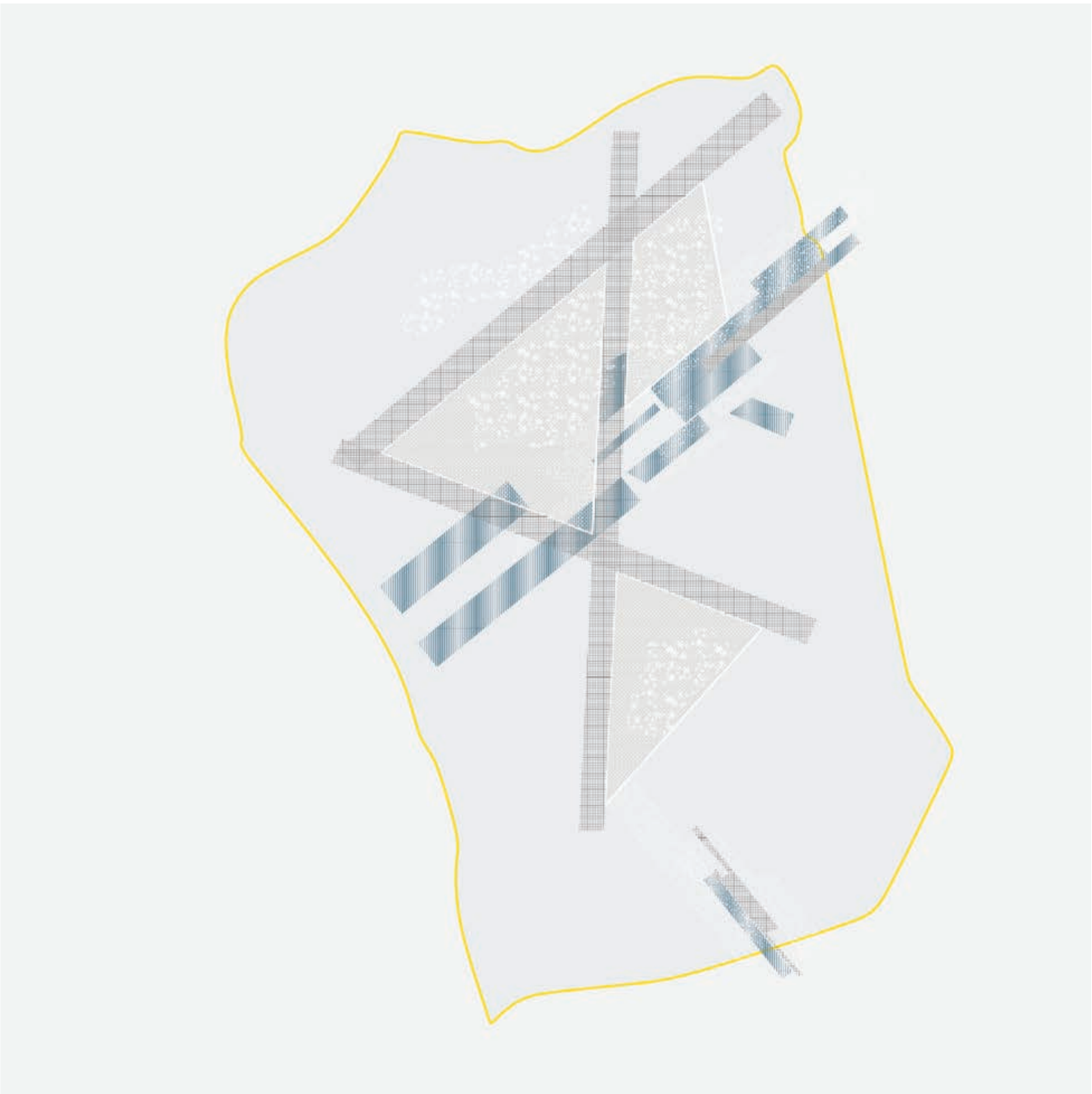


Fig. 4.1b. Ashley Scott Kelly and Rikako Wakabayashi, et al., Gateway NRA Revitalization, 2007.

0 500m Scale: 1:25,000

Area: 499 ha
Open Area: 499 ha
Built Area: 0 ha
Water Area: 35 ha
Perimeter: 9.2 kms

XXX

Fig. 4.2a. Naval Air Station Squantum, Quincy, United States.

Area: 60 ha
Pervious Surface: 23 ha
Impervious Surface: 37 ha
Runway Length: 0.7 kms
Perimeter: 3.3 kms

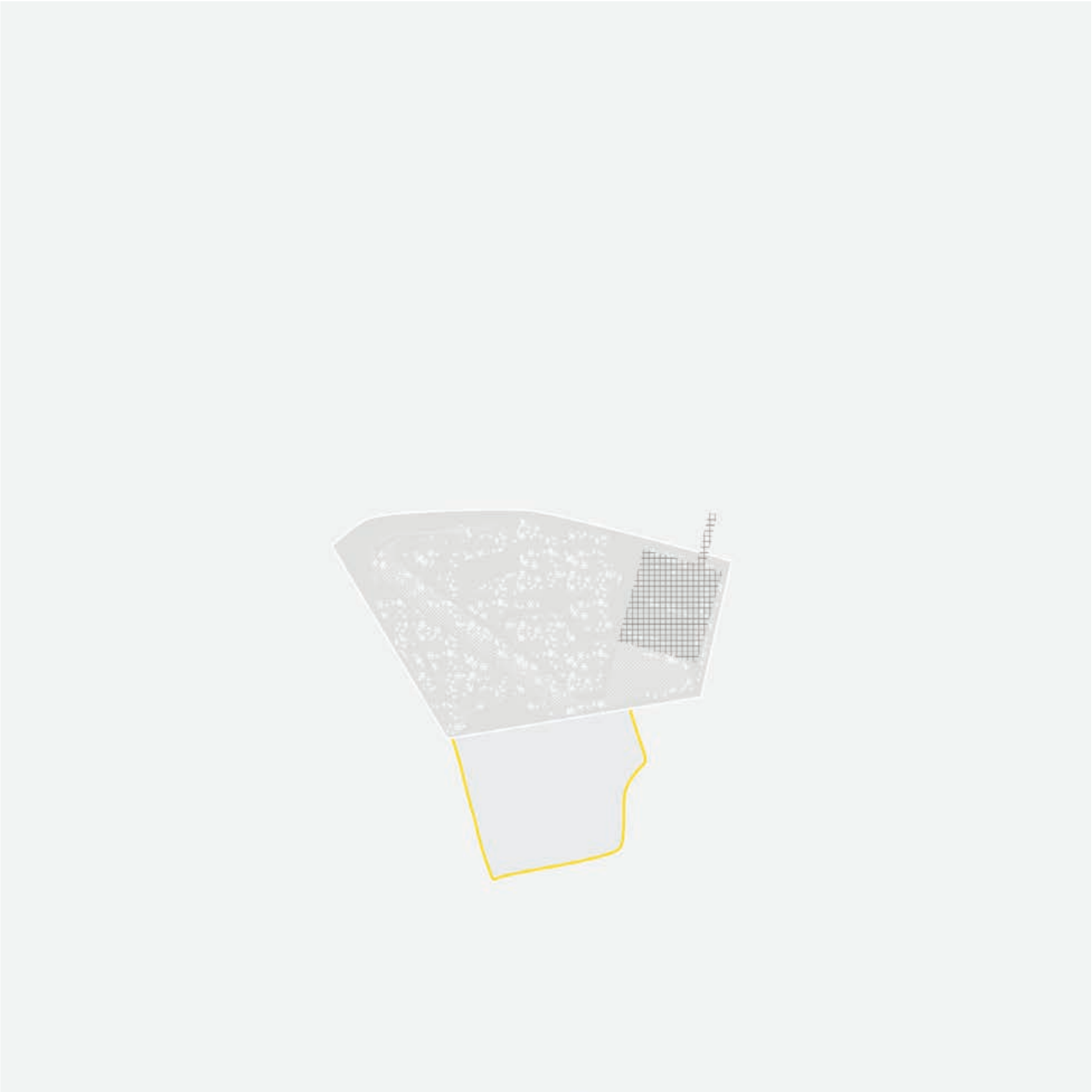


Fig. 4.2b. Carol R. Johnson Associates, et al., Squantum Point Park, 2001.

0 500m Scale: 1:25,000

Area: 62 ha
Open Area: 62 ha
Built Area: 0 ha
Water Area: 0 ha
Perimeter: 3.2 kms

EDNO

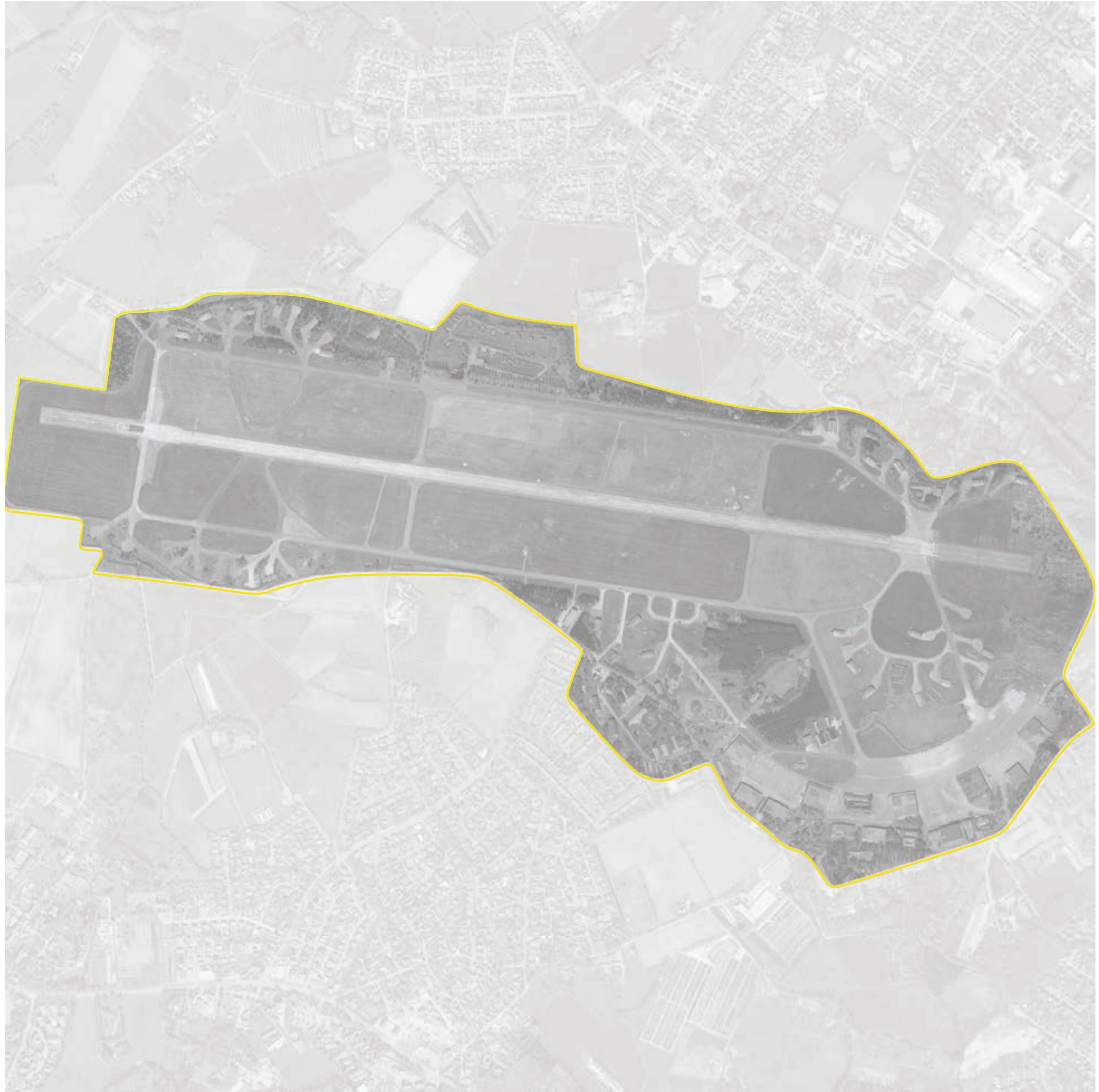


Fig. 4.3a. Fliegerhorst Oldenburg, Oldenburg, Germany.

Area: 367 ha
Pervious Surface: 241 ha
Impervious Surface: 125 ha
Runway Length: 3.3 kms
Perimeter: 9.8 kms

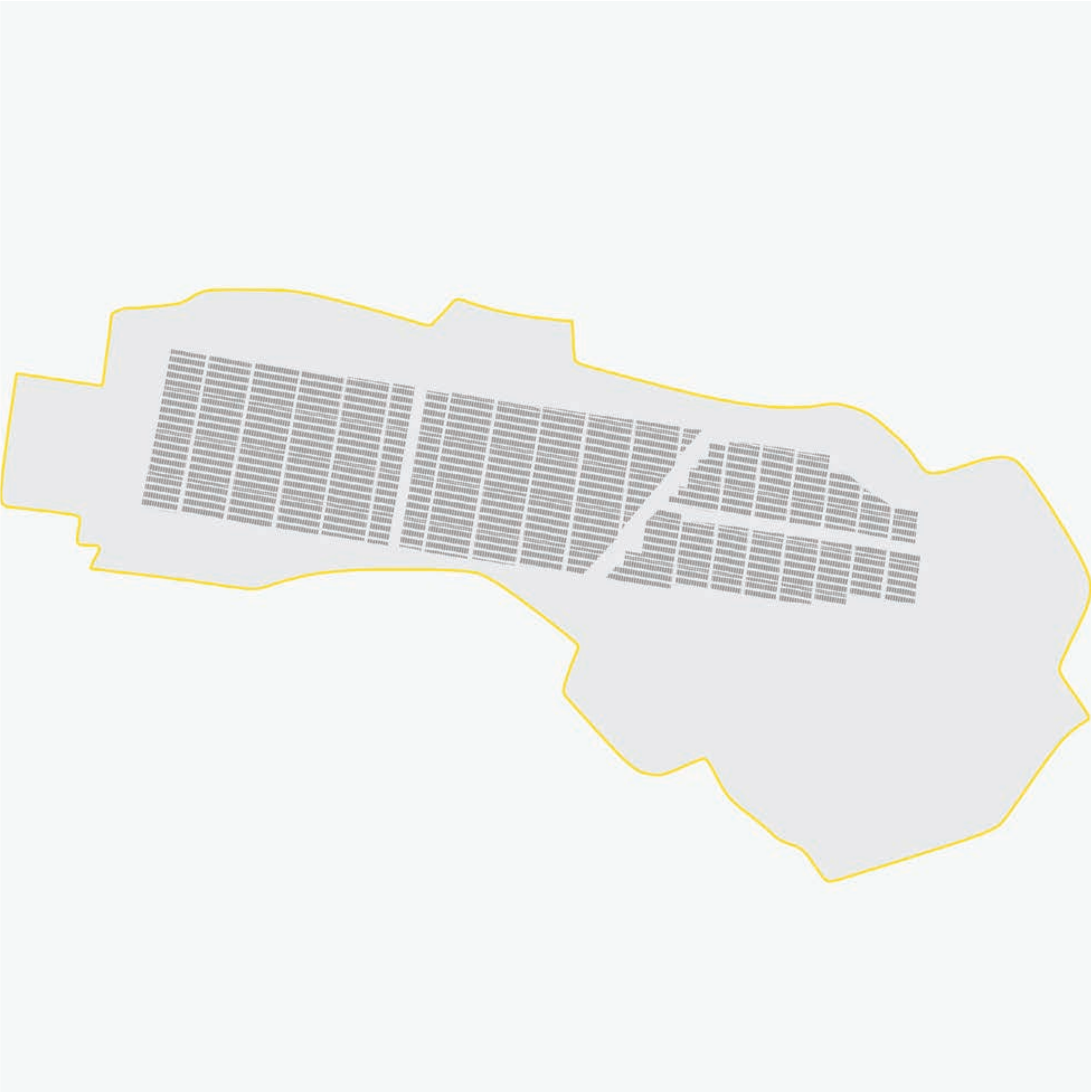


Fig. 4.3b. IFE Eriksen AG, et al., Oldenburg Airbase Solar Farm, 2011.

0 500m Scale: 1:25,000

Area: 269 ha
Open Area: 269 ha
Built Area: 0 ha
Water Area: 0 ha
Perimeter: 8.7 kms

CGX

Fig. 4.4a. Merrill C. Meigs Field Airport, Chicago, United States.

Area: 36 ha
Pervious Surface: 13 ha
Impervious Surface: 23 ha
Runway Length: 1 kms
Perimeter: 3.5 kms

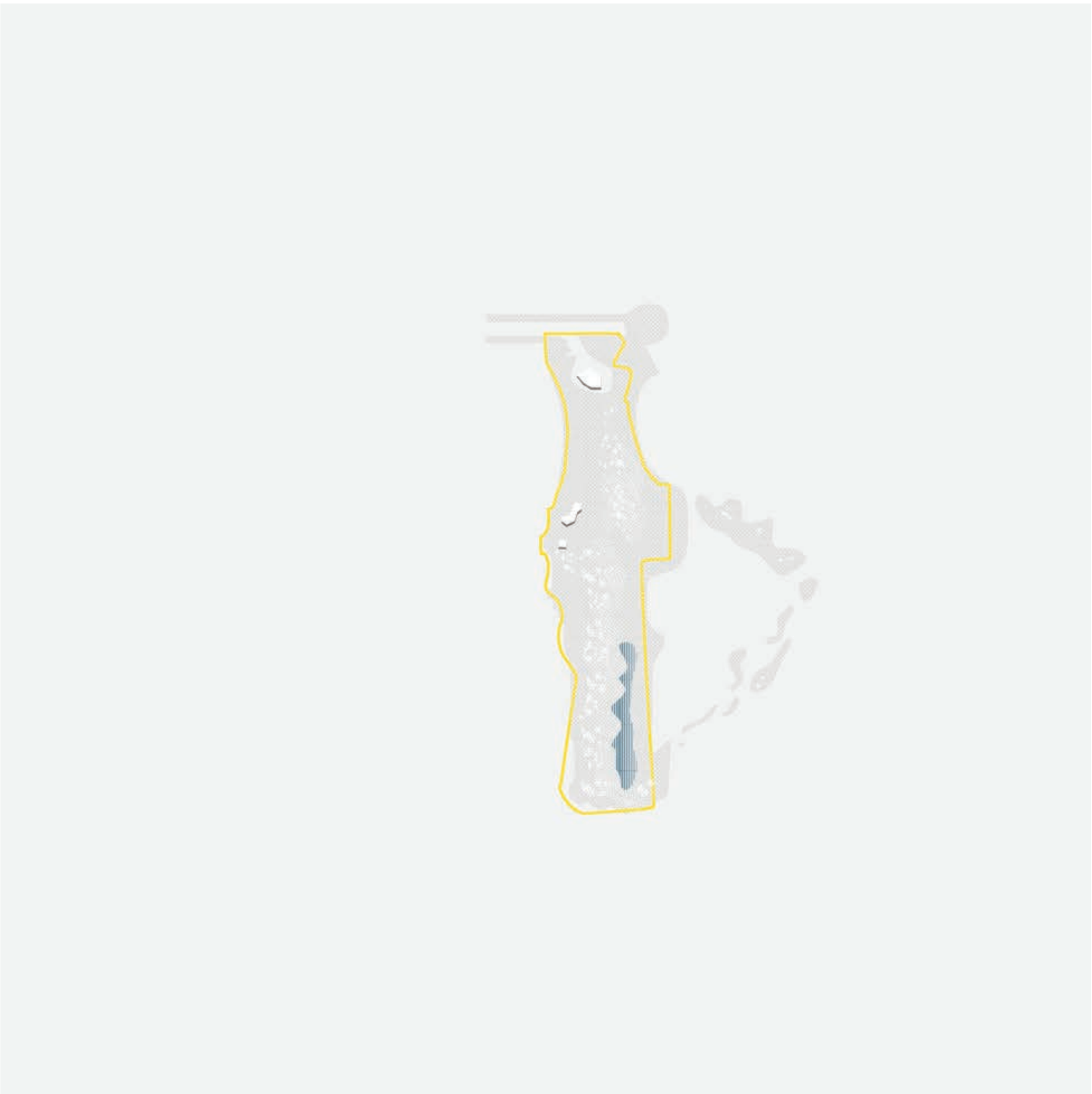


Fig. 4.4b. Studio Gang Architects and JJR, et al., Northerly Island Framework Plan, 2010.

Area: 71 ha
Open Area: 46 ha
Built Area: 0 ha
Water Area: 25 ha
Perimeter: 4.7 kms

0 500m Scale: 1:25,000

XXX

Fig. 4.5a. Francisco de Miranda Airbase, Caracas, Venezuela.

Area: 104 ha
Pervious Surface: 32 ha
Impervious Surface: 72 ha
Runway Length: 2 kms
Perimeter: 5.4 kms

Fig. 4.5b. Anita Berrizbeitia, et al., La Carlota Metropolitan Park, 2012.

0 500m Scale: 1:25,000

Area: 104 ha
Open Area: 66 ha
Built Area: 37 ha
Water Area: 5 ha
Perimeter: 7.7 kms

CAS

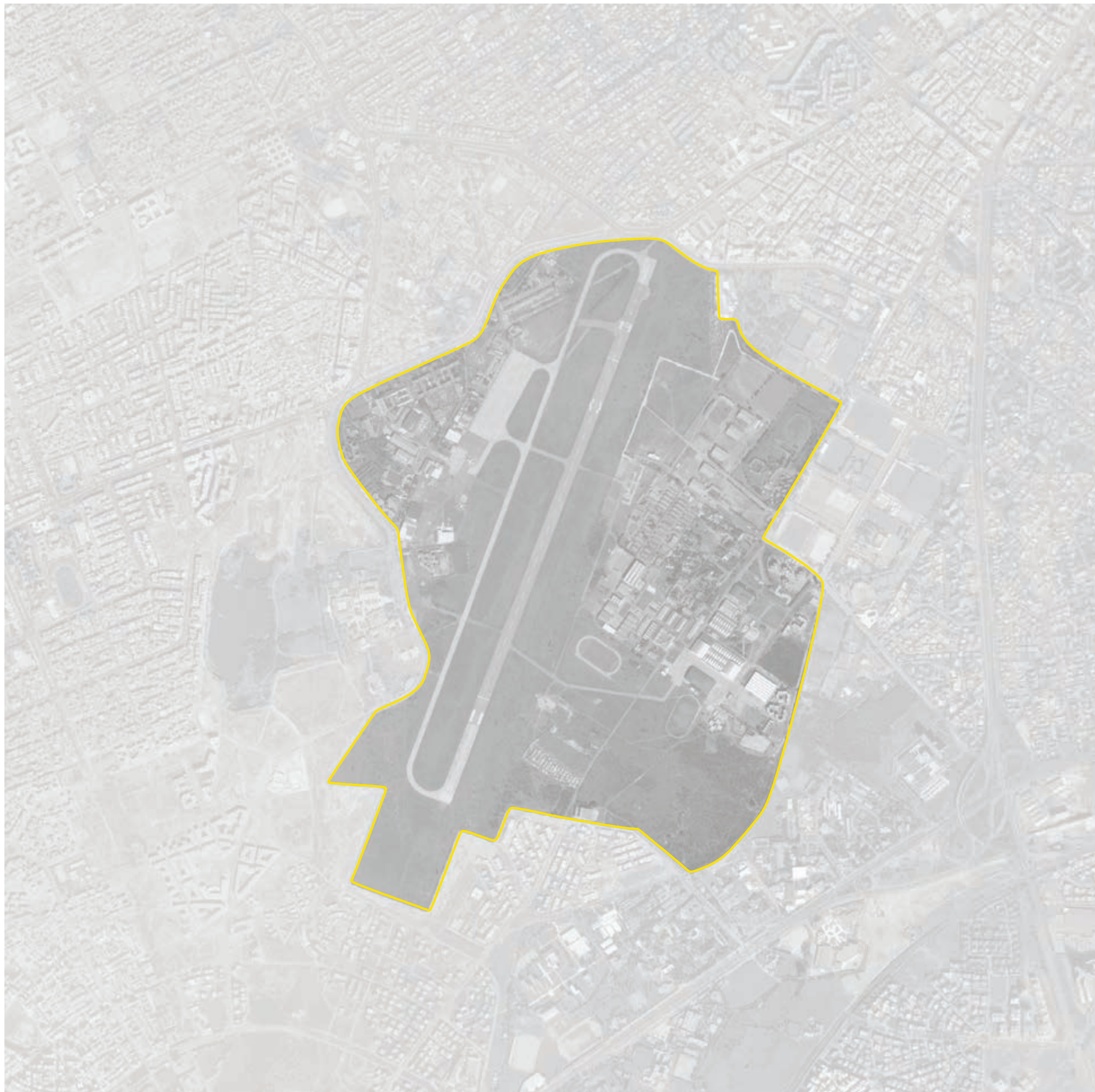


Fig. 4.6a. Anfa Airport, Casablanca, Morocco.

Area: 297 ha
Pervious Surface: 183 ha
Impervious Surface: 115 ha
Runway Length: 4.2 kms
Perimeter: 8 kms

Fig. 4.6b. Agence Ter and Reichen et Robert & Associes, et al., The Green Quarter of Anfa, 2007.

Area: 486 ha
Open Area: 159 ha
Built Area: 327 ha
Water Area: 18 ha
Perimeter: 14.6 kms

0 500m Scale: 1:25,000

Part II: Operations

Hydrologies

Ecologies

Infrastructures

Interventions

Transforming an abandoned airfield is a complex task that walks the line between issues of management—related to wildlife, storm-water, and pollution—and issues of design—related to aesthetic goals, urban networks, and public space—among others. Zooming in on any one of these issues, we find that an entire range of complex concerns is involved. A storm-water management strategy, for example, must simultaneously address water-quality enhancement, groundwater recharge, aquatic recreation, wildlife habitat, wetlands protection, landmark protection, erosion control, sediment deposition, and the creation of open space.

Most of the time, we are unaware of the water, sewage, waste, and electrical systems that undergird and enable our life in cities. Other systems, like road networks, may present themselves to us partially, but they too are dependent upon an invisible complex of subsurface materials and networks. To address the issues that these hidden systems present, a number of airport transformation projects are rendering these systems visible and hybridizing them with recreation, program, and landscape to give them presence within a project. Transformed airfields embrace environmental sustainability, preserve local agricultural heritage, restore compromised habitats, and commemorate the aviation history of their former airports. They set a new standard of sustainable park design and urban development. Furthermore, citizens and communities can become key participants in imagining these new sites.

To realize an airfield transformation, many operations—executed by different parties over extended periods of time—must contribute to achieving the project's ambitions and vision. These operations will require knowledge from design, environmental management, hydrology, transportation planning, urban development, and engineering. Because transformation is a process comprised of many other processes that unfold over time, the set of operations presented in Part II represents a foundation of shared knowledge to the parties working together to propose and implement an airfield's transformation. These techniques and tools, divided into four thematic sections—Hydrologies, Ecologies, Infrastructures, and Interventions—build upon the strategies and ideas elaborated in Part I.

Hydrologies

With new environmental conditions of sea level, tides, precipitation, flooding, and storm surge exacerbated by climate change, our assumptions about water resources and management are shifting. Coastal threats and hazardous waterborne contaminants are among the most significant problems impacting abandoned airfield sites and must be taken into account through strategies that protect water quality, public health, and resilience. Vast airfield sites must take special consideration of the rate and direction of groundwater flow and its potential effects of flooding. Other water-related issues at stake include poor water quality caused by aviation contaminants, excess runoff due to extensive areas of impervious paved surfaces, and the site's relationship to other geological or subsurface hydrological resources. Regional studies of geology and hydrology, subsurface investigations of the release of hazardous materials, and site-specific geotechnical and drainage data may inform the analysis and evaluation of water quality and other hydrological concerns.

In response to changing environmental conditions, it is possible to introduce flood-control measures, landscape interventions, and disaster preparedness on a neighborhood scale in existing urbanized areas and primary transportation corridors. Paisajes Emergentes's proposal in Quito, Ecuador (Parque del Lago, fig. 3.3) aims to generate an active hydrological park by flooding the site. The resulting aquascape highlights natural water cycles and acts as an organizing structure for the park's various programs.[47] In Taiwan (Taichung Gateway Park, fig. 3.6) the proposal entitled "Aqua Cultures" puts forward a new model of a park that integrates recreation, culture, water treatment, and biodiversity. Through the integration of an innovative symbiotic water treatment system, the park can provide a sustainable vision and suggestive experience of water management to visitors.[48] Transformed airfields should strive to protect, conserve, and remediate water resources and to restore natural hydrological processes wherever possible. To assure their success, they should incorporate the ongoing measurement and monitoring of key sustainability metrics and provide adaptable mechanisms for change.

Civil

Airfields on oceanfront sites cannot avoid the consequences of sea level rise. Resilient strategies can be introduced to protect the site's long-term preservation and inhabitability. Since sea level and storm surge levels will continue to rise, waterfront sites should not depend solely on tactics that aim to keep water out, but must also adopt ways to resiliently manage and respond to periodic surges without significant damage or need for evacuation. The restoration of natural soft-edge waterfront conditions can make inland areas less vulnerable to storm surges. Raised structures can protect infrastructures from these surges as well. In New York (Floyd Bennett Field, fig 4.1) elevated pathways, piers, and jetties were built safely above projected sea and surge levels. These infrastructures and other design elements were calibrated to mitigate the potential impacts of those threats.[49] The design of resilient waterfronts adapted to sea level rise and storm event requires several considerations. These include: the selective removal of bulkheads and surficial remnants of landfilled areas throughout the site; the selective removal of redundant buildings found to be lacking in cultural or economic value; and the restoration of ecological zones and shorelines for habitat and human occupation.

Civil

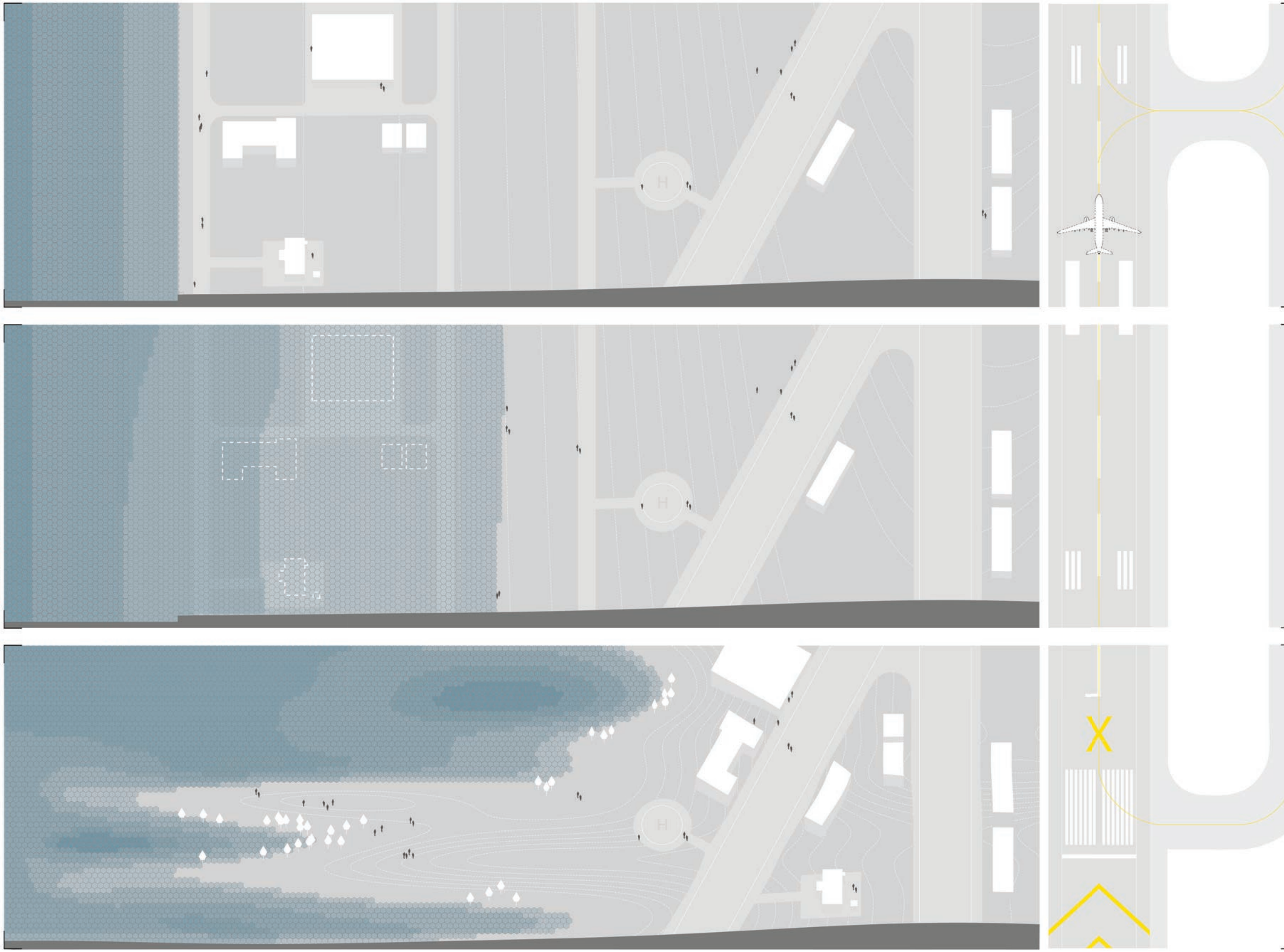


Fig. 5.1a. Site Inventory.

b. Removal of Structures in Floodplain.

c. Shoreline Restoration and Elevated Construction.

Surface

When a former airport site is reimagined as a green infrastructural landscape consisting of parks, greenways, and open spaces, water can play a central role in its new functioning. Existing streams and rivers can become urban amenities and the site can perform essential processes related to storm-water management and water quality control. The vast open space of an airfield represents an enormous surface area through which water will pass, whether in the form of precipitation, retained water bodies, streams, infiltration, or runoff. This interface between the surface and the flows of water should be dealt with at the scale of the site so that these flows can be carefully managed. For example, large pervious areas of the site may provide extensive surface area for slowing down and cleaning urban runoff. In addition to infiltration, the surface can also be designed to accommodate water bodies for drainage and retention as a measure to delaying runoff. Once a retained volume of water is cleaned, it may be used for recreational purposes or agricultural irrigation.

Stormwater Management

In sensitive natural areas and preserves, the management of storm-water must contribute to the rehabilitation and maintenance of wetlands and water tables. Management strategies may be deployed on site to help slow, channel, treat, or reuse storm-water or encourage ground infiltration to minimize runoff. Conventional drainage pipes can be replaced by vegetated swales, filter strips, wetlands, detention ponds, and other storage and treatment systems designed to utilize natural processes. Additionally, strategies that capture and clean runoff as it flows through the site—using Natural Treatment System (NTS) basins, replacing impervious surfaces with pervious materials, and installing green roofs—offer cost-effective solutions while helping to improve the recreational and ecological value of on-site storm-water.

In Denver (Stapleton Redevelopment, fig. 1.2) the storm-water treatment system formed a fundamental aspect of the community's spatial organization. The system collects water from individual parcels of land and extends over a network connecting parks and open spaces. The system treats water initially through non-point sources such as parking lots and median strips, where the coarsest particulates are removed and captured. Subsequently, the water is conveyed to regional treatment sites in parklands where the water treatment is complete. Ultimately the water is returned to a day-lighted creek that runs through the site.[50] The use of vegetated swales for storm-water management has been proposed for Irvine (Orange County Great Park, fig. 2.4) and Athens (Hellinikon Metropolitan Park, fig. 1.5)[51] where a treatment system is planned to catch, store, and release rainwater through a series of terraces, embankments, and retaining walls that create areas of leveled ground also suitable for various activities.

Stormwater Collection and Cleansing

Storm-water may be collected on site in uncovered grade-level bodies like ponds, lakes, and waterways and has the potential to be reused for other purposes like landscape irrigation. From these reservoirs, the water may be diverted in open channels into the ocean or other regional hydrological networks. Dry detention basins, built in depressions in the terrain, are typically grass-covered and controlled by a restricted outflow located at their lowest point that ensures the slow emptying of accumulated water into the channel system after the basin has filled. In cities like Oslo (Fornebu Airport) and many others, the airfield's large vegetated areas associated with detention ponds represent an important buffer for nearby residential areas whose safety depends on the capture and conveyance of waters during extreme flood events.[52] This kind of system is widely employed because it allows flooding to occur in a gradual and predictable manner across a terrain.

Various water bodies—canals, streams, fountains, lakes;[53] ponds, channels;[54] lagoons[55]—can control the flow, drainage, and evaporation of stormwater. They can be designed on a site to address a wide range of water management needs. Lakes, for example, can treat excess water from parks and nearby buildings;[56] and cultivated soil and softscape corridors can collect rainwater.[57] The use of these strategies must take into account the height of the water's surface; the ability of the water body to sustain moderate flood levels; clear indication of whether a water body is suitable for human use; as well as annual fluctuations between wet and dry seasons.

Water reuse systems and their connections to site irrigation and other non-potable usages can also play a key role in creating wildlife habitats that support native species. In Irvine (Orange Country Great Park, fig. 2.5), for example, the two-mile-long Canyon features a sinuous stream of water dotted by a string of small pools and a diverse mosaic of natural habitats. The Canyon's ecological features—slopes covered by rocky outcrops, woodlands, and coastal sage scrub—also support aquatic habitats. Water is collected from several lakes and used for irrigation and general park maintenance. In Quito (Parque del Lago, fig. 3.3) the scheme by Paisajes Emergentes proposes channeling water into circular pools where, powered by wind energy, it would be treated in order to meet public health and safety standards. Additionally, an advanced pump system would ensure that the water that has reached the end of the treatment process would sit at a higher elevation than the untreated water, potentially creating a continuous cycle of the water on the site.[58]

Surface

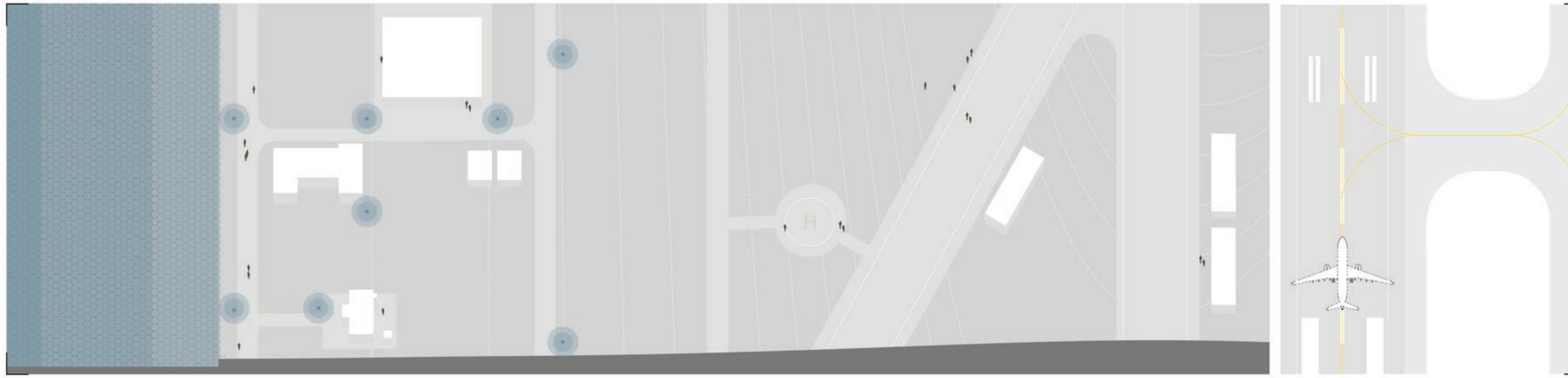
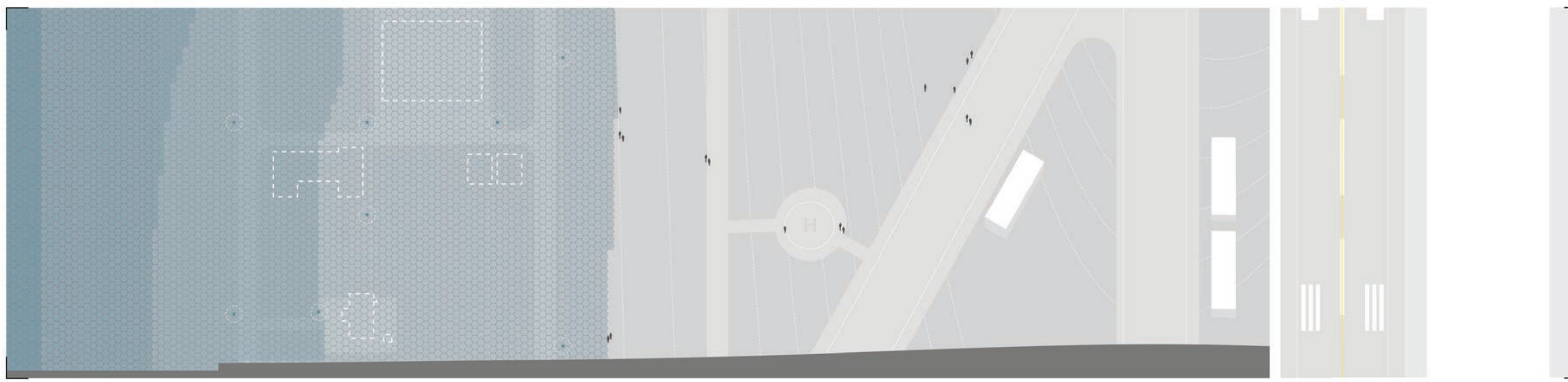
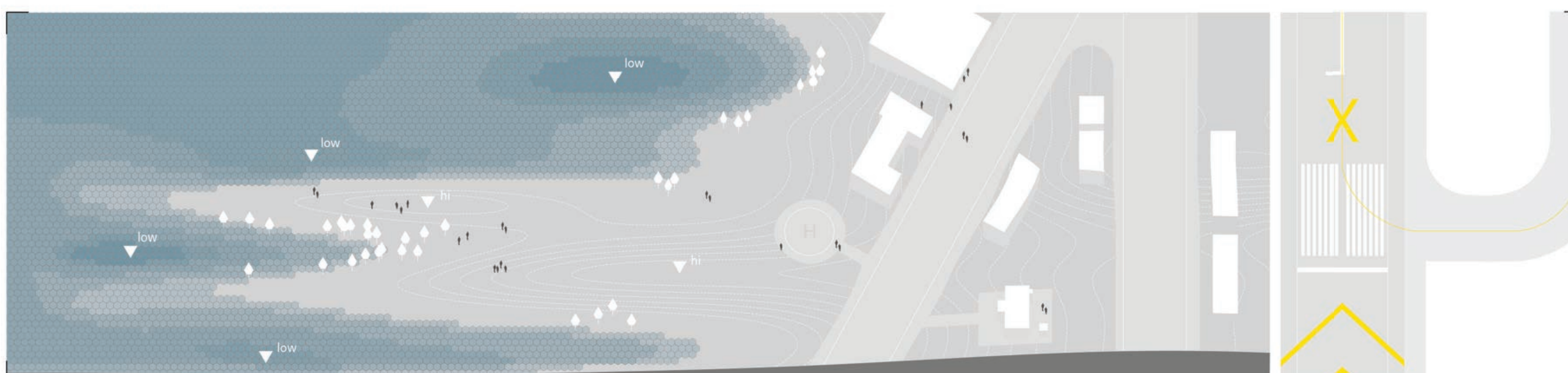


Fig. 5.2a. Surface Inventory.



b. Surface Utility Cap and Seal.



c. Shoreline Stabilization and Elevated Construction.

0 50m

Scale: 1:2500

Subsurface

The quality of surface water and groundwater on an airfield site is affected by historic and current land uses and the composition of underground geological materials. Subsurface hydrology is approached largely from a resource-management and human-health perspective in order to assess how development decisions and management practices will impact the chemical quality of soil and groundwater. For sites with polluted soil and groundwater, additional efforts are directed toward the design of monitoring, detection, and compliance schemes.

Drainage Systems

Drainage systems remove excess water from the surface of a site (i.e. surface drainage) and from the soil below the surface (i.e. subsurface drainage) in order to protect the site from waterlogging. A site that lacks subsurface drainage must drain surface water fast enough to prevent infiltration into the ground, where water may cause costly damage to pavements, membranes, and other construction materials. Underground tile drains are often the principal means of subsurface drainage in a site. In Athens (Hellinikon Metropolitan Park, fig. 1.5) softscape corridors constitute the site's primary surface drainage system. Alternatively, local drain pipes off site can be tapped to supply recycled water to the site for non-potable needs such as irrigation.[59] In Novato (Hamilton Wetland Restoration, fig. 3.4), for instance, this strategy prevented the need to divert on-site water from sensitive wetlands to satisfy other needs on site.

Subsurface

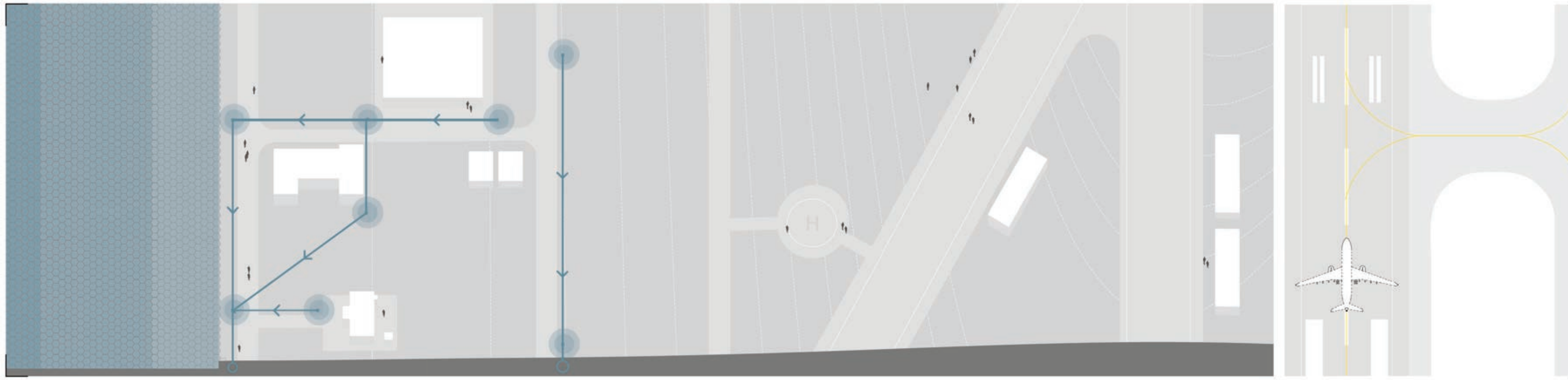
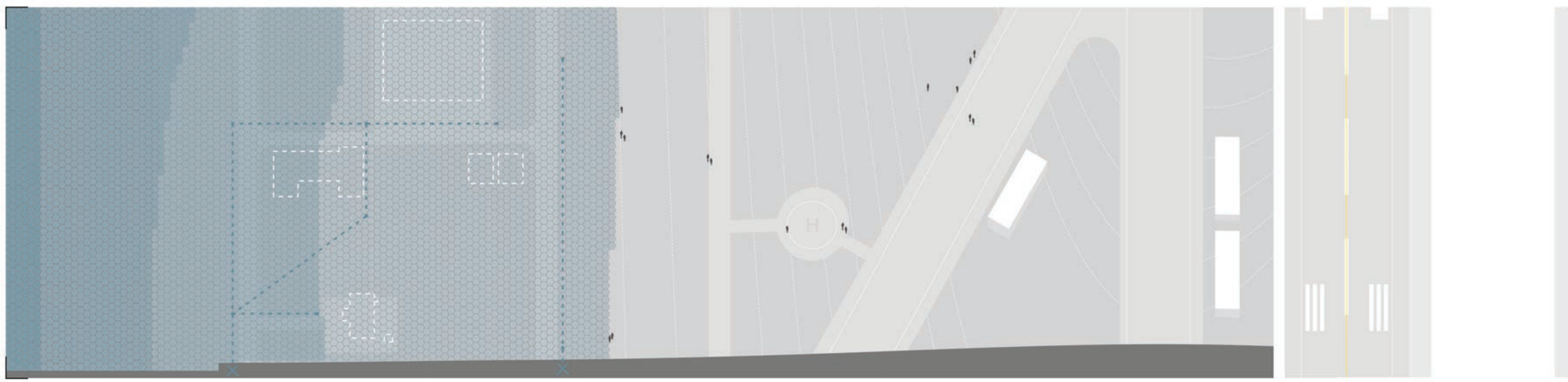
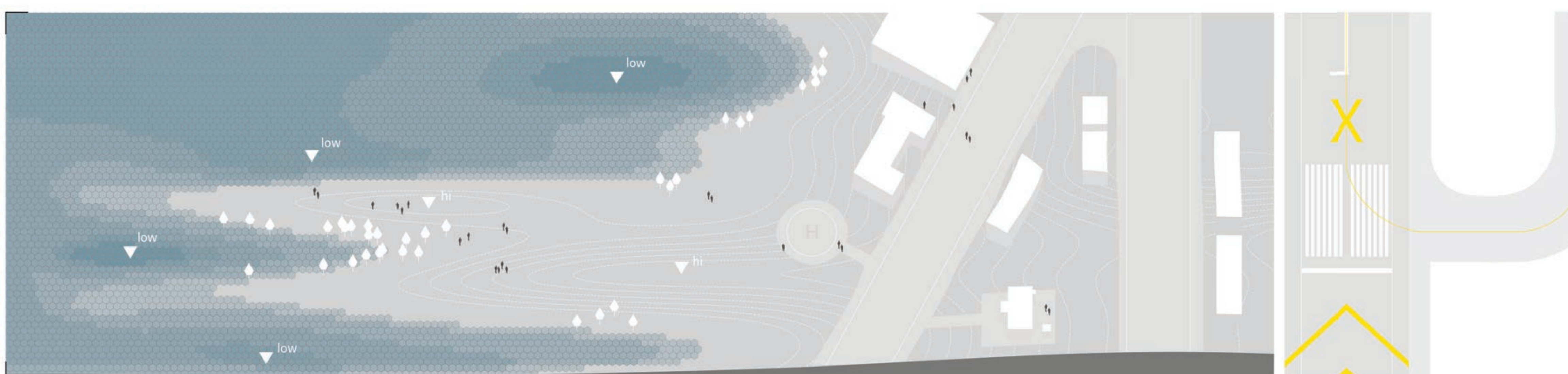


Fig. 5.3a. Subsurface Inventory.



b. Subsurface Utility Removal.



c. Shoreline Stabilization and Elevated Construction.

0 50m

Scale: 1:2500

History

Airports are frequently built atop rich hydrological environments such as wetlands, tidal marshes, and natural coasts. These systems were typically diverted or destroyed in order to accommodate the construction of airports and have since lost their diverse wildlife habitats and hydrological functions. The transformation of airfields, however, provides an opportunity to restore natural systems. A site's history can provide useful information for reestablishing wetlands, marshes, and native species. Original aerial photography and maps of a site can support design proposals to convert and restore particular forms of natural systems.

In New York (Floyd Bennett Field, fig. 4.1) the park emphasizes and integrates the presence of water as a defining feature of the larger Gateway recreation landscape. The landscape plan for the Midway Atoll (Henderson Field Airport, fig. 3.7) proposes the demolition of runways and the reestablishment of native habitat for endangered marine species. The plan seeks to transform the islands into a research center and destination for ecotourism focused on Midway's fragile ecosystems, marine resources, and historical significance.[60] The decommissioned Harvard Airfield in Quincy (Squantum Point Park, fig. 4.2) has been transformed into a park by the reestablishment of tidal marshland.[61] In Novato (Hamilton Wetland Restoration, fig. 3.4) the former airfield was flooded and a system of ponds and channels was created to serve as cells for the wetland restoration.[62] In San Francisco (Crissy Field, fig. 1.1) wetlands and dune landscapes were restored in the context of a cultural landmark.[63]

History

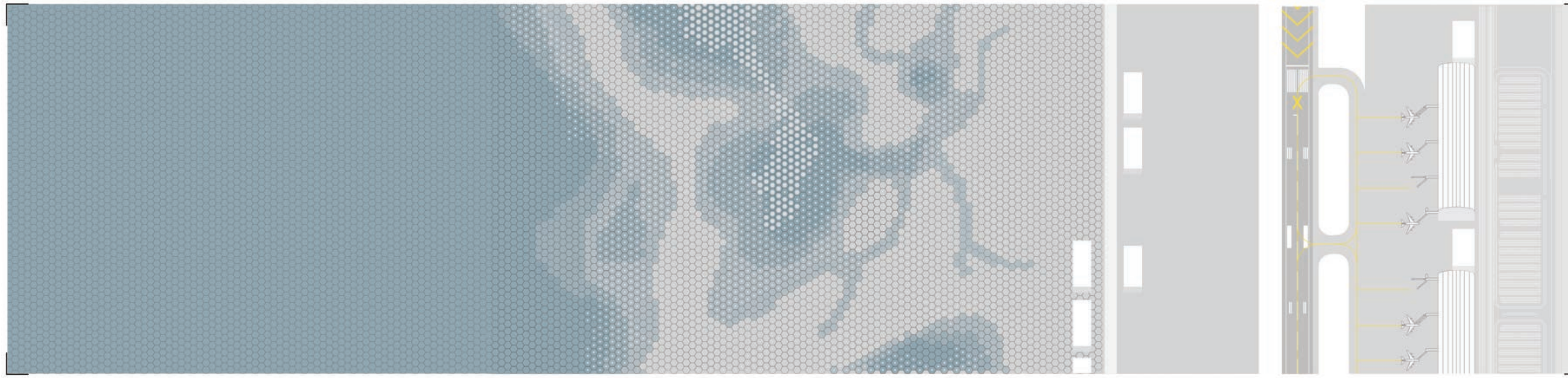
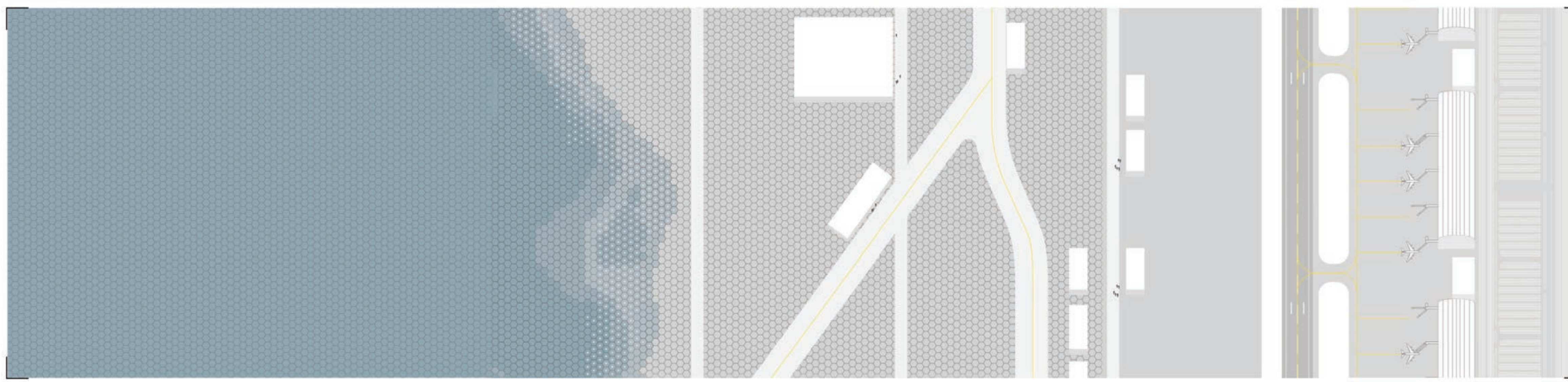
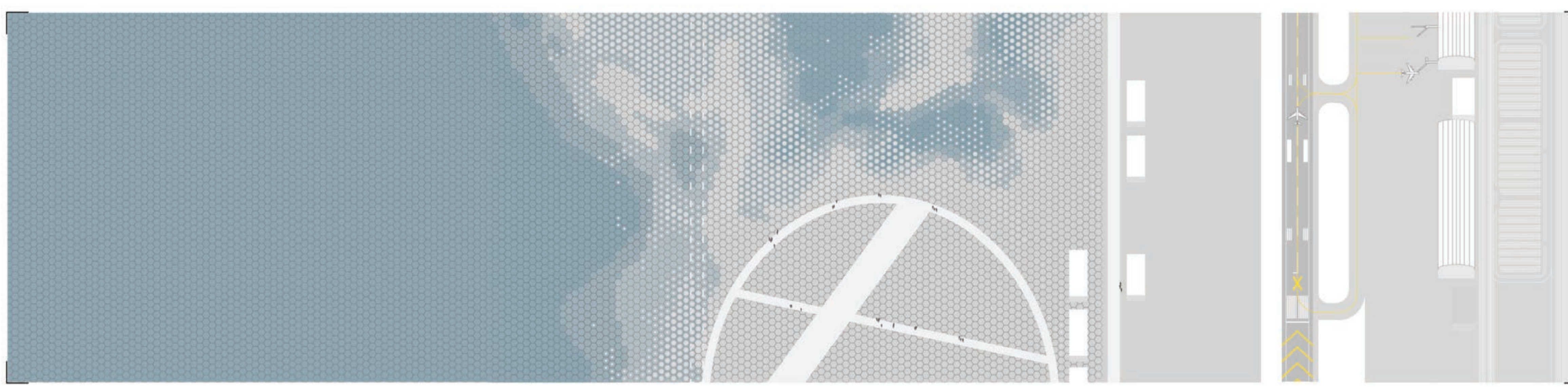


Fig. 5.4a. Site Pre Airport.



b. Site during Airport Life.



c. Site Post Airport.

0 200m Scale: 1:10,000

Region

Streams and rivers are commonly buried, culverted, or diverted during the construction of airports, causing interruptions and breaks in regional hydrological systems. The transformation of an abandoned airfield site presents an opportunity to restore or extend these regional systems. In Chicago (Northerly Island Framework Plan, fig. 4.4), for example, the new urban park allows the extension of Chicago's system of lakefront parks to the entire region. Proposals for the former international airport in Quito (Parque Bicentenario, fig. 3.2) imagine the creation of lakes to collect and filter water from the surrounding mountains and function as wading pools, swimming pools, fishing ponds, and reflecting basins.[64]

Daylighting, the process of uncovering streams that have been channelized and culverted, is proposed in many projects as a means of restoring original hydrological systems and enhancing water quality on site. In Irvine (Orange County Great Park, fig. 2.4) the daylighted and restored Agua Chinon creek once again performs seasonal floodplain and aquifer recharge.[65] Regional partnerships can offer numerous benefits for hydrological management by providing opportunities for communities to share ideas. In Denver (Stapleton Redevelopment, fig. 1.2) design guidelines for water quality facilities have been developed through a collaborative effort involving corporate, municipal, and county-level participants in conjunction with the developer and consulting engineers and landscape architects. This collaboration ensured that water-quality systems would simultaneously support the local community's urban design goals and interact effectively with the city's existing overall water systems.[66]

Region

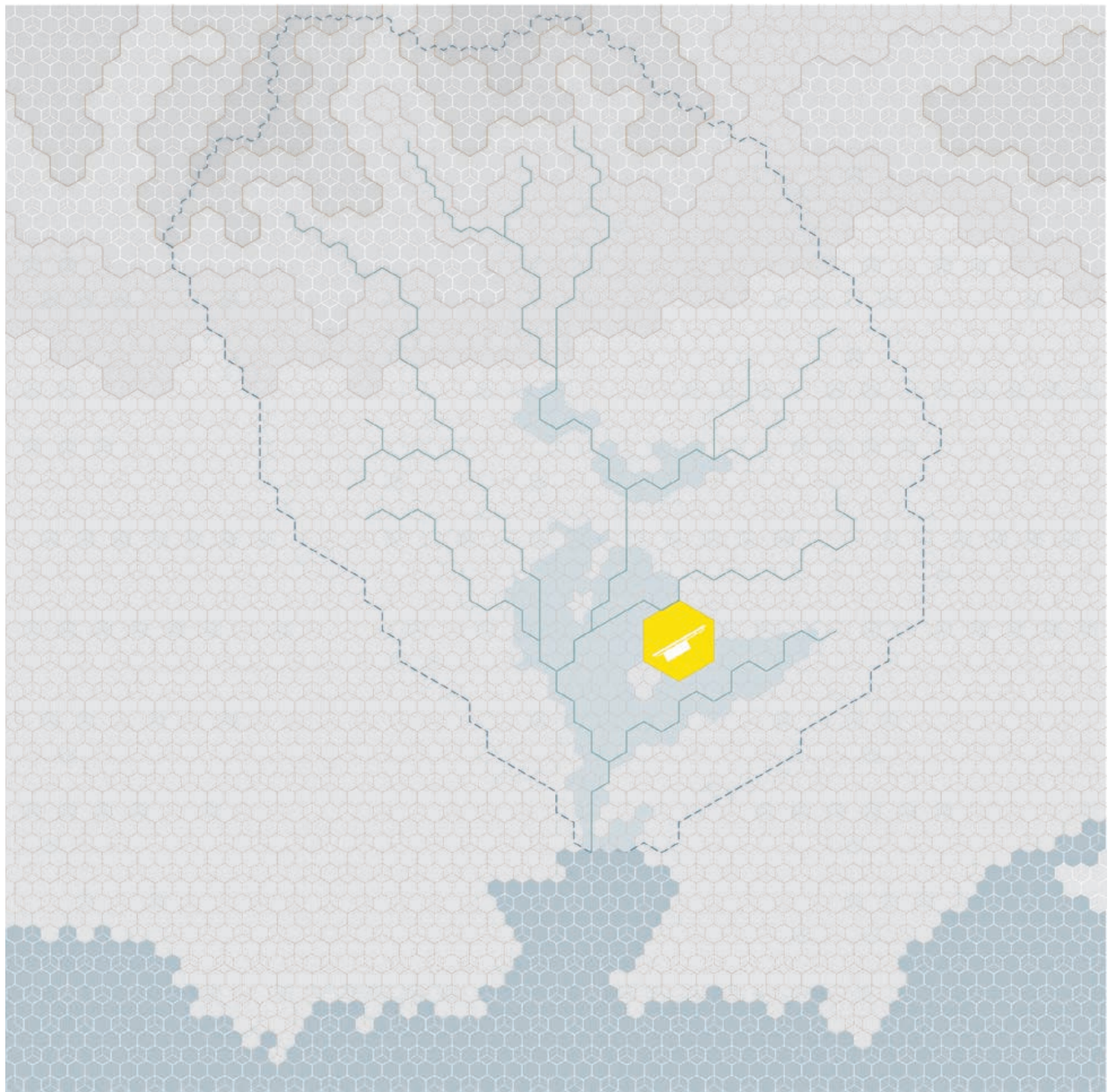


Fig. 5.5a. Watershed Recognition.

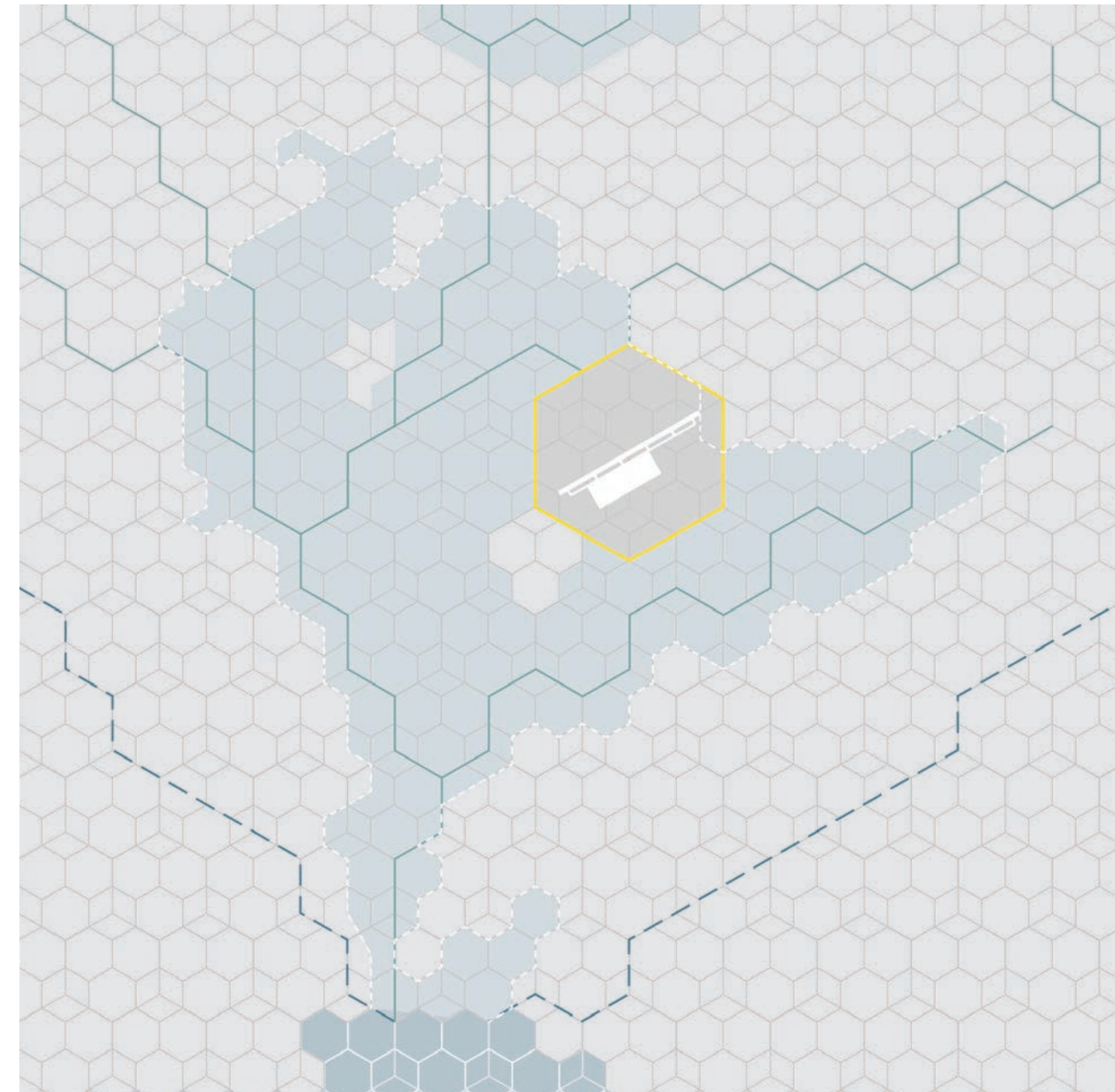


Fig. 5.5b. Detail of Watershed Recognition.

Ecologies

To approach the transformation of an airfield site—and the infrastructures and contamination that come along with it—it is essential to rethink the meaning of "nature" under postindustrial urban conditions. On these sites, complex assemblages of interdependent ecologies encompass diverse plant and animal species and hydrological systems. The management of a site's ecological dynamics requires the consideration of native habitat restoration, biodiversity enhancement, and the increase of connectivity to regional ecological systems. By providing wildlife corridors and habitats, a transformed airfield site can enhance biodiversity and the natural heritage characteristic to a region. The strengthening of ecological systems, as well as the sustainable and low-carbon practices that should inform any environmental site management strategy, often produces additional human benefits like the improved social and economic health of a site and its inhabitants. This is the case in New York (Floyd Bennett Field, fig. 4.1) where the challenge was to establish a relationship between the new park site and the existing ecological systems throughout the Gateway National Recreation Area while proposing new opportunities for environmental stewardship, reclamation, restoration, and remediation.

Many projects for the redevelopment of airport sites incorporate self-organization, spontaneous regrowth, and succession of flora and fauna. Such projects aim to enable ecological systems to adapt and grow over time. The competition proposal by James Corner Field Operations and Stan Allen Architect for Toronto (Downsview Park, fig. 2.3) consists of two organizational strategies: "Circuit Ecologies," consisting of circuitous pathways with event spaces and active programs, and "Through-Flow Ecologies," made up of habitats, plantings, drainage systems, and infrastructure. This strategy is intended to respond to changes in the site's natural systems and cultural programs over time.[67]

Flora

In an operative airfield site, the growth of plants is discouraged and relegated to limited areas that do not threaten aviation operations. In fact, the construction of most airports involves the elimination of large areas of vegetation in favor of bare, paved fields. In the transformation of former airfields, however, plants may be reintroduced and stimulated to thrive. Vegetation can serve a range of crucial roles in transformation projects. Plantings may organize and delineate spaces and act as the experiential fabric that binds a site together. Diverse plant species can perform ecological goals ranging from rainwater collection to amelioration of urban heat island effect, introduction of local character, and provision of endangered wildlife habitat.

In Quito (Parque Bicentenario, fig. 3.2) the park proposed by Anita Berrizbeitia et al. guides visitors along paths through forest and prairie landscapes filled with Ecuadorean plants. Wooded areas, agricultural plots, and gardens alternate and follow a humidity gradient ranging from dry and open areas at one extreme of the park to wet and densely vegetated areas at the other.[68] In Gatow (Park Landscape and Urban Agriculture Gatow, fig. 2.6) the design proposes strips of meadow and grassland parcels that alternate with strips of high forbs. In Taiwan (Taichung Gateway Park, fig. 3.5) plant species are selected across the park to reduce heat, humidity, and pollution and to remediate contaminated runoff. The competition scheme entitled “Aqua Cultures,” (fig. 3.6) on the other hand, proposes a sequence of gardens characterized by different landscape types and plant palettes that give identity to different areas of the park, including the Conifer Overlook and Mimosa Promenade.[69]

Grass

In San Diego (San Diego International Airport) eelgrass helps to minimize the impacts of storm-water runoff and furnishes a new foraging ground for terns.[70] In New York (John F. Kennedy International Airport) tall fescue grass serves as a deterrent to the waterfowl and migratory birds that pose a bird strike danger in the vicinity of the active runways.[71] In Casablanca (Anfa Airport, fig. 4.6) flowering prairies and gardens are proposed, and in Irvine (Orange County Great Park, fig. 2.5) the competition proposal by Hargreaves Associates suggests the use of native oak grassland to weave the disparate parts of the park together.[72]

Plants

In Athens (Hellinikon Metropolitan Park, fig. 1.5) the proposed tree-planting strategy for the site’s softscape corridors employs garrigue scrubland plants to colonize the interior portions of the softscapes in order to prepare the ground for ecological succession and future mature trees (e.g. pine, olive, and oak).[73] In Caracas (La Carlota, fig. 4.5) chaguaramo palms, acacia, and araguaney trees are used.[74] In Casablanca (Anfa Airport, fig. 4.6) acacia are used alongside gleditsia trees.[75] And in Berlin (Landscape Park Johannisthal, fig. 2.1) strips of wooded areas are used to mark the entrances to the site and contrast against the expansive meadows therein.[76] In Casablanca (Anfa Airport, fig. 4.6) a variety of hydrophilic plant species helps to collect rainwater and exploit rainy periods of the year.[77]

Grids

In Munich (Landschaftspark München Riem) gridded groves of trees (e.g. hornbeam, pine, and oak) define an overall diagonal orientation to the new park—drawing inspiration from the orientation of vernacular field patterns in the region and pulling visitors into the park from the surrounding areas of the city.[78] In Berlin (Tempelhofer Park, fig. 1.4) proposed gridded oak groves—referred to as "tree archipelagos"—are scattered throughout the airfield to provide orientation and sense of scale to visitors.[79]

Flora

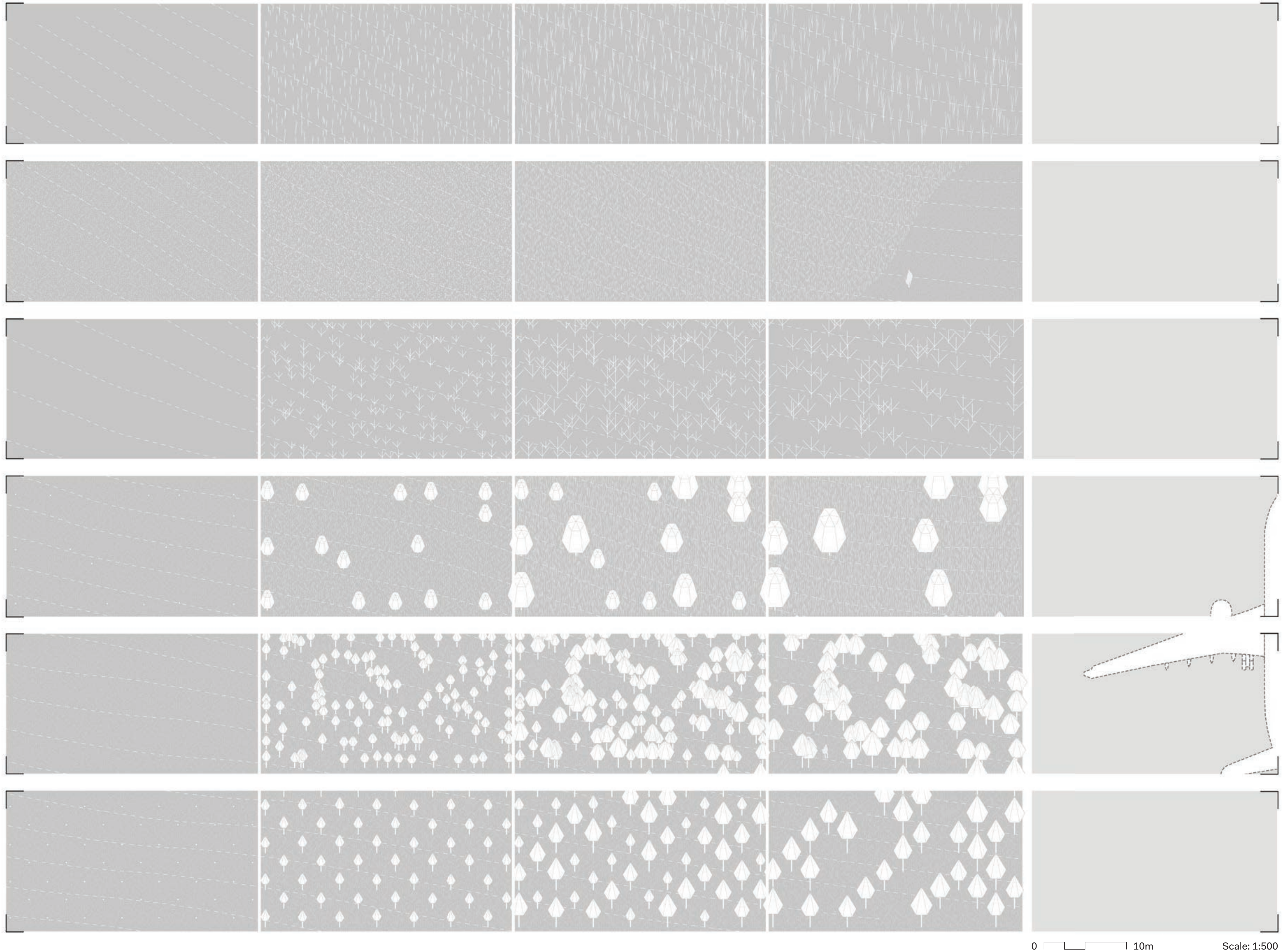


Fig. 6.1a. Wetland.

b. Meadow.

c. Garrigue.

d. Oak Grassland.

e. Forest.

f. Gridded Tree Grove.

Fauna

Similar to their strategies for managing vegetation on site, active airports generally seek to suppress the populations of animals. Birds in particular pose a special threat to aircraft taking off and landing. As a result of decades of aviation activity, airport sites tend to have low biodiversity and habitat area. The transformation of former airfields, however, provides an opportunity to increase biodiversity, restore native species, introduce beneficial non-native species, and construct wildlife corridors that link regional habitat areas. Furthermore, a number of new operations practices are bringing fauna back to active airports as well.

In some airfield sites, populations of sheep, llamas, or donkeys graze on dry grasslands.[80] This serves as an ecological management tool for reducing the site's carbon footprint by eliminating the use of weed-whackers and other lawn management equipment.[81] In some sites, various efforts are undertaken to protect endangered species of animals.[82] At Midway Atoll (Henderson Field Airport, fig. 3.7), for example, the Laysan albatross and its habitat are specially cared for.

The peregrine falcon, a bird of prey that feeds on medium-sized birds like waterfowl, pigeons, doves, songbirds, and waders, can scare off and significantly reduce the number of smaller birds flying near airports and their boundary zones. The presence of falcons on active airport sites, therefore, contributes to the prevention of dangerous bird strikes between aircraft and birds.[83] In Chicago (Northerly Island Framework Plan, fig. 4.4) fish-spawning sites and bird habitats have been constructed to attract populations of nuthatch, downy woodpecker, red-eyed vireo, red-tailed hawk, cardinal, yellow warbler, bluebird, marsh wren, meadowlark, heron, bittern, rail, egret, sora, puddleduck, and shorebird.[84]

Fauna

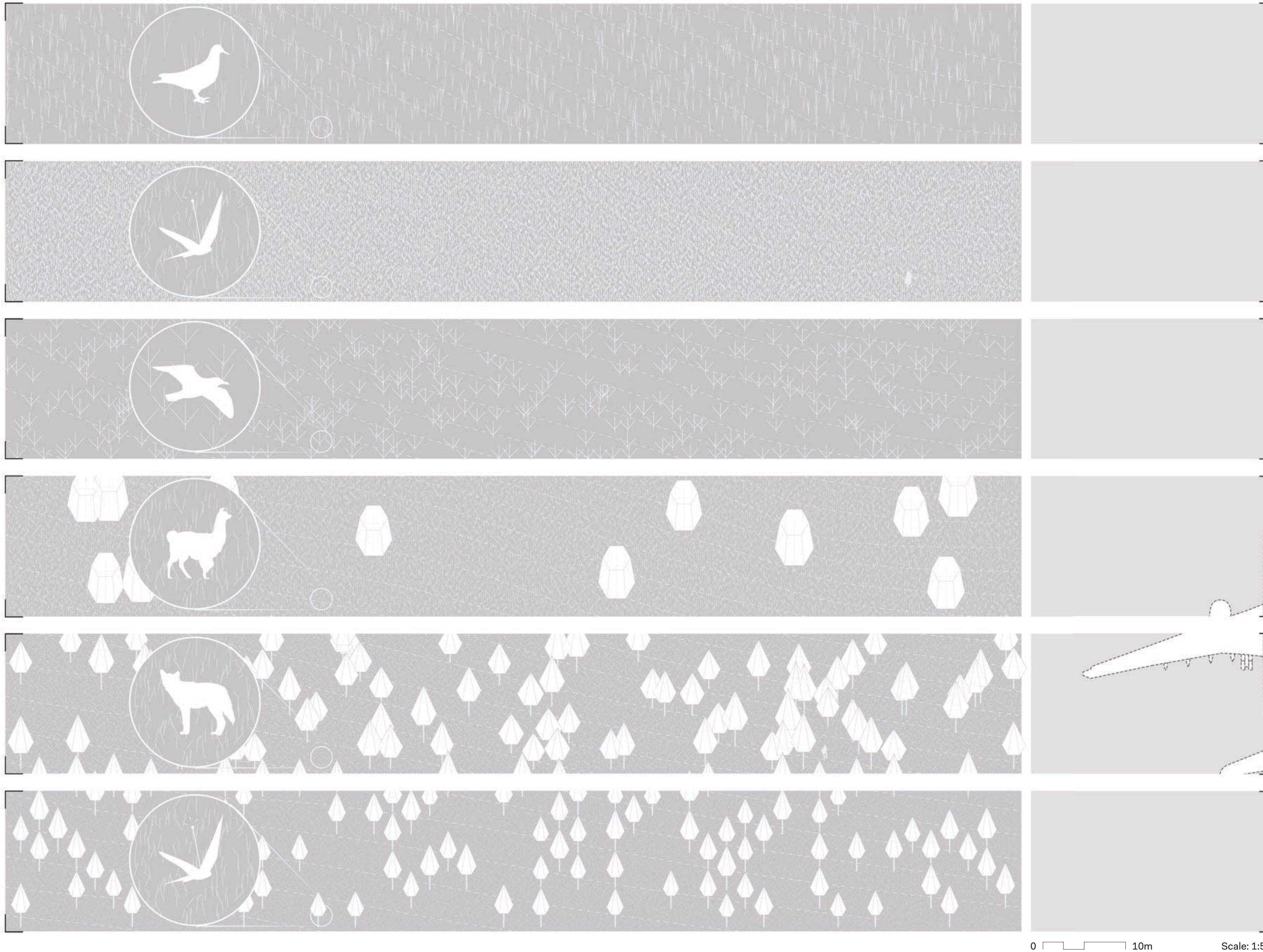


Fig. 6.2a. Wetland with Tern.

b. Meadow with RoBird.

c. Garrigue with Peregrine Falcon.

d. Oak Grassland with Llama (grazing).

e. Forest with Coyote Decoy.

f. Gridded Tree Grove with RoBird.

Restoration

Birds and wildlife once thrived in the rich wetland environments atop which many airports were built. The ecological restoration of these sites, however, can reestablish wetlands, tidal marshes, dunes, and the native plant and animal species that inhabit them. But it is a "mistaken assumption that we can somehow bring back past ecosystems by removing invasive species and replanting native species. This overly simplistic view of the world ignores two basic tenets of modern ecology—that environmental stability is an illusion, and that an unpredictable future belongs to the best adapted."[85]

Habitat Restoration

Decommissioned airport sites provide many opportunities for the reclamation, restoration, and reconstruction of large areas of land as renewed habitats. Building upon the natural and cultural heritage of an airfield, layers of site history can help to generate and inform design and restoration plans. Often, the creation of new wildlife habitat is paired with the design of environments for recreational and public use.[86]

Wildlife corridors—designated swaths of land that connect disparate natural areas—are critical for a local animal population's ability to move across various habitats or migrate seasonally. In wildlife corridors, human access is denied and plantings must allow animals to move easily across the space. In the transformation from airfield to park, many projects have become designated natural reserves. Sites in Berlin (Landscape Park Johannisthal, fig. 2.1) and Midway Atoll (Henderson Field Airport, fig. 3.7), among many others, now contain natural reserves. These sites help to restore and maintain natural habitats for fish-spawning, birds, and endangered species.[87] In Quito (Parque Bicentenario, fig. 3.1) the design and planning strategy reestablishes the three unique ecologies that previously converged at this site: a humid forest, a prairie, and a transitional zone.[88]

In Irvine (Orange County Great Park, fig. 2.4) restored native habitats are found in the three major sections of the park: the Wildlife Corridor, off limits to the general public, is reserved for wildlife movement from the mountains to the sea; Agua Chinon, linking a 974-acre nature reserve north to south, is crisscrossed by paths that allow visitors to experience this area; the Canyon, a microcosm of regional topography and landscapes, acts as a counterpoint to the former runway; and other linear, hard-edged features of the park.[89]

Wetlands Restoration

Wetlands provide crucial wildlife habitat and perform essential ecological services. Former airfield sites are often sited in relationship to former wetlands, and it may be possible to restore these wetlands or construct new ones.[90] In Novato (Hamilton Wetland Restoration, fig. 3.4) the former airfield was flooded and a system of ponds and channels was created to serve as cells for wetland restoration.[91] The successful restoration of wetlands is achieved in phases on a timeframe often measured in decades and generally requires the following actions and considerations: evaluation of the contamination of site and soils, followed by excavation of pilot channels through the outboard marshland; breaching the outboard levee to bring full exchange (over time) between the site and the waterbody as the channel widens and deepens; after breaching the levee, tidal exchange or water movement will introduce new sediments, raising site grades above the constructed mudflat surfaces (i.e. placed dredged material); the scouring and deposition of sediments on site will create a channel network drainage system; tides carry the seeds of vegetation from adjacent salt marshes and establish them in precise relationship to elevation, wind-wave energies, and substrate conditions; sediments will accumulate and vegetation will colonize the site over time, creating a diverse array of habitat types; the rate at which tidal wetlands will develop depends on the amount of wave energy on site, the initial elevation of the placed dredged material, and the rate at which sediments are supplied from the nearby body of water.

Dune Restoration

Natural and artificially stabilized dunes provide protection to coastal development and limit storm impacts to landward coastal resources. The case of San Francisco (Crissy Field, fig. 1.1) presents a well-developed and well-documented case of dune restoration. Dunes were classified on the site into three substrate types—“remnant,” “sand,” and “dredge”—based on the source material from which they were created. Remnant dunes existed prior to restoration and were enhanced by restoration efforts; sand dunes were created from sand collected along the Crissy shoreline; and dredge dunes were constructed from dredge materials from local sites. Dunes were further classified according to the type of zone that they occupied: dunes in areas showing evidence of moving sand (blowouts, hummocks, or very fine sands) were classified as “foredunes,” while dunes in all other areas were classified as “transitional.” The restored dunes were then measured for variables including species richness, total percent vegetative cover, percent exotic species cover, and relative abundance.[92] Generally, dune restoration proceeds according to the following steps: determine the volume of wind-blown sand; if wind-blown sand is available on site, install sand fencing and plants, and if not, import clean sand of compatible grain-size to build the dune; after the dune is shaped, sand fencing and planting can take place; if wind-blown sand is not available on site, a dune can be built by importing quarry sand and capping it with natural dune sand; to stabilize the dune, plant beachgrasses and dune vegetation at least 100 feet landward of mean high water; and lastly, install sand or snow fence to capture wind-blown sand and keep pedestrian traffic off fragile dune vegetation.

Restoration

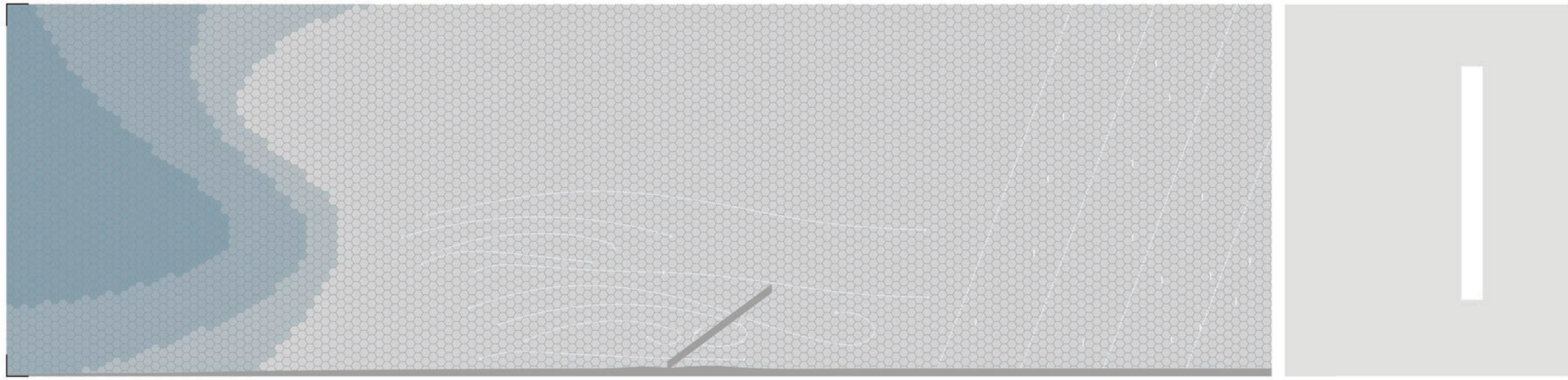
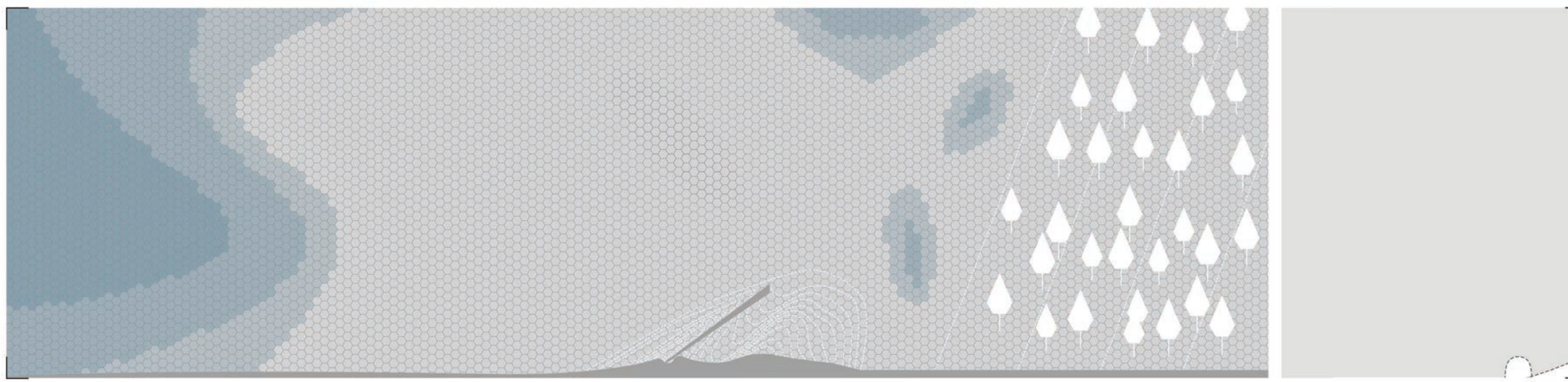
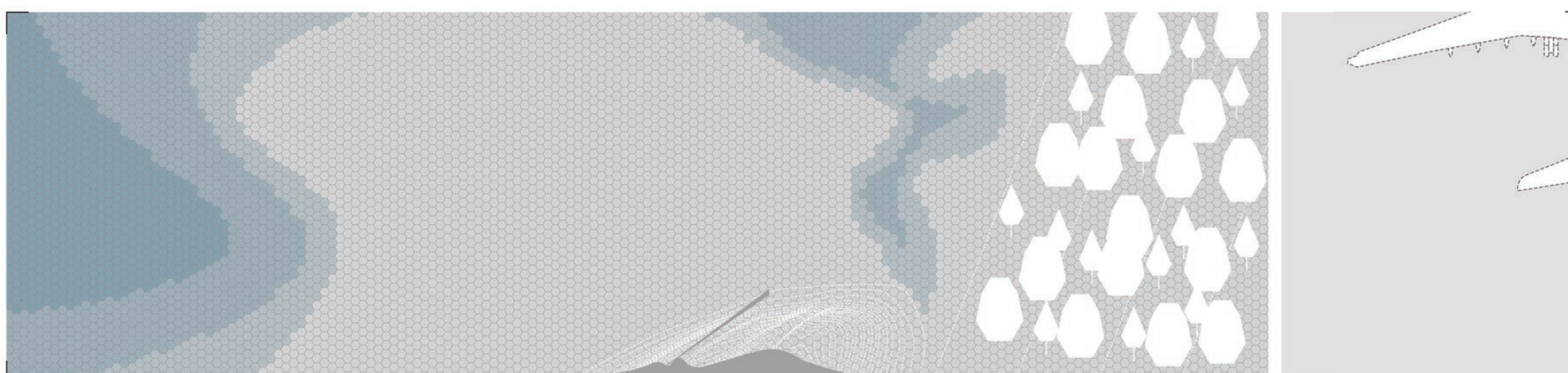


Fig. 6.3a. Planting and Fence Installation.



b. Vegetation and Sediment Accretion.



c. Dune Stabilization and Protection.

0 10m

Scale: 1:500

Remediation

Abandoned airfield sites can only be occupied—or bought and sold—if they are deemed to be environmentally safe. Over decades of time, aviation activities generate oils, paint residues, hydraulic fluids, used batteries, and other wastes that contaminate the site and threaten the wellbeing of people, plants, and animals. A range of strategies is available, however, for rendering an airfield site suitable to for human and ecological occupation and viability.

The primary contaminants found on airfield sites can be divided into organic and inorganic contaminants. Organic contaminants include combustion gases, fuel, oil, grease, chemical stabilizers, and pesticides. These substances generally come from fueling operations, aircraft and engine maintenance, atmospheric deposition, electrical substations, and landscape maintenance. Inorganic contaminants include corrosive metals, salts, and radionuclides (generally associated with military activities), among others. Inorganic contaminants may be introduced on site due to the corrosion of aircraft and ground vehicle parts, environmental pollution from agricultural activities, wastewater, and roadway runoff. De-icing operations, cleaning, construction/deconstruction, and commissioning/decommissioning of surfaces and buildings also introduce organic and inorganic contaminants to the site in the form of detergents, chemical wastes, and paving and aggregate materials (concrete, asphalt, bricks, metals). Organic and inorganic contaminants are toxic to humans, livestock, underground and burrowing animals, and aquatic life. They impact the ground, subsurface soils, and water as well.[93]

In accordance with past regulations governing waste disposal in the United States, much of the waste historically generated at airports was disposed of on site. Today, in order to facilitate and support the reuse and transfer of these contaminated sites, airfields can be classified according to Environmental Condition of Property (ECP) area types[94] that determine a property's suitability or unsuitability for transfer by lease or deed.[95] The seven ECP area types are as follows: Type 1: 0-5% contaminated, areas where no release or disposal of organic/inorganic pollutants has occurred, including no migration of these substances from adjacent areas; Type 2: 5-20% contaminated, areas where only release or disposal of organic/inorganic pollutants has occurred; Type 3: 30-40% contaminated, areas where release, disposal, and/or migration of organic/inorganic pollutants and hazardous substances have occurred but at concentrations that do not require a removal or remedial action; Type 4: 30-40% contaminated, areas where release, disposal, and/or migration of organic/inorganic pollutants and hazardous substances has occurred and where all remedial actions necessary to protect human health and the environment have been taken; Type 5: 50-70% contaminated, areas where release, disposal, and/or migration of organic/inorganic pollutants and hazardous substances has occurred and where removal or remedial actions are under way, but where all required remedial actions have not yet been taken; Type 6: 80-100% contaminated, areas where release, disposal, and/or migration of hazardous substances has occurred, but where required actions have not yet been implemented; and Type 7: areas that are unevaluated or require additional evaluation.

Areas classified as Type 1 through Type 4 are considered suitable for transfer by deed. Areas classified as Type 5 and Type 6 are considered unsuitable for transfer by deed until all remedial actions have been completed or until the remediation has been demonstrated to be proceeding properly and successfully.[96] Areas classified as Type 7 requires consideration or further evaluation.

Contamination Cleanup

Following the rationale that a cleanup effort is adequately protective if it prevents people from exposure to residual contamination, federal and state environmental laws allow for contamination to be contained—rather than removed or treated—from a site. Containment is most often carried out by laying an asphalt or clay cap over contaminated soils. A ventilation system may also be introduced and configured to prevent the migration of volatile chemicals from groundwater or soil into neighboring buildings. Caps, ventilation systems, and other engineered controls are only protective, however, when operating according to plan. As with all engineered systems, wear and tear or lack of maintenance can compromise effectiveness, potentially exposing people to residual contamination. Therefore, engineered contamination strategies must be accompanied by maintenance and operations plans and meet specific standards outlined under federal and state laws. The economic feasibility of a cleanup strategy must also be taken into consideration, as cleanup costs can vary widely.

Brownfield Remediation

A number of innovative remedial and financial techniques have been employed in recent years to accelerate the cleanup of brownfield sites. Remedial strategies such as bioremediation, chemical treatment, physical separation, and in situ oxidation are often applied in conjunction with a number of complementary strategies. Other processes include, for example, soil vapor extraction which pulls vapor from soil and treats it, effectively removing contaminants from a site's soil and groundwater. On brownfields with heavy metal contamination, phytoremediation can use deep-rooted plants to absorb metals from the soil into their tissues. Once the plants reach maturity, they are removed and disposed of as hazardous waste. In Denver (Stapleton Redevelopment, fig. 1.2)—the largest urban infill project in the United States—the contamination cleanup efforts have made the site a landmark of brownfield redevelopment.[97] Inventive financial strategies can also help to manage remediation processes. For example, environmental firms can partner with insurance companies to underwrite the cleanup of a distressed brownfield property and provide a guaranteed cleanup cost, thus limiting remediation costs and exposure to litigation related to contamination risks.

Remediation

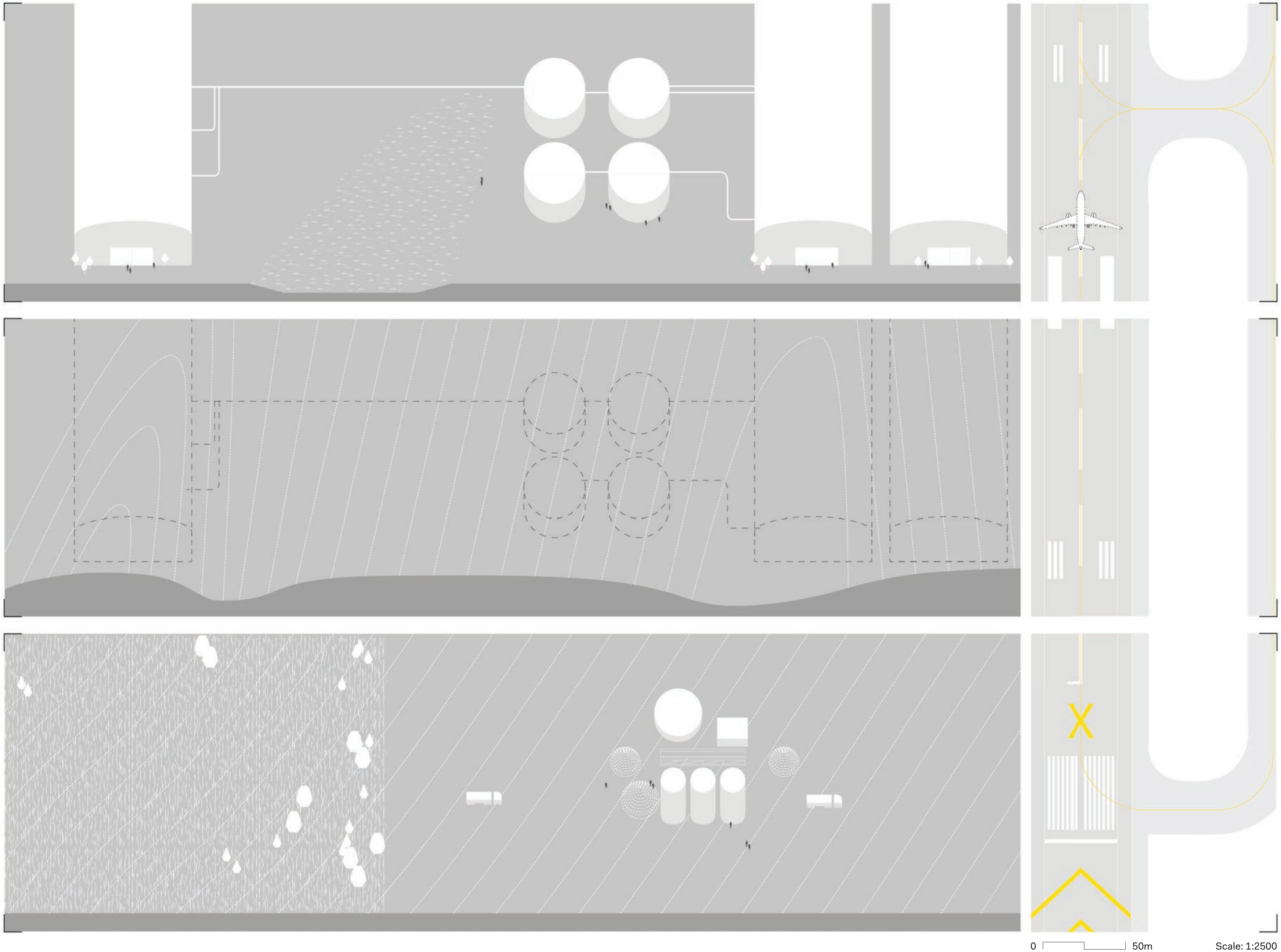


Fig. 6.4a. Site Inventory.

b. Demolish, Cut-and-Fill, Cap.

c. Wash and Remediate.

Growth

The transformation of an abandoned airfield site can activate processes of local and regional growth by introducing new productive ecological and cultural activities. The operation of growth involves the building-up of a site's resources and values and may take the form of cultivation of the land, creation of new habitats and ecosystems, or development of a community where one did not exist before.

Community gardens, for instance, generate positive educational, social, and cultural value by making healthy produce available for local consumption. In Irvine (Orange County Great Park, fig. 2.4) the former airfield site provided spaces for community gardens, allowing the public to explore alternative models of food production, community organization, and environmental and human health.[98] In the city of New York (Floyd Bennett Field, fig. 4.1) the former airfield serves as Brooklyn's largest community garden with more than 200,000 within walking distance of the former airfield's 550 hectares of open space.[99]

Airfield sites can also take advantage of their existing environmental conditions to encourage the growth and restoration of specific microhabitats. By maintaining and integrating existing wildlife habitats into the new park program, the project in New York (Floyd Bennett Field, fig. 4.1) reinforced the National Park Service's ethic of stewardship to historical and ecological sites. In Irvine (Orange County Great Park, fig. 2.4) unusual habitats can also be restored and regrown for a variety of native plants and animals.[100] There, rock piles and rock fields provide shelter for small mammals, lizards, and common snakes. Edges between ecotones are softened and faded with an undulating and porous perimeter so that ground beetles, mice, snakes, lizards, birds, and plants can take advantage of the refuge that these shelters provide.

Growth

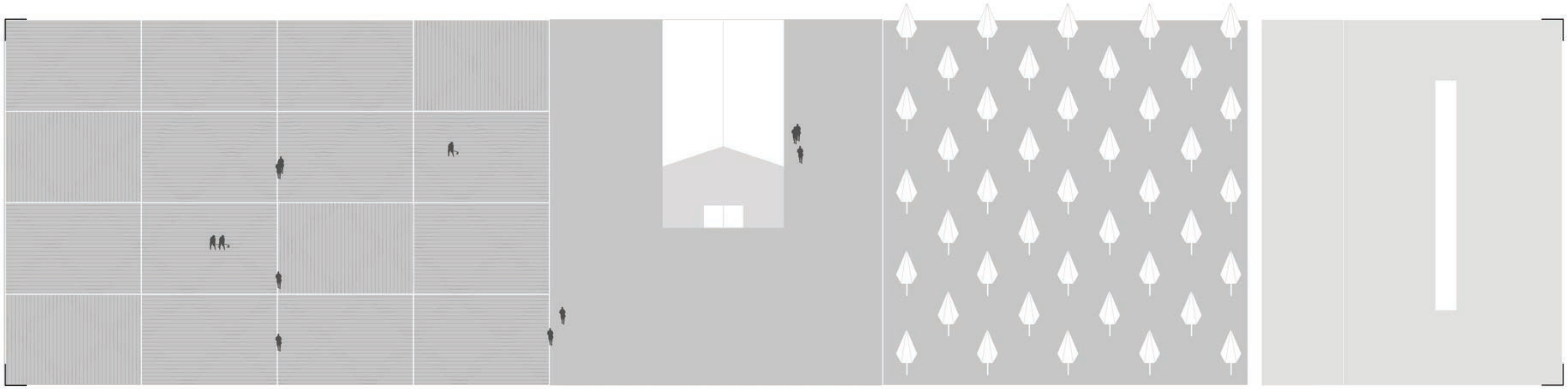
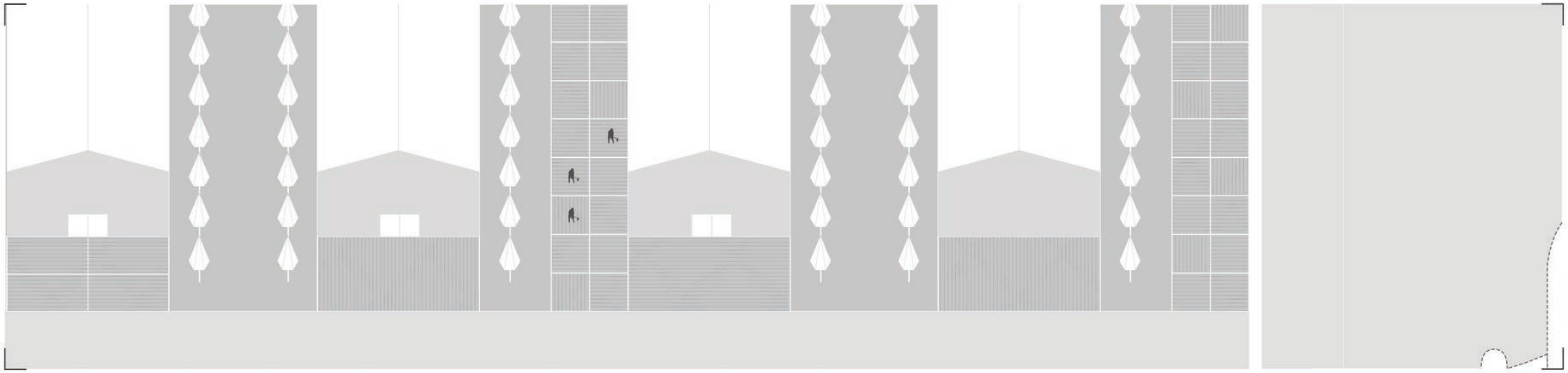
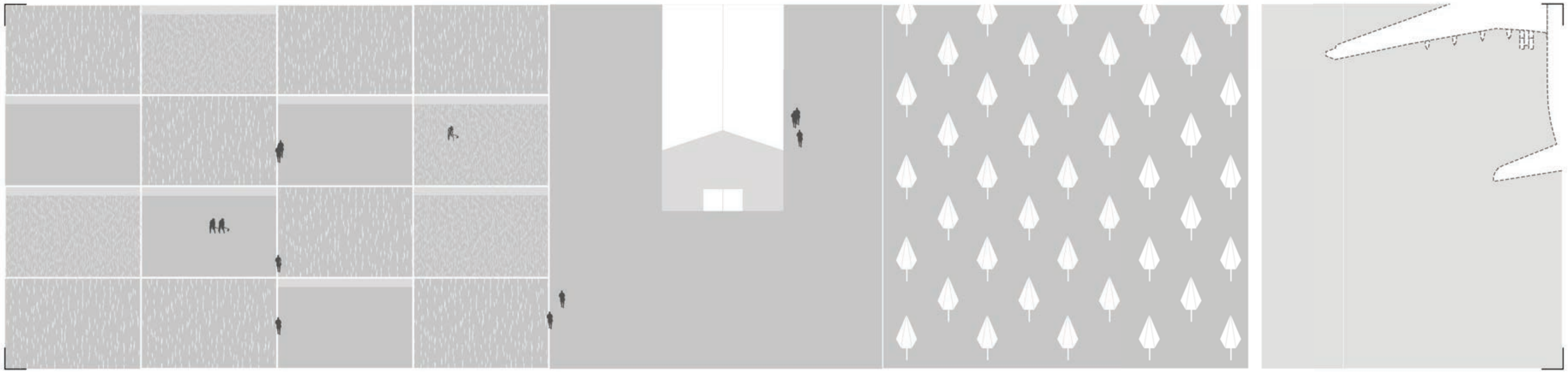


Fig. 6.5a. Agriculture (fields) and Regrowth (succession).



b. Greenhouses and Community Gardens.



c. Aquaculture (fish ponds) and Regrowth (forest).

0 10m Scale: 1:500

Infrastructures

In order to activate and accommodate new programs, a transformed airfield site depends on a foundation of infrastructures and operating systems. Networks of utilities, vehicular circulation and access, waste management, security, and, increasingly, forms of energy production are all necessary to power and sustain activity on site. In many cases, existing infrastructures will have to be rethought, adapted, or constructed anew to allow an airfield to connect and power its diverse zones and facilities, perform as a unified set of systems, and plug into the surrounding city's infrastructural grid. To ensure the long-term viability and sustainability of a site, its infrastructural systems—some of them constituted of substantial structures and others of invisible networks—must be adaptive to unpredictable changes over time. On such vast sites, considerations of renewable energy production and strategies for reduced fossil fuel consumption and greenhouse gas emission should also accompany plans for new infrastructures.

Civil

Converted airfield sites require the extension of existing infrastructures from the surrounding urban context to serve the newly introduced facilities and programs. The necessary primary services—typically carried by underground pipelines and conduits—include local sanitary sewers, domestic potable water, recycled water for irrigation and water features, and storm-water catch basins and drains, in addition to “dry” utilities such as gas, electricity, television, and internet. Special conduits may also be required for services like fiber optic networks, direct current (DC) voltage generated by solar panels, and other new technologies. Generally, major utility conduits can be found along the perimeter of a site or in roadways. This is the case in Irvine (Orange County Great Park, fig. 2.4) where smaller direct service lines extend from the perimeter into the park for specific uses.

Civil

Fig. 7.1a. Dry Utilities (Gas, Electricity, etc).

b. Sewage System.

c. Storm Drain Infrastructure.

Scale: 1:2500

Transportation

While some former airfields can take advantage of existing transportation connections on site, many are physically isolated from the primary transportation routes of their cities. Often access to and from the city—especially via public transit—is limited to only a few points, or transit within the site itself is restricted and inadequate. In New York (Floyd Bennett Field, fig. 4.1) the area of the site is one and one-half times the size of Central Park, making foot travel difficult and automobile travel the only viable means of cross-site movement.

The challenge for former airfield sites, therefore, is to rethink internal and external transportation systems to connect the site advantageously to its urban and regional contexts and offer low-impact alternatives to car travel for visitors to move across the site. In Denver (Stapleton Redevelopment, fig. 1.2) the airfield is reimagined as a series of streetscapes and greenways.[101] In Athens (Hellenikon Metropolitan Park, fig. 1.5) a network of roads, walkways, and bicycle paths organizes the site.[102] A wide range of circulation systems, including jogging trails and elevated walkways, provide possibilities for weaving a site together.

In Quincy (Squantum Point Park, fig. 4.2) the "flight path"—the former airfield's runway—serves as the primary means of circulation within the park and uses a series of interpretive markers to inform visitors about the site's history and environment. In the competition proposal by James Corner Field Operations and Stan Allen Architect for Toronto (Downsview Park, fig. 2.3) a system of "Circuit Ecologies" is comprised of circuitous pathways with event spaces and active programs.[103]

Transportation

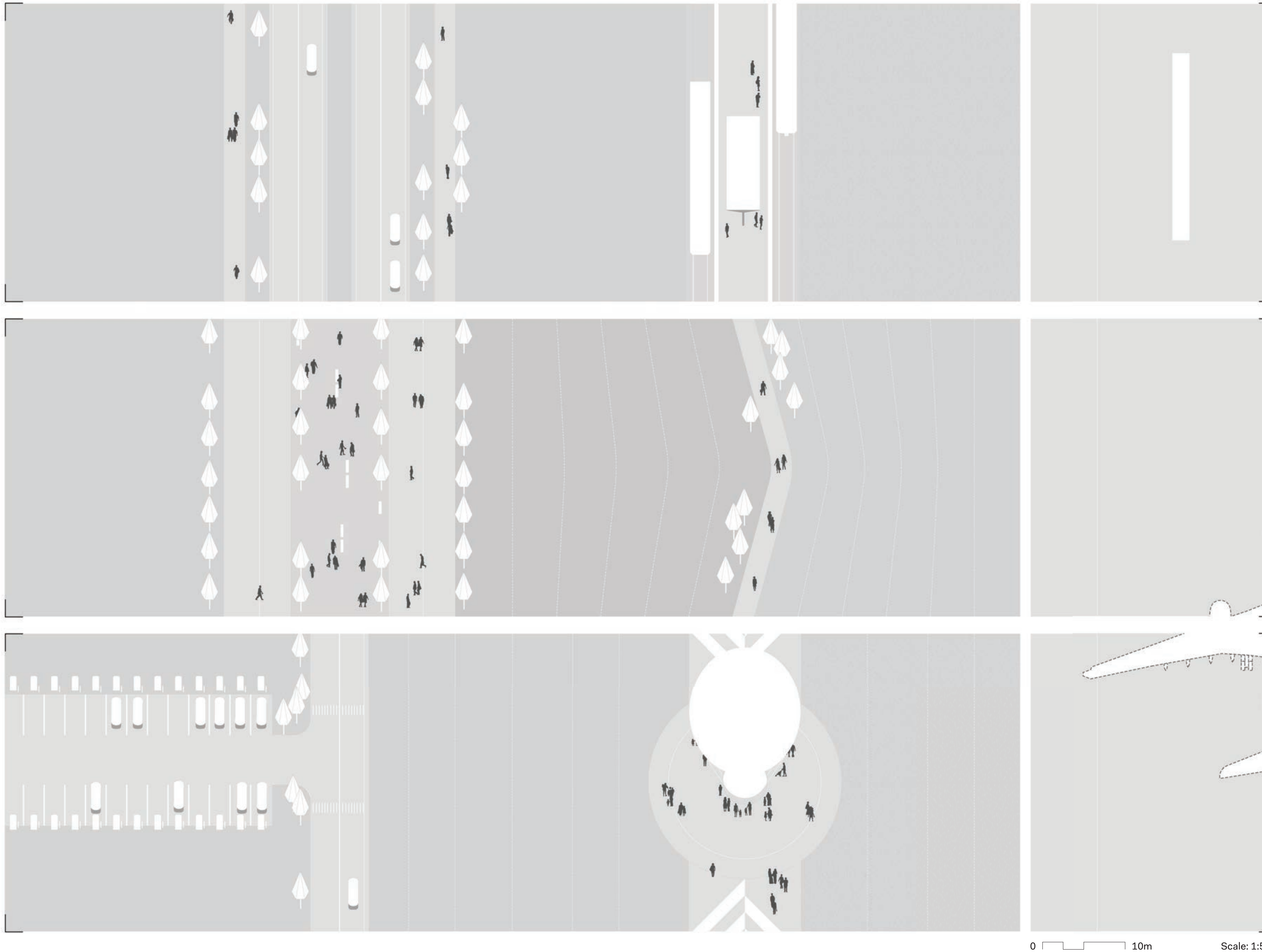


Fig. 7.2a. Tram Connecting City to Airport and Green Streets.

b. Cycling and Jogging Trails and Promenades.

c. Electric Vehicles and Aerial Transportation.

Enclosure

Decommissioned airfields are most often associated with a range of redundant buildings left in the wake of airport operations. Among these, many provide enclosure for a range of future activities. Often buildings associated with airport operations such as hangars, maintenance sheds, terminals, and other enclosures are scaled to the airplane and afford enormous dimensions. While the enormity of these enclosures can also be an impediment to their adaptive reuse, they have often been found useful as temporary or seasonal enclosure for a range of programmatic activities. In some instances, these are occasional uses associated with a program of events. In other instances, these enclosures are found useful as the structural elements of a more durable program of adaptive reuse. Often these adaptations benefit from reducing the redundant enclosure to its most minimal structure and enclosed surfaces, through the removal of layers of other, less useful materials, fixtures, and fittings associated with their historic uses.

Enclosure

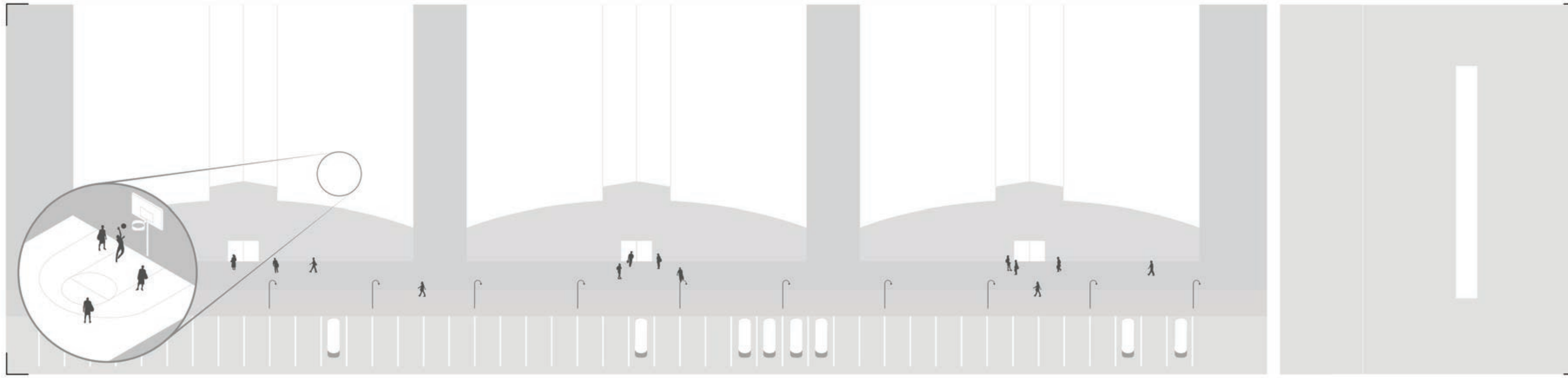
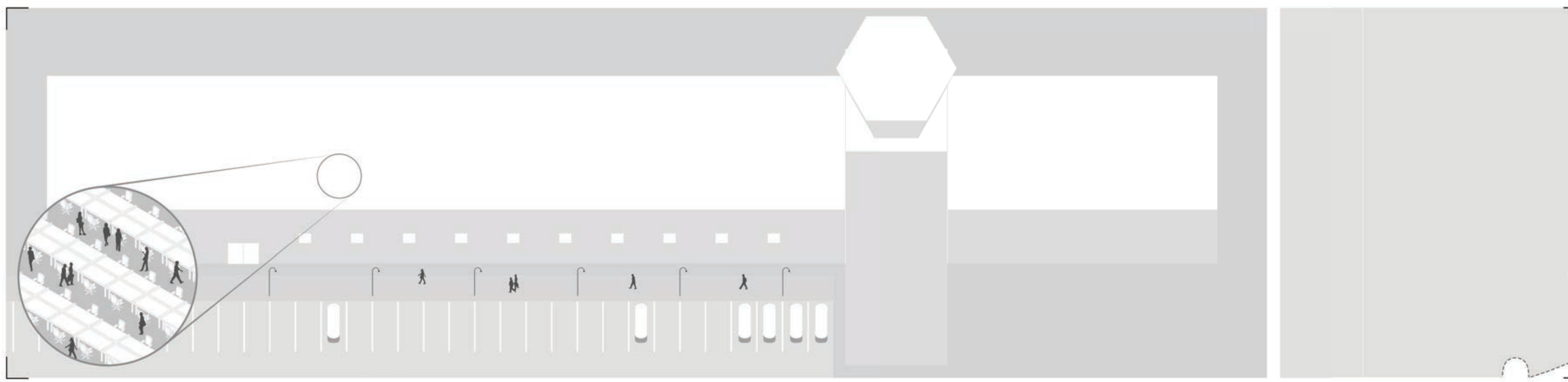
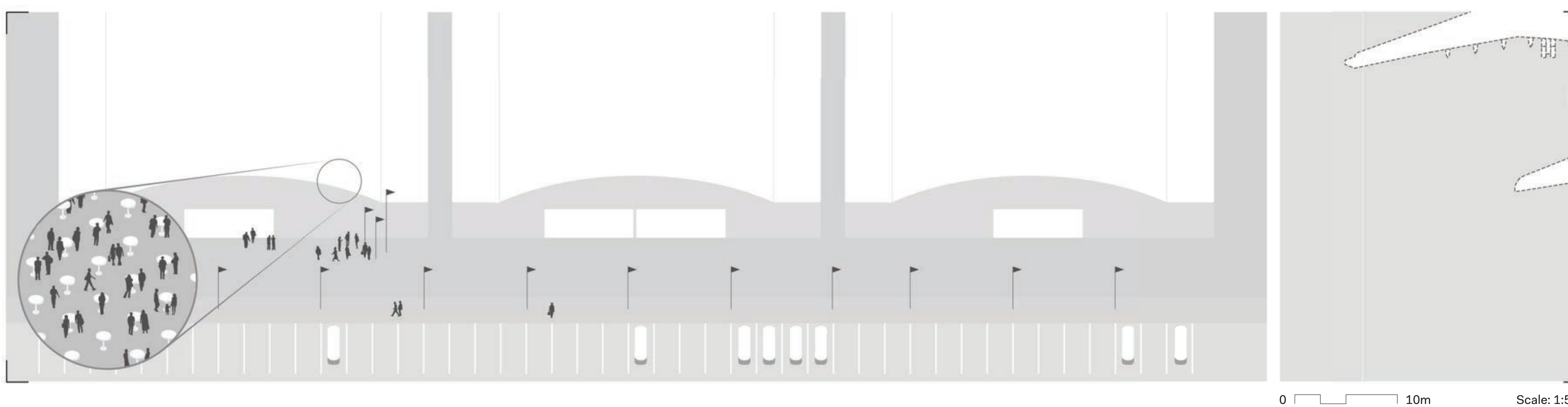


Fig. 7.3a. Indoor Athletic Programs.



b. Office Space, Restaurants, or Multi-Purpose Arenas.



c. Convention Center or Event-Based Programs.

Energy

As large urban cultural sites, transformed airfields have the potential to produce and consume significant amounts of energy. With today's understanding of the impacts and limited resources of fossil-fuels, airfield sites have the responsibility to seek new models for energy. As such, they should simultaneously adopt sustainable strategies of reduced energy consumption and renewable energy production—to power their own needs and supply adjacent urban districts.

Alternative Energy

Taking advantage of the vast area of the site, the former airfield in Oldenburg (Fliegerhorst Oldenburg, fig. 4.3) was transformed into a solar park with 59,100 solar panels that produce a combined 13 million kilowatt-hours of electricity every year—enough to supply the electricity needs of about 3,200 households.[104] In Taiwan (Taichung Gateway Park, fig. 3.5) wind turbines supply the energy needs for the park's lighting and other electronic devices.[105] In Vatnsmýri (Reykjavík Airport, fig. 1.6) one zone of the site is dedicated to production. A computer server farm and geothermal system located below ground is proposed to generate heat for the greenhouses and other areas aboveground.[106] In Paisajes Emergentes's scheme for Quito (Parque Bicentenario, fig. 3.3) wind and solar energy heat the proposed pools and thermal baths.[107] In Irvine (Orange County Great Park, fig. 2.4) a variety of solar technologies including ten Dish-Stirling collectors and a one-acre photovoltaic array have been installed to generate more than one megawatt of renewable energy on site annually. The photovoltaic array has also been integrated into the site's strategy for parking by acting as shade structures for vehicles. Current work on the site includes the construction of demonstration hydrogen fuel cell charging stations for electric vehicles and a proposal for solar- or biofuel-powered park vehicles.[108]

Waste

The question of what to do with existing landfills and recycling facilities on airfield sites—and how to handle the impacts of decades of waste production on site—poses a significant challenge to the transformation of airfield sites, where new programs and facilities will generate their own streams of waste as well. Comprehensive maintenance and operations plans must pay special attention to considerations of waste management and the mitigation of pollution associated with former and current waste streams. The major objectives of such a plan should include the reduction of waste volume, the reuse of waste, and the reduction in travel distance required to transport waste.

Waste management plans must take into account the storage, sorting, and transportation of three on-site waste streams: municipal and mixed waste, recyclable materials (e.g. metal, glass, plastic), and organic waste (e.g. biodegradable paper products, food scraps, and fats, oil, and grease from food production). It is advisable to sort and separate waste streams on site in order to send recyclable waste to offsite material recovery and recycling facilities. For organic waste, biodrying can be performed on site to facilitate the decomposition of waste into biomass or compost. Biodiesel production, alternatively, can convert fats, oils, and grease into fuel to power many of the site's internal transportation systems. These processes have been employed in Irvine (Orange County Great Park, fig. 2.4) where the use of solar-powered trash compactors has also been proposed.[109]

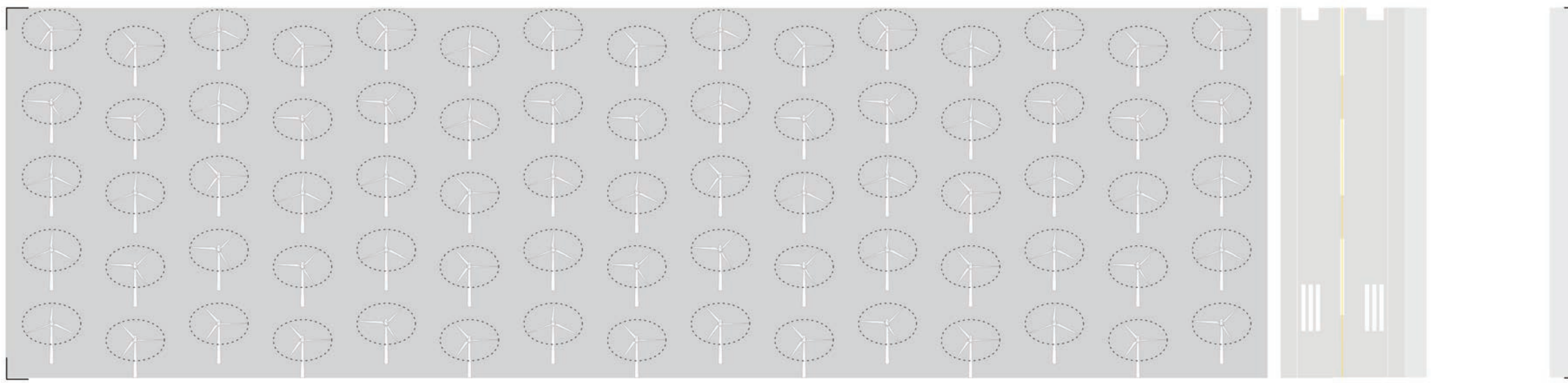
Light

Lighting systems contribute to the making of safe and sustainable sites. A comprehensive lighting plan should aim to minimize light pollution and over-consumption of energy. In Irvine (Orange County Great Park, fig. 2.4) an automated system reduces light pollution by lowering light levels when appropriate. Throughout the park, small photovoltaic cells attached to light fixtures charge during the daytime and power them at night.[110] In Toronto (Downsview Park, fig. 2.3) a proposed system of "Through-Flow Ecologies" is based on a series of lighting and informational markers designed throughout the park.[111]

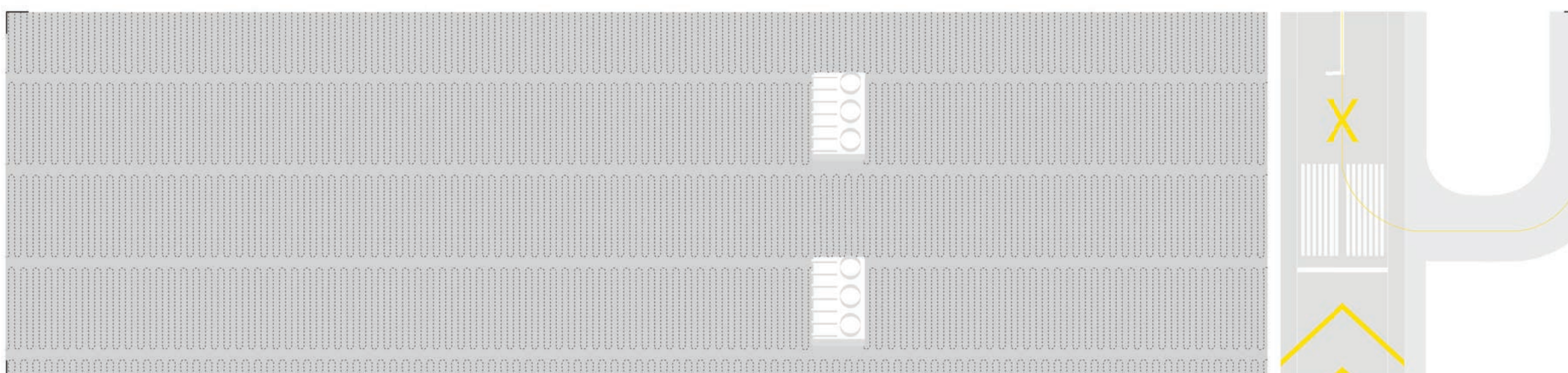
In Oslo (Fornebu Airport) a demand-controlled system of lighting reduces energy consumption by 40% compared to traditional systems. The system, constructed along a new main road, uses energy-efficient fixtures and dims lights during nighttime and low-traffic hours. The system is highly controllable, benefits from increased lamp-life, and produces less light pollution for the surrounding urban district.[112]

Energy

Fig. 7.4a. Solar Park.



b. Wind Farm.



c. Geothermal Energy.

0 50m

Scale: 1:2500

Perimeter

Boundaries, edges, and buffers can serve to delineate or bring together various elements on a site. By inscribing a perimeter around or between certain areas, zones in the site are given discrete identity and enable new functions. An airfield's perimeter also acts as a membrane—permeable or impermeable—between the site and the city. New relationships can be established between an airfield and its adjacent urban districts through the manipulation of this edge.

In Munich (Landschaftspark München Riem) trees planted in gridded blocks, groves, and hedgerows delineate the various zones and open spaces of the park and separate these areas from the surrounding urban development.[113] In Berlin (Landscape Park Johannisthal, fig. 2.1) garden plots and spaces for recreational activity located along the edges of the park buffers between the city and the natural reserve at the park's center.[114] Also in Berlin (Tempelhof Airport, fig. 1.4) the proposal by Topotek1 and Dürig AG features a tree-lined promenade circumscribing the main field. The promenade connects the areas temporarily given over to citizens for their free use in the boundary zone.[115] In Quito (Mariscal Sucre International Airport, fig. 3.2) the park's edges are turned into zócalos—areas for urban development that include a boundary promenade as well as public space for cultural programs.[116]

Perimeter

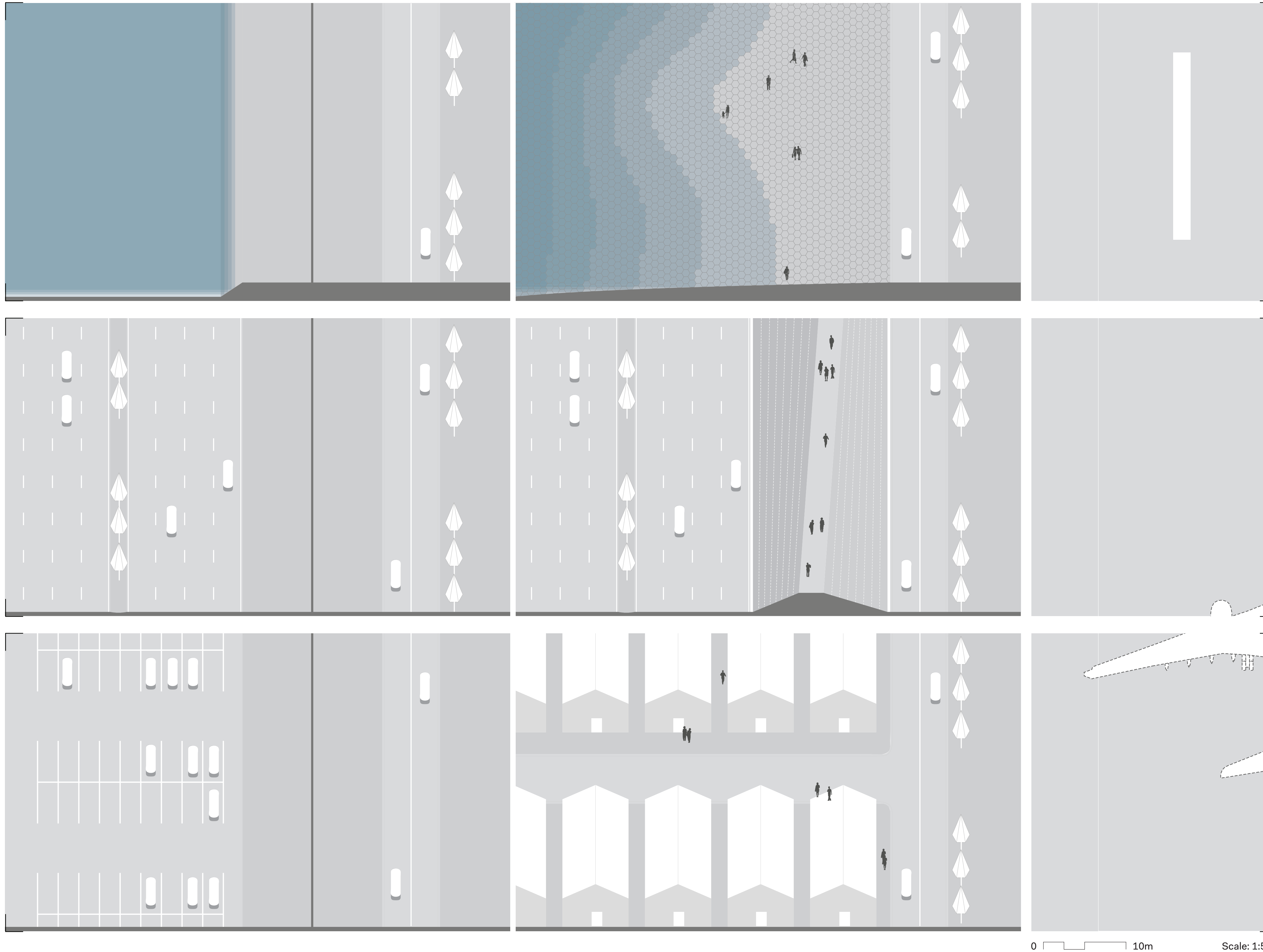


Fig. 7.5a. From Road to Riverbank.

b. From Fence to Shield Park.

c. From Parking Lot to Neighborhood.

Interventions

The transformation of an abandoned airfield site enables many forms of occupation that were not formerly possible, such as open spaces, educational programming, and passive and active recreation, among others. However, the conservation, preservation, and reimagining of a site's natural and historical heritage should accompany the introduction of new possibilities. Existing hangars, for example, may be preserved for use as aviation museums or educational and social spaces. A remnant found on virtually all airfield sites, the hangar can stage any number of new experiences and interactions for visitors to the site.

One goal of transforming an airfield site should involve minimizing the environmental impact of the transformation itself. A site's constituent materials and media can be salvaged, recycled, and repurposed in order to simultaneously generate less waste and maintain a native sense of place and history. Concrete from a former runway, for instance, can be reused as aggregate for new roadways or repurposed as landscape features like benches and site walls. It follows that salvaged media should be assessed to determine their condition and level of contamination. When new materials and media are introduced, they should be sustainably engineered and waste-neutral in order to avoid compromising the environmental goals of a transformation project.

Fields

The open land of an abandoned airfield may be set aside for completely unstructured activities, highly specific functions, and anything in between. Typically, large gatherings, informal play, and picnicking require extended, uninterrupted spaces. On the other hand, more specific functions like allotment gardens, playgrounds, and production facilities necessitate smaller, more differentiated spaces. Many of these fields—large and small—can accommodate different uses in different seasons or at different times of day.

In sites like Denver (Stapleton, fig. 1.2)[117] and Caracas (La Carlota, fig. 4.5)[118] open spaces of various dimensions and materials play host to a range of outdoor activities. In Berlin (Landscape Park Johannisthal, fig. 2.1) surfaces are dedicated to active sports, flexible recreational activities, and playgrounds.[119] In Quincy (Squantum Point Park, fig. 4.2) areas are given over to pedestrian esplanades, parking lots, and a soccer field.[120] In Chicago (Northerly Island Framework Plan, fig. 4.4) an outdoor music amphitheater connects to the adjacent museum campus and becomes a skating rink in the winter.[121] In Quito (Parque Bicentenario, fig. 3.2) the proposal by Anita Berrizbeitia et al. features a sizeable open oval-shaped area in the center of the park that accommodates large cultural events.[122] Alternatively, the competition scheme by Paisajes Emergentes (fig. 3.3) proposes outdoor rooms with distinct programmatic character ranging from an open-air aquarium to thermal baths.[123]

In Gatow (Park Landscape and Urban Agriculture Gatow, fig. 2.6) an open lawn accommodates picnic and barbecue areas as well as community allotment gardens for fruit and vegetable production.[124] Similarly in Vatnsmýri (Reykjavík Airport, fig. 1.6) proposals include allotment gardens and markets in addition to a variety of spaces for sports and other recreational activities.[125] In Irvine (Orange County Great Park, fig. 2.4) a large lawn is proposed as an un-programmed open area of turf with large shade trees and nighttime lighting. The lawn is intended for passive recreation, informal picnics and gatherings, and open play. A canyon winding through the site and a 72-hectare wildlife corridor connecting the park to the Cleveland National Forest set aside significant areas of the park for ecological functions that are off-limits to visitors. Much of the park's land, however, remains accessible to visitors and accommodates recreational pursuits like hiking and bicycling as well as sustainable agriculture and its related educational facilities.[126]

Fields

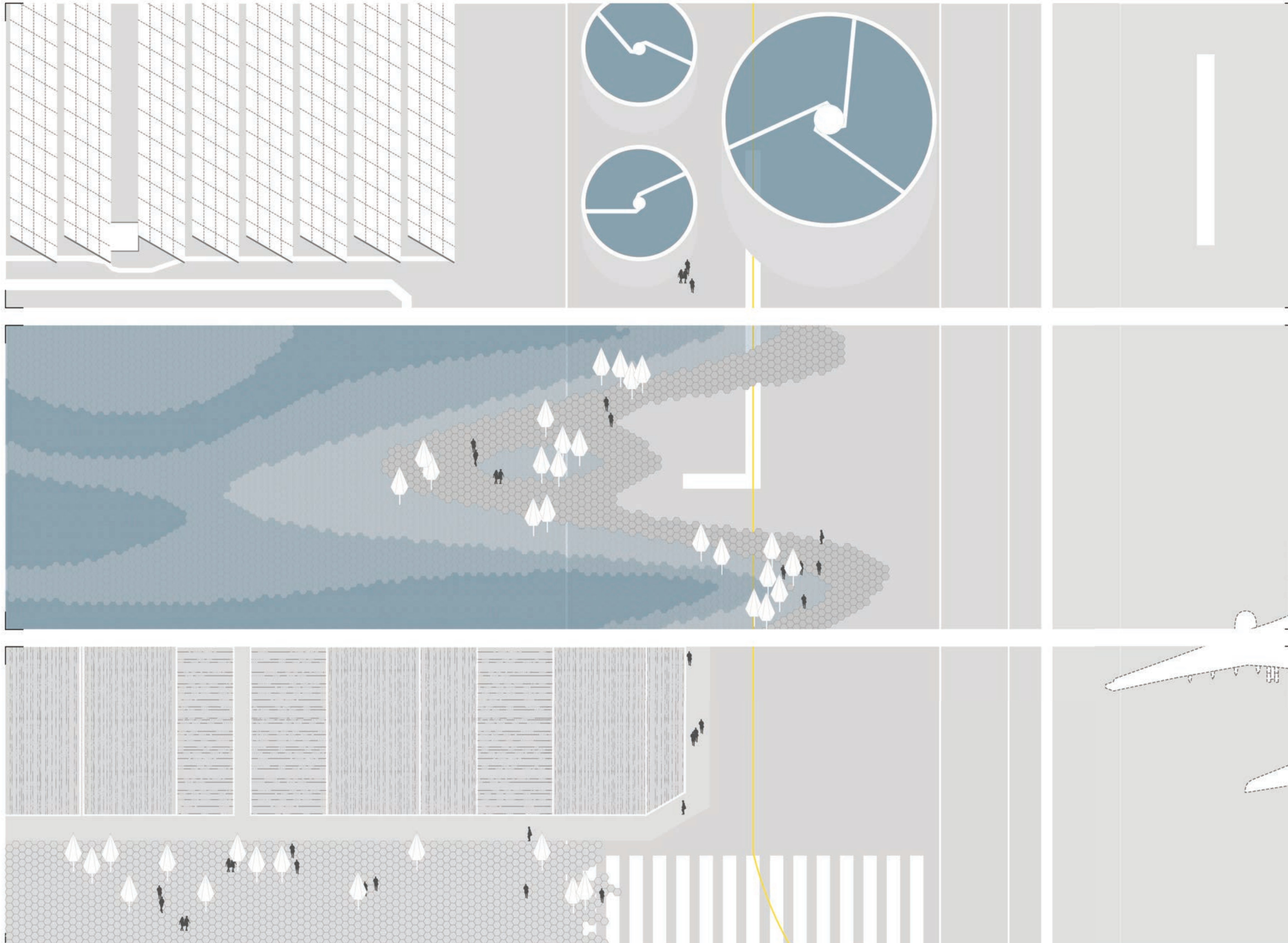


Fig. 8.1a. Water and Energy.

b. Soft Edge.

c. Park and Agriculture.

0 10m Scale: 1:500

Flows

Although an airfield may appear to be a fixed plot of land, it is characterized by dynamic flows of air, water, wildlife, energy, traffic, and capital, among others. These flows, connected to larger regional systems and processes, comprise the inputs and outputs that animate a site and should be managed sustainably.

In Athens (Hellinikon Metropolitan Park, fig. 1.5) softscape corridors composed of coordinated topographic and drainage systems manage the collection and redirection of storm-water across the site.[127] In Irvine (Orange County Great Park, fig. 2.4) an off-limits wildlife corridor connects the park with the Cleveland National Forest to allow the unimpeded travel of animal populations in the region.[128] In Munich (Landschaftspark München Riem) the park provides a 400-meter-wide band of open space that enables airflow between the large forests in the east and the city center, supplying downtown Munich with cooler air in the summer. The diagonal layout and the orientation of the gridded groves of trees that are characteristic of the site—such as hornbeam, pine, and oak—support this climate function.[129]

Flows

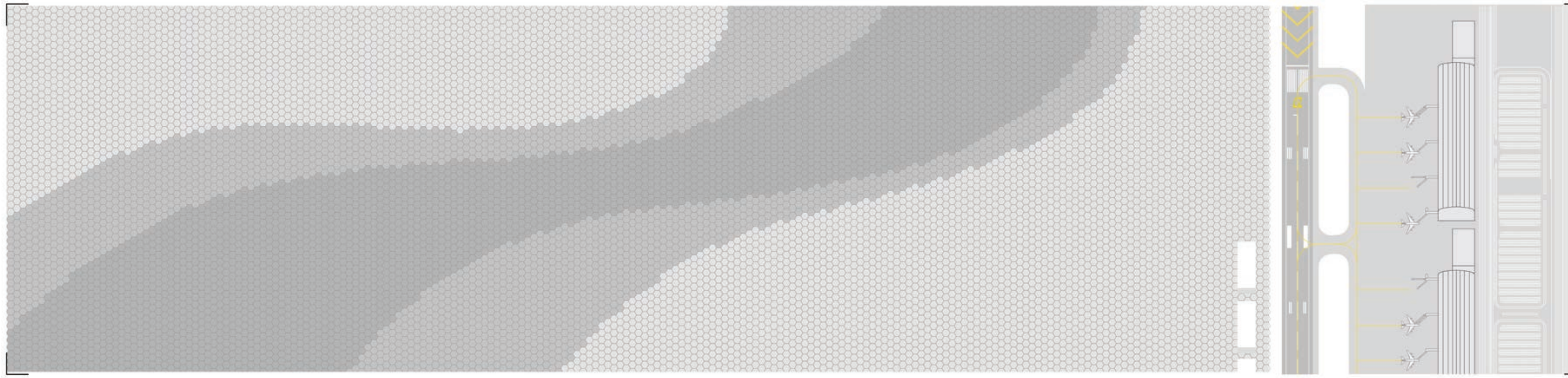
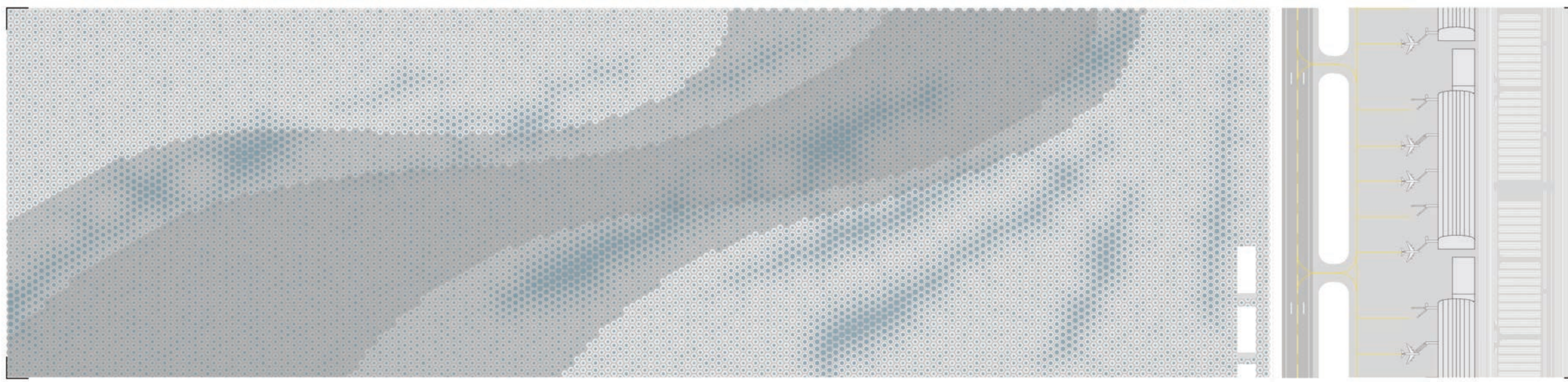
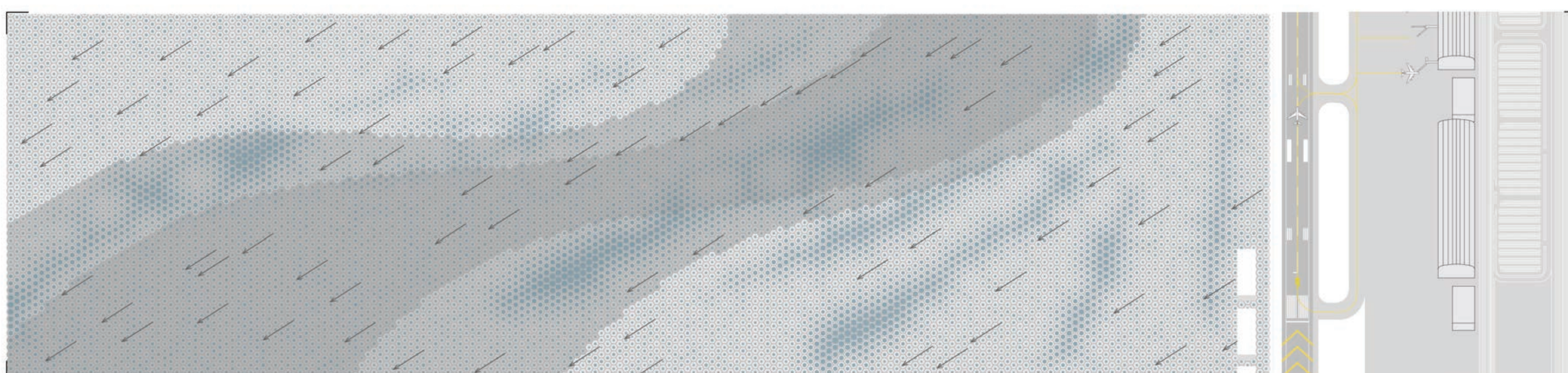


Fig. 8.2a. Wildlife Corridors.



b. Water Corridors.



c. Air Corridors.

0 200m Scale: 1:10,000

Forms

The vast, open, horizontal nature of airfield sites is often perceived by designers as canvases for topographic invention and intervention. Extensive cut and fill, and elaborate landforming strategies have been prominent in the work of many landscape architects on airport sites.130 This kind of site work involves the manipulation of soils, paving, vegetation, and drainage systems. Highly contoured landforms can provide views of the surrounding landscape and afford a range of programmatic opportunities. However, any manipulation of topography must consider issues of accessibility, safety, and storm-water management.

In Munich (Landschaftspark München Riem) built-up landforms offer views of the city center and the Alps beyond and become a site for sledding in the winter. The landform along the northern edge of the park in Caracas (La Carlota, fig. 4.5)—constructed with recycled materials from demolition—shields the highway, retains storm-water, and offers elevated paths along its crest, seating on its slopes, and landing areas for the bridges that provide access to the park.[131] In Novato (Hamilton Army Airfield, fig. 3.4) clean dredged sediment from the San Francisco Bay Area was used in the restoration of the tidal marshes and wetlands.[132] Nearby in San Francisco (Crissy Field, fig. 1.1) efforts to restore wetland and dune field landscapes on the site prompted designers to reintroduce convoluted dune formations—which in the past were generated by bracing wind and wave attacks on an otherwise relentlessly flat site—as sculpted landforms.[133]

In Irvine (Orange County Great Park, fig. 2.4) concrete salvaged from former runways has been reused to create large stones on site. All paving materials recovered from the site have been recycled at a facility located adjacent to the park; gravel and cobbles have been reused for infiltration media and roadbed support. Large slabs of concrete—referred to on site as El Toro Stone—have been stacked to form retaining walls and waterfalls and are laid as trail steps. Organic building materials (e.g. drywall and wood) have also been repurposed as soil amendment, while reusable components (e.g. redwood beams) have been used for new construction.[134]

Forms

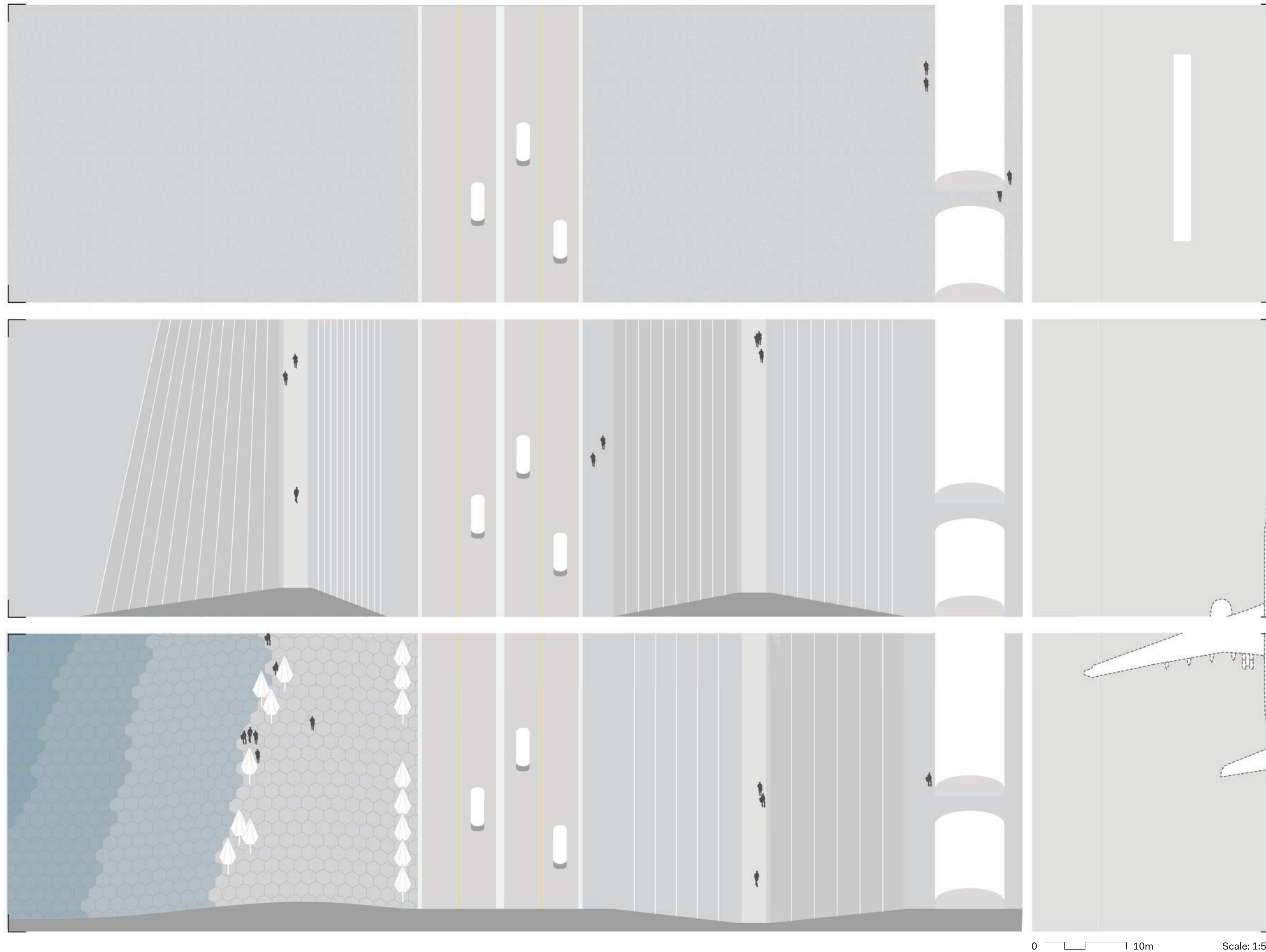


Fig. 8.3a. Site Inventory.

b. Landform Manipulation.

c. Dredging and Excavation.

Archaeologies

All former airfield sites encompass existing structures, materials, and other conditions that must be dealt with over the course of the site's transformation. The fate of this inherited matter can take several forms: it may be preserved in its found condition, conserved and incorporated into a transformation proposal, or dismantled or destroyed and removed from the site. It is necessary to take a position on the value of existing materials and pursue transformation operations accordingly.

Typically, conservation strategies offer the most sustainable options because they seek to adapt and repurpose the materials found on site. For example, historic airport buildings like control towers and hangars may be maintained and adapted to accept new services and functions. Strategies of renovation (in the case of abandoned structures) or relocation of uses (in the case of currently occupied structures) enable the conservation of an airfield's built heritage. In New York (Floyd Bennett Field, fig. 4.1) the challenge was to address the value of Gateway National Recreation Area's historic structures and the industrial cultural heritage that they represent without relying solely on preservation to maintain these values.

The aesthetic fascination of historic buildings can contribute to their viability as new attractor points for cultural activities, events spaces, sports facilities, and productive functions (e.g. offices, warehouses, or markets). This is the case in Irvine (Orange County Great Park, fig. 2.4) where a hangar and its two flanking warehouses have been restored and adapted for use as the Palm Court Arts Complex. In Oslo (Fornebu Airport) the former terminal building and control tower mark the starting point of a central water feature that stretches the length of the site.[135] In Denver (Stapleton Redevelopment, fig. 1.2) the control tower is preserved as a landmark in the midst of the new urban neighborhood.

Runways

With grass poking up through the cracks of the tarmac, some airports are slowly being handed back to nature. Some proposals accelerate this process by calling for the removal of former runways. In that case, detailed study should be undertaken to understand the material and organizational implications of removal. In Irvine (Orange County Great Park, fig. 2.4), for example, the existing runways accounted for 79 hectares; removing 85% of the runways would reduce the remaining paved area to 11.7 hectares; removal of an additional 50% would leave 5.6 hectares available (in this case for park circulation and a military memorial).[136]

In New York (Floyd Bennett Field, fig. 4.1) the former runways are maintained as found.[137] In Caracas (La Carlota, fig. 4.5), on the other hand, the proposal reconfigures them as programmatic spines for activities across the site.[138] In Quincy (Squantum Point Park, fig. 4.2) the "flight path" of the former runway is converted into the park's primary pathway.[139] And in Athens (Hellinikon Metropolitan Park, fig. 1.5) one runway is maintained as a visual and circulation axis while the second is transformed into an expansive belvedere reaching toward the sea.[140]

In Casablanca (Anfa Airport, fig. 4.6) the flat runways and taxiways are interspersed with open plots of land that can potentially reestablish natural habitats.[141] In Gatow (Park Landscape and Urban Agriculture Gatow, fig. 2.6) the runway is converted into agricultural land for crop rotation. In addition, remaining parts of the decommissioned shooting range and earthen ramparts are turned into a climbing wall, skating rink, and slide.[142] In Munich (Landschaftspark München Riem) the layout of the former runways motivated the diagonal orientation of new gridded blocks and groves of trees across the site.[143]

Archaeologies

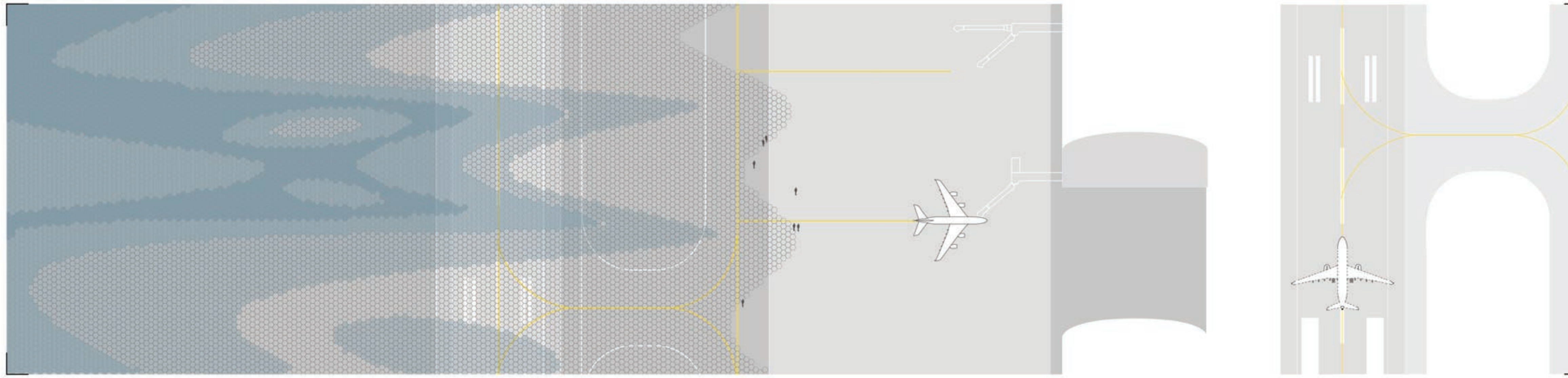
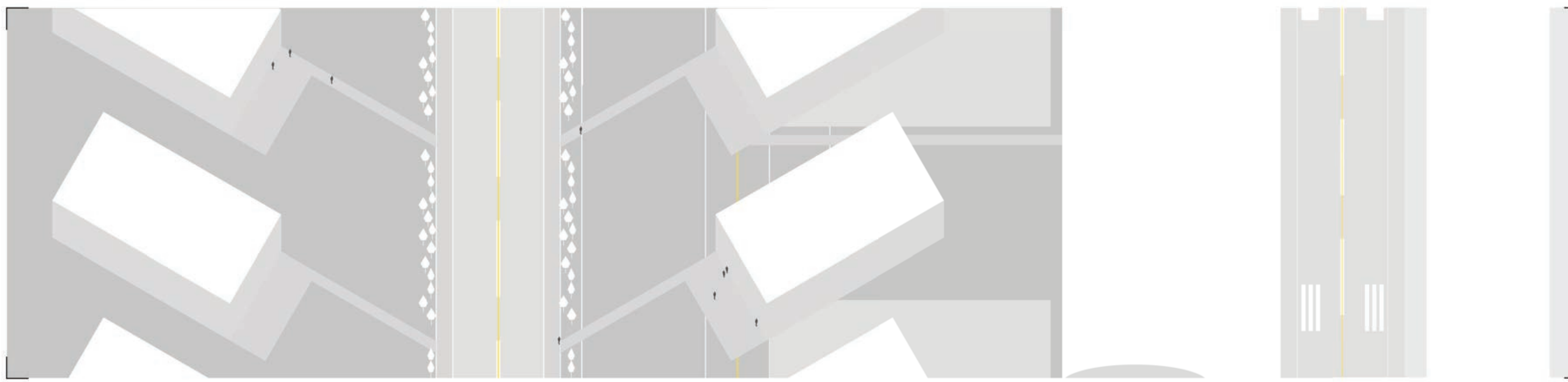
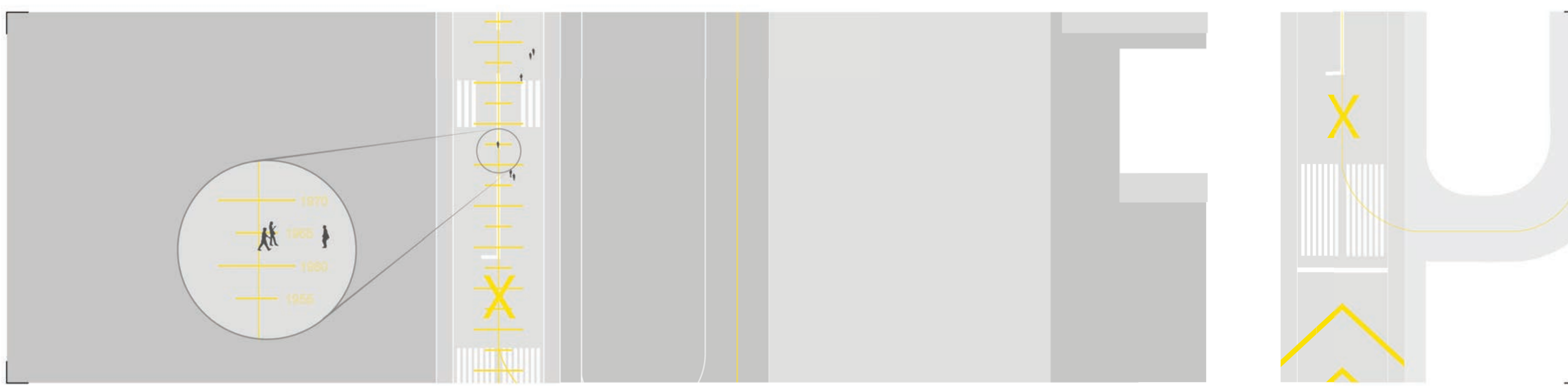


Fig. 8.4a. Historic Architecture.



b. Repurposed Infrastructure.



c. Preserved Memory.

0 50m

Scale: 1:2500

Artifacts

If transformed airfield sites are to thrive in their larger urban contexts, they must become attractive destinations. The urbanity and vibrancy of these sites depend on their ability to attract a consistent flow of visitors, residents, businesses, and investment. By inventively conceiving the specific areas, function, and facilities of a site, an airfield may generate any number of new symbolic centers, cultural nodes, or hubs of activity.

Playgrounds

In Irvine (Orange County Great Park, fig. 2.4) a zone called “Kids Rock!” offers ways for children to engage with the site through climbing, sliding, balancing, splashing, searching, and learning. In this area of the park—whose goal is to educate children about conservation ecology and the water cycle—structures shaped like clouds provide cooling shade and mist, climbing rocks symbolize mountains, aquatic play areas emulate the Canyon and Lake zones of the park, and a seating wall made of recycled concrete from the former runway embodies the park’s goals of sustainability.[144]

Platforms

In Berlin (Landscape Park Johannisthal, fig. 2.1) an elevated promenade and viewing platforms retained by gabions circumscribe the nature conservation area and mark the transition to the park areas that can be used for active sports, playgrounds, and other recreational activities.[145] In Quincy (Squantum Point Park, fig. 4.2) the “flight path” of the former runway was repurposed as the park’s primary pedestrian promenade. Lined with interpretive markers, it informs visitors of the site’s history and ecology. Additionally, a boat launch and lookout point grant visitors views of the downtown skyline and greater Boston Harbor.[146] In Oslo (Fornebu Airport) a multipurpose plaza characterized by large slabs of stone and moveable water elements invites children to manipulate the flowing streams.[147] In Chicago (Northerly Island Framework Plan, fig. 4.4) boardwalks and floating docks draw visitors close to the water.[148]

Performance

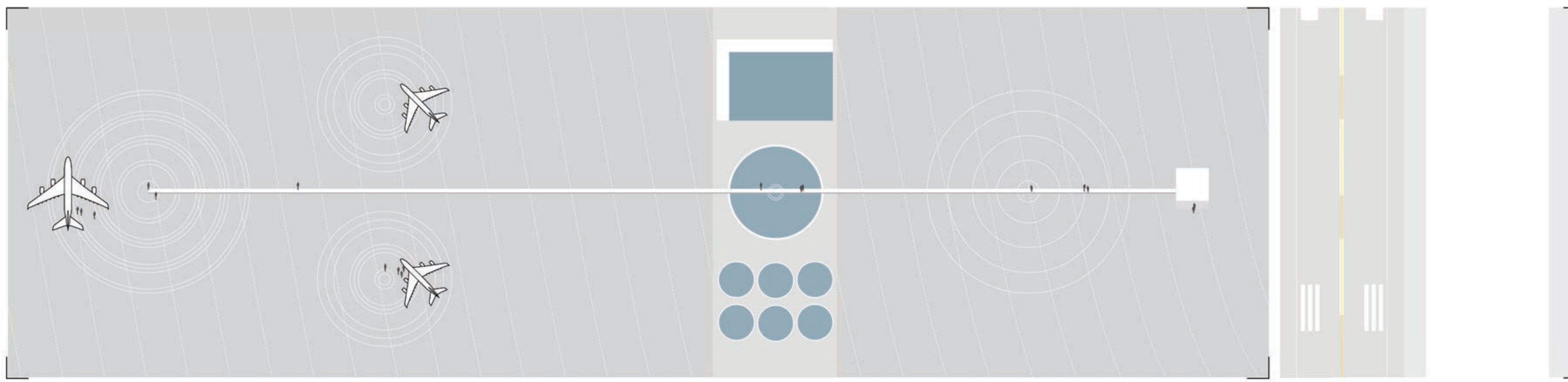
In Denver (Stapleton Redevelopment, fig. 1.2) and Oslo (Fornebu Airport) amphitheaters provide spaces for performance and reflection.[149] In Caracas (La Carlota, fig. 4.5) the proposal reconfigures the runway as a programmatic spine around which stadia, markets, swimming pools, and music shells are concentrated.[150] In New York (Floyd Bennett Field, fig. 4.1) proposed sports facilities ranging from indoor ice rinks to rock-climbing walls and basketball courts serve the large local population.[151] In Casablanca (Anfa Airport, fig. 4.6) the site will house a new business center including office space, private residences, a new university, an aeronautical museum, and a theater to help turn the site into a new cultural and business zone for the city.[152] In Vatnsmýri (Reykjavík Airport, fig. 1.6) fish and tree farms, greenhouses for fruit, vegetable, and flower production are proposed as a greenway on the former runway.[153] In Irvine (Orange County Great Park, fig. 2.4) the Palm Court Arts Complex is home to the Great Park Gallery and the Great Park Artist Studios, housing a publicly accessible artists-in-residence program. This new civic space also features Hangar 244, a 10,000 square-foot event center, as well as a shaded outdoor performance plaza and permanent public art installation.[154]

Elements

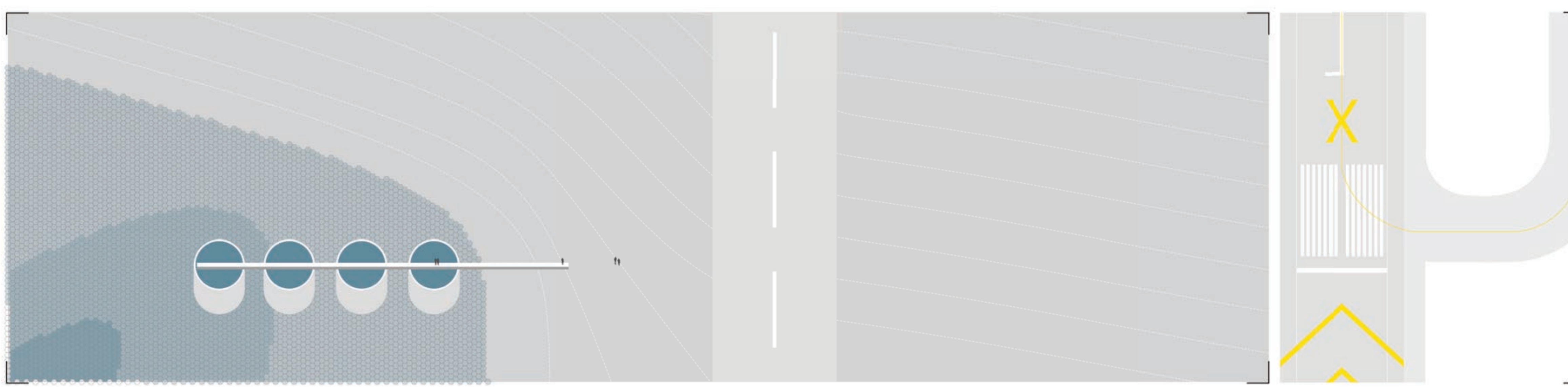
Airfields sites stimulate experimentation with a range of advanced and prototypical technologies. Among these are drones, wildlife controls, and climate devices. The RoBird, a robotic peregrine falcon designed to scare away birds from airports, flaps its wings in a lifelike imitation of a raptor's attack behavior.[155] Sound cannons frighten and disorient birds by providing a regulated blast of sound.[156] Coyote decoys may also be used as a scare tactic to keep geese and other wildlife at bay.[157] In operative and transformed airfields alike, these devices may help to reduce the risk of bird strikes and manage wildlife populations on site. Additionally, in Taiwan (Taichung Gateway Park, fig. 3.5) devices for climate control (e.g. water fountains, atomizers, and electrical devices) help to reduce heat, humidity, and pollution in the park.[158]

Artifacts

Fig. 8.5a. Exhibition Airplanes.



b. Repurposed Infrastructure.



c. Retrofit Gasometers.

0 50m

Scale: 1:2500

Conclusion

Abandoned airports offer enormous potential for urban redevelopment in cities internationally. Thousands of abandoned or underutilized airports exist around the world, and these redundant infrastructures present extraordinary opportunities for addressing the social, economic, and ecological challenges confronted by cities today. As global populations rise and people increasingly move to cities, urbanization continues to grow in speed and scope, exacerbating associated social and environmental challenges in these urban environments. In many cases the intelligent reconsideration of former airport sites offers partial solutions to meet such challenges. As vast, relatively unoccupied territories of several hectares often in the heart of cities, abandoned airports afford the rare opportunity to simultaneously increase housing stock, improve community amenities, address social tensions, alleviate environmental challenges, and enhance quality of life for populations living in proximity to these sites. While the enormity, vacuity, and relative contamination of former airport sites raise challenges for governance and redevelopment, these challenges have proven manageable, in a range of successful cases around the world, through enlightened political leadership, intelligent professional consultations, and effective community engagement.

This publication describes the challenges and opportunities associated with the redevelopment of abandoned airfields. It assembles a range of international case studies to inform comparative evaluation and due diligence in advance of such major undertakings. Among the numerous considerations attendant to such a project, experience shows that a robust program of political consultation and community involvement is central to their success. In addition to engaging with local stakeholders and civic leadership, successful outcomes most often involve the integration of comparative analysis and feasibility planning from the earliest stages of the project. Equally critical, successful redevelopment of former airport sites depends upon rigorous feasibility studies of the economic development plan, ecological potential, and environmental remediation of these sites. This work builds upon early engagement of and effective communication with a complex range of public, private, and professional stakeholders. In spite of these challenges, international experience further shows that the redevelopment of former airport sites can be an especially effective lever of urban, social, economic, and environmental redevelopment programs. Conversely, such experience also shows the resulting deleterious political, social, and environmental impacts on communities adjacent to and far from these sites if they are allowed to languish, abandoned and underutilized, over time.

Notes

Introduction

1. Data obtained by national agencies combined and implemented with Internet researches. North America information gathered from U.S. Department of Transportation, Federal Aviation Administration and Office of Bureau of Transportation Statistics; personal interview with Mr. Luis Loarte, FAA Office of Airport Planning & Programming, National Planning and Environmental Division, (May 5, 2016). Europe information gathered from interpretation of data from EUROCONTROL and national aviation agencies.

2. U.S. Department of Transportation, Bureau of Transportation Statistics, https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_01_03.html; (accessed January 2, 2017). U.S. law categorizes airports by type of activities and hub type (according to the percentage of annual passenger boardings). Accordingly, a large hub has 1% or more of total national annual passenger boardings; a medium hub airport has 0.25% to 1% of boardings; a small hub airport has at least 0.05%, but less than 0.25%; and a non-hub airport has more than 10,000 boardings, but less than 0.05%. Source: U.S. Federal Aviation Administration, available at the website: http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/

3. The ASSET 2 study was unable to categorize 281 airports. The 281 airports will continue to be listed as Unclassified in the NPIAS. Source: U.S. Department of Transportation, Federal Aviation Administration, *Asset 2: In-Depth Review of the 497 Unclassified Airports* (accessed March 1, 2014), iii, 5.

4. The general information on active airports in Europe has been collected from the European Aviation Agency EUROCONTROL, an intergovernmental organization with 41 States, committed to building, together with its partner, a Single European Sky that will deliver the air traffic management (ATM) performance required for the twenty-first century and beyond. This information have been integrated and implemented with the data collected from local agencies of statistics and aviation (AIS/AIM offices) for each European states. The list of Aeronautical Information Service by State is available at this link: http://www.eurocontrol.int/articles/ais-online (accessed July 14, 2016).

5. In Italy, for example, among the hundreds of existing airports only 42 have been included in the national plan, but half of these have an uncertain future. Source: ENAC, *Piano Nazionale degli Aeroporti* (February 2012).

6. Definition according to U.S. Department of Transportation, Federal Aviation Administration available at the website: http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/ (accessed January 5, 2017).

7. *Oxford English Dictionary* (2016).

Part I: Options, Buying Time

8. The federal system of airports defines non-aeronautical activities the broad category encompassing the passenger-dependent activities, as well as rent on land and non-terminal facilities and fees collected for activities and services on airport property. It also includes other passenger-dependent activities such as food and beverage, retail concessions, parking, and rental cars. (FAA Airport Compliance Manual 2009). See Lois S. Kramer, *Airport Revenue Diversification. ACRP Synthesis 19* (Washington, DC: Transportation Research Board, 2010).

9. Sonja Dümpelmann, Charles Waldheim, eds., *Airport Landscape. Urban Ecologies in the Aerial Age* (Cambridge: Harvard Design Studies, 2016), 157.

10. The ACRP Synthesis 19 examines the issues surrounding revenue diversification at airports and the different ways that airports are generating alternate sources of operating revenue. See: Lois S. Kramer, *Airport Revenue Diversification. ACRP Synthesis 19* (Washington, DC: Transportation Research Board, 2010).

11. Corydon Ireland, "Change is on the runway," *Harvard Gazette* (November 13, 2013).

12. Referred to the "Standard Classification of Environmental Condition of Property Area Types for Defense Base Closure and Realignment Facilities." This classification is under the jurisdiction of ASTM Committee E50 on Environmental Assessment, Risk Management and Corrective Action and is the direct responsibility of Subcommittee E50.02 on Real Estate Assessment and Management. Current edition approved April 1, 2010. Published May 2010. Originally approved in 1995. Last previous edition approved in 2002 D5746 - 95. DOI: 10.1520/D5746-98R10. See ASTM International, *Standard Classification of Environmental Condition of Property Area Types for Defense Base Closure and Realignment Facilities*, available at the following link: http://www.astm.org/FULL_TEXT/D5746/HTML/D5746.htm (accessed May 9, 2016).

13. Referred to the seven Environmental Condition of the Property (ECP) categories - formalized in ASTM Standard ASTM D5746-98 (2010) Standard Classification of ECP Area Types (ASTM, 2010) - for federal real property transactions and military construction projects.

Part I: Options, Holding Ground

14. "On-hold" is different from similar expressions such as "stand-by" or "in-pause". In English stand or pause express a more passive meaning. Instead, the preposition "on" implies a proactivity: it has an embryo of activation. Speaking about on-hold infrastructure is speaking of infrastructures that are still having an embryo of life that can be activated or re-activated. It's one thing to talk about abandoned airports and another thing to consider on-hold airports. In fact, for airports on-hold, the cycle is not over yet. It refers to a phase of transition. In that sense, the indeterminate state of these airports could be transformed into an opportunity. The definition of "on-hold airports" has been

deeply described in the book by Sara Favargiotti, *Airports On-holds. Towards Resilient Infrastructures* (Trento: List Lab, 2016).

15. The ACRP Synthesis 19 explores case studies of how airports have addressed the reuse of vacant or underutilized airport facilities given the costs of physical conversion as well as regulatory requirements on airport operators. See: Lois S. Kramer, *Airport Revenue Diversification. ACRP Synthesis 19* (Washington, DC: Transportation Research Board, 2010).

16. Dümpelmann and Waldheim, *Airport Landscape*, 121.

17. Crissy Field closed to fixed-wing aircraft in 1974 and it has turned over to a National Park Service (NPS) in 1994. Hargreaves Associates, *Crissy Field*, San Francisco, United States, JFO, Completed 2001.

18. Johannisthal airport has been declared a nature conservation area in 2003. Büro Kiefer Landschaftsarchitektur Berlin, *Landscape Park Johannisthal*, Berlin, Germany, JOHANNISTHAL, Construction 1998–2010.

Part I: Options, Recyling

19. Dümpelmann and Waldheim, *Airport Landscape*, 9.

20. Anthony Flint, "The Evolution of How We Build Airports," *The Atlantic Cities Place Matters* (November 20, 2013).

21. Competition proposal titled "Emergent Ecologies". James Corner Field Operations et al., *Downsview Park*, Toronto, Canada, YZD//2, Competition 1999.

22. See U.S. Army Corps of Engineers, San Francisco District in cooperation with the California State Coastal Conservancy and San Francisco Bay Conservation Development Commission, *Hamilton Army Airfield Wetland Restoration, Feasibility Study, Final Report* (San Francisco, CA: December 1998), 137.

23. Dümpelmann and Waldheim, *Airport Landscape*, 137.

24. Part of the airfield is still being used for aviation activity, specifically by the Bombardier/de Havilland for test flights. Bernard Tschumi Architects, *Downsview Park*, Toronto, Canada, YZD//1, Competition 1999.

Part I: Options, Transforming

25. It refers to the competition proposal for the Canadian Forces Base. Hargreaves Associates *Orange County Great Park*, Orange County, Irvine, California, United States, NZJ #1, Competition 2005. See Dümpelmann and Waldheim, *Airport Landscape*, 173.

26. Competition proposal titled "Emergent Ecologies." James Corner Field Operations, et al., *Downsview Park*.

27. The reopening of Tempelhof Airport has been driven by public participation. Citizens are still engaged in shaping the site by proposing productive and leisure activities. Tempelhofer Feld, Berlin, Germany, THF, Reopened 2010, but also winning proposed in the winning competition project by GROSS.MAX., and Sutherland Hussey Architects, THF//1.

28. Competition proposal titled "The Digital and the Wild." Bernard Tschumi Architects, *Downsview Park*.

29. It has been proposed in the competition project by Topotek 1 and Dürig AG. *Tempelhof Airport*, Berlin, Germany, THF//2, Competition 2010.

30. It refers to the project for the decommissioned El Toro Marine Corps Air Station. Ken Smith Landscape Architect, *Orange County Great Park*, Orange County, Irvine, California, United States, NZJ//2, Master Plan 2006. See Dümpelmann and Waldheim, *Airport Landscape*, 191.

31. San Diego International Airport, http://www.san.org/Airport-Projects/Environmental-Affairs#124541-wildlife. (accessed January 5, 2017).

32. Philippe Coignet, et al., *Hellinikon Metropolitan Park and Urban Development*, Athens, ATH, Competition 2005. See Dümpelmann and Waldheim, *Airport Landscape*, 173.

33. Studio Gang Architects, *Northerly Island Framework Plan*, Chicago, United States, CGX, 2010. See Dümpelmann and Waldheim, *Airport Landscape*, 191.

34. Hargreaves Associates, *Crissy Field*, San Francisco, United States, JFO, Completed 2001. See Dümpelmann and Waldheim, *Airport Landscape*, 193.

35. Competition proposal by Lateral Office, *Reykjavík Airport*, Vatnsmýri, Iceland, RKV//1, Competition 2007. See Dümpelmann and Waldheim, *Airport Landscape*, 131.

36. It refers to the competition proposal titled "Aqua Culture," Stoss Landscape Urbanism, *Taichung Gateway Park*, Taichung, Taiwan, TXG//2, Competition 2011. See Dümpelmann and Waldheim, *Airport Landscape*, 185.

37. Anita Berrizbeitia, et al., *Mariscal Sucre International Airport*, Quito, Ecuador, UIO//2, Competition 2008. See Dümpelmann and Waldheim, *Airport Landscape*, 179.

38. Competition proposal "3km Airport park," Paisajes Emergentes, et al., "3km Airport park," *Parque del Lago*, Quito, Ecuador, UIO//3, Competition 2008 (second prize). See Dümpelmann and Waldheim, *Airport Landscape*, 181.

39. Anita Berrizbeitia, et al., *Generalísimo Francisco de Miranda Air Base*, La Carlota, Caracas, Venezuela, LA CARLOTA, Competition 2012. See Dümpelmann and Waldheim, *Airport Landscape*, 147.

40. Bjørbekk & Lindheim Landskapsarkitekter, *Oslo Airport*, Fornebu, Oslo, Norway, FBU, 2004–2008. See Dümpelmann and Waldheim, *Airport Landscape*, 143.

41. AECOM, *Stapleton Redevelopment*, Denver, Colorado, DEN, Begun 1997. See Dümpelmann and Waldheim, *Airport Landscape*, 153.

42. Dümpelmann and Waldheim, *Airport Landscape*, 145.

43. Ibid., 123.
44. National Park Service, Ashley Scott Kelly and Rikako Wakabayashi, *Floyd Bennett Field*, New York, NOP, 2007. See Dümpelmann and Waldheim, *Airport Landscape*, 155.
45. Jones & Jones Architects and Landscape Architects, Ltd, *Henderson Field Airport*, Sand Island, Midway Atoll, United States territory, MDY, Conceptual Site Plan 2008. See Dümpelmann and Waldheim, *Airport Landscape*, 201.
46. Studio Ernesto Bilbao, *Parque Bicentenario*, Quito, Ecuador, UIO//1, Competition 2008, Master Plan 2012. See Dümpelmann and Waldheim, *Airport Landscape*, 129.

Part II: Operations, Hydrologies

47. In 2008 the Metropolitan Municipality of Quito, the Corporation for Environmental Health "Vida para Quito", and the Architects' Association of Pichincha-Ecuador, launched an Open International Competition for Ideas for the design of Quito´s Lake Park (Parque del Lago) to transform Mariscal Sucre International Airport in a metropolitan park. The competition called for water to be a central part of the design, which offered architects a truly unique design opportunity. The competition proposal "3km Airport park" proposed the transformation of the runway into an urban park as an opportunity to test the insertion of leisure activities and aquatic ecosystems typical to the tropics. Paisajes Emergentes, et al., "3km Airport park," *Parque del Lago*, Quito, Ecuador, UIO//3, Competition 2008 (second prize).
48. "Aqua Cultures" is a living filter for water and air that catalyzes a robust range of urban programs: recreational and cultural activities occur within, atop, and beside the pools of water. Stoss Landscape Urbanism, "Aqua Culture", *Taichung Gateway Park*. See Dümpelmann and Waldheim, *Airport Landscape*, 185.
49. Sea level rise may increase by 2 to 6.5 feet over the next century (uncertain estimation). This operation is described in "Floyd Bennett Field Blue Ribbon", 28.
50. For the redevelopment of Stapleton airport, the entire 4,500-acre development area has been defined as a site for water quality purpose. AECOM, *Stapleton Redevelopment*. See "Regional and City-Wide Collaborative Approaches to Stormwater Management", Using Rainwater to Grow Livable Communities, available at the following link: https://www.werf.org/liveablecommunities/studies_den_co.htm (accessed on June 7, 2016).
51. Ken Smith Landscape Architect, *Orange County Great Park*. See "Orange County Great Park", in *Sustainable Sites Initiative 2008* (accessed in 2014).
52. Referred to the article by Svein Ole Åstebøl, et al., "Sustainable stormwater management at Fornebu - From an airport to an industrial and residential area of the city of Oslo, Norway", *Science of The Total Environment* (Elsevier: January 2005): 244.
53. Bjørbekk & Lindheim Landskapsarkitekter, *Oslo Airport*.
54. U.S. Army Corps of Engineers, San Francisco District California State Coastal Conservancy, *Wetland restoration at the former Hamilton Army Airfield*, Novato, California, SRF, Begun 1999.
55. Studio Gang Architects, *Northerly Island Framework Plan*.
56. Paisajes Emergentes, et al., "3km Airport park," *Parque del Lago*.
57. Philippe Coignet, et al., *Hellinikon Metropolitan Park and Urban Development*.
58. Paisajes Emergentes, et al., "3km Airport park," *Parque del Lago*.
59. By providing an additional source of water, water recycling can help to find ways to decrease the diversion of water from sensitive ecosystems, according to the definition of "Water Recycling and Reuse: The Environmental Benefits" of the United Stated Environmental Protection Agency (EPA), https://www3.epa.gov/region9/water/recycling/, data accessed on June 27, 2016.
60. Jones & Jones Architects and Landscape Architects, Ltd, *Henderson Field Airport*. See Dümpelmann and Waldheim, *Airport Landscape*, 191.
61. Carol R. Johnson Associates, *Squantum Point Park*, Quincy, Massachusetts, United States, SQUANTUM, 1997–2001. See Dümpelmann and Waldheim, *Airport Landscape*, 157.
62. U.S. Army Corps of Engineers, San Francisco District California State Coastal Conservancy, *Wetland restoration at the former Hamilton Army Airfield*, Novato, California, SRF, Begun 1999. See Dümpelmann and Waldheim, *Airport Landscape*, 173.
63. Hargreaves Associates, *Crissy Field*. See Dümpelmann and Waldheim, *Airport Landscape*, 191.
64. Anita Berrizbeitia, et al., *Mariscal Sucre International Airport*, Quito, Ecuador, UIO//2, Competition 2008; and Paisajes Emergentes, et al., "3km Airport park," *Parque del Lago*, Quito, Ecuador, UIO//3, Competition 2008 (second prize). See Dümpelmann and Waldheim, *Airport Landscape*, 173.
65. The project proposes that the Agua Chinon stream corridor, long buried at El Toro Air Base, will be uncovered and reconstructed to harbor native habitats while supporting human activities Engineered features will slow water flows, serving conservation needs. This stream corridor will attract dozens of native bird species, and be the site of recreation trails and education programs for the wide public. The visual experience of Agua Chinon will change from season to season and year to year. See The Great Park DESIGN STUDIO, *A Vision For The Great Park of The 21st Century. Comprehensive Master Plan Summary Report*, (Approved by Board of Directors: September 27, 2007): 43. Ken Smith Landscape Architect, *Orange County Great Park*.
66. The philosophy of Urban Drainage and Flood Control District (UDFCD) is to use "private consultants, where possible, to design improvements, has led to the development of significant technical and design expertise in a selected subset of the consulting engineer and landscape architectural communities. Consultants interested in water resources work have come to view projects funded by the District as an opportunity to innovate, within the performance requirements

established through the Urban Storm Drainage Criteria Manual (Volume 3), to make projects that are functional, maintainable, and beneficial for communities." Referred to the article *Regional and City-Wide Collaborative Approaches to Stormwater Management* available at the "Water Environmental Research Foundation" website: https://www.werf.org/liveablecommunities/studies_den_co.htm (accessed on June 7, 2016).

Part II: Operations, Ecologies

67. James Corner Field Operations, et al., "Emergent Ecologies," *Downsview Park*. See Dümpelmann and Waldheim, *Airport Landscape*, 169.

68. Anita Berrizbeitia, et al., *Mariscal Sucre International Airport*. See Dümpelmann and Waldheim, *Airport Landscape*, 179.

69. It refers to the competition proposal "Aqua Culture." Stoss Landscape Urbanism, *Taichung Gateway Park*.

70. San Diego International Airport, SAN.

71. John F. Kennedy International Airport, JFK.

72. Dümpelmann and Waldheim, *Airport Landscape*, 187.

73. Ibid., 175.

74. Ibid., 147.

75. Ibid., 149.

76. Ibid., 163.

77. Ibid., 149.

78. Ibid., 145.

79. Ibid., 167.

80. It refers to the following projects: Hartsfield-Jackson Atlanta International Airport, ATL; Chicago O'Hare International Airport, ORD; and Landscape Park Johannisthal, Berlin, JOHANNISTHAL.

81. At Chicago O'Hare International Airport, ORD, a herd of goats has been added to its sheep, llamas, and donkeys as part of an ongoing effort to reduce its carbon footprint.

82. This operations happens also in active airports such as: San Diego International Airport, SAN; San Francisco Airport, SFO; SeaTac Airport, Seattle, SEA; Chicago O'Hare International Airport, ORD; Bend Municipal Airport, Oregon, BDN.

83. John F. Kennedy International Airport, JFK//1.

84. Dümpelmann and Waldheim, *Airport Landscape*, 197.

85. See Peter del Tredici, "The Flora of the Future", in Chris Reed, Nina-Marie Lister, eds., *Projective ecologies* (Cambridge, MA: Harvard University Graduate School of Design; New York: Actar Publishers, 2014): 239.

86. Dümpelmann and Waldheim, *Airport Landscape*, 191.

87. Studio Gang Architects, *Northerly Island Framework Plan*.

88. Dümpelmann and Waldheim, *Airport Landscape*, 129.

89. Ken Smith Landscape Architect, *Orange County Great Park*. See Dümpelmann and Waldheim, *Airport Landscape*, 199.

90. Referred to the following projects: Hargreaves Associates, *Crissy Field*, San Francisco, United States, JFO, Completed 2001; and Agence Ter Reichen et Robert & Associés, *Anfa Airport*, Casablanca, Morocco, CAS, Commenced 2007. Studio Gang Architects, *Northerly Island Framework Plan*.

91. U.S. Army Corps of Engineers, San Francisco District California State Coastal Conservancy, *Wetland restoration at the former Hamilton Army Airfield*, Novato, California, SRF, Begun 1999.

92. Six species dominated the dune plant assemblages in 2000: Abronia latifolia, Abronia umbellata, Ambrosia chamissonis, Artemisia pycnocephala, Camissonia cheiranthifolia and Leymus mollis. See Kristen Ward, Myla Ablog, *Crissy Field Restoration Project Summary of Monitoring Data 2000-2004* (San Francisco: January 2006), 21.

93. For all those airports that do not possess their own wastewater treatment plants, all effluents carrying petroleum compounds, surfactants, the de-icing agents used in winter, and other organic and inorganic pollutants run off together with rain water or snowmelt into drainage ditches, whence they enter the soil, surface waters (rivers, lakes, ponds), and ultimately ground waters.

94. The Department of the Navy (DON) Base Realignment and Closure Program Management Office's (BRAC PMO) has adopted this classification for the disposal and environmental actions in several air bases such as Irvine (Orange County Great Park) and San Francisco (Hamilton Army Field). See the official website http://www.bracpmo.navy.mil (accessed on June 28, 2016).

95. For additional information see *Chapter 1.5 Situate*.

96. Referred to the seven Environmental Condition of the Property (ECP) categories (formalized in ASTM Standard ASTM D5746-98 (2010) Standard Classification of ECP Area Types)) (ASTM, 2010) for federal real property transactions and military construction (MILCON) projects.

97. See Parsons, Stapleton Brownfield Remediation (August 2005). https://www.parsons.com/Media%20Library/0805_Stapleton.pdf

98. Ken Smith Landscape Architect, *Orange County Great Park*. See ASLA, *Orange County Great Park* (ASLA: 2011).

99. National Park Service, Ashley Scott Kelly and Rikako Wakabayashi, *Floyd Bennett Field*. See Dümpelmann and Waldheim, *Airport Landscape*, 155.

100. Ken Smith Landscape Architect, *Orange County Great Park*. See Leslie McGuire, "One Great Big Beautiful Buffet: The Ecological Restoration of Orange County's Great Park", *LandscapeOnline* (accessed on June 22, 2016).

Part II: Operations, Infrastructures

101. AECOM, *Stapleton Redevelopment*.
102. Philippe Coignet, et al., *Hellinikon Metropolitan Park and Urban Development*.
103. Competition proposal titled "Emergent Ecologies." James Corner Field Operations, et al., *Downsview Park*.
104. Dümpelmann and Waldheim, *Airport Landscape*, 133.
105. Competition proposal titled "Phase Shift Park." Mosbach Paysagistes et al., *Taichung Gateway Park*, Taichung, Taiwan, TXG//1, Competition 2011.
106. Dümpelmann and Waldheim, *Airport Landscape*, 131.
107. Ibid., 181.
108. Ken Smith Landscape Architect, *Orange County Great Park*. See "Orange County Great Park", in *Sustainable Sites Initiative 2008* (accessed in 2014).
109. Ibid.
110. Ibid. See The Great Park DESIGN STUDIO, on behalf of the City of Irvine and the Orange County Great Park Corporation, *A Vision For The Great Park of The 21st Century. Comprehensive Master Plan Summary Report* (Approved by Board of Directors: September 27, 2007), 138.
111. Dümpelmann and Waldheim, *Airport Landscape*, 169.
112. See Statsbygg, *Sustainable Fornebu. From Airport To Sustainable Community* (Statsbygg: 2013), 14.
113. Dümpelmann and Waldheim, *Airport Landscape*, 145.
114. Ibid., 153-155.
115. Topotek 1 and Dürig AG, *Tempelhof Airport*.
116. Anita Berrizbeitia, et al., *Mariscal Sucre International Airport*. See Dümpelmann and Waldheim, *Airport Landscape*, 179.

Part II: Operations, Interventions

117. AECOM, *Stapleton Redevelopment*.
118. Anita Berrizbeitia, et al., *Generalísimo Francisco de Miranda Air Base*.
119. Büro Kiefer Landschaftsarchitektur Berlin, *Landscape Park Johannisthal*. See Dümpelmann and Waldheim, *Airport Landscape*, 163.
120. Carol R. Johnson Associates, *Squantum Point Park*, Quincy, Massachusetts, United States, SQUANTUM, 1997–2001.
121. Dümpelmann and Waldheim, *Airport Landscape*, 197.
122. Anita Berrizbeitia, et al., *Mariscal Sucre International Airport*.
123. Paisajes Emergentes, et al., "3km Airport park," *Parque del Lago*.
124. "The park design proposes open lawn areas in the south that include spaces for active sports and other recreational uses. [...] In the center of the site, the design proposes the allotment of community gardens for fruit and vegetable production as well as picnic and barbecue areas." kieferCSLandschaftsarchitektur Berlin, *Park Landscape and Urban Agriculture Gatow*, Gatow, Germany, GWW, Competition 2010–2011. See Dümpelmann and Waldheim, *Airport Landscape*, 127.
125. Lateral Office, *Reykjavík Airport*. See Dümpelmann and Waldheim, *Airport Landscape*, 131.
126. Ken Smith Landscape Architect, *Orange County Great Park*.
127. Dümpelmann and Waldheim, *Airport Landscape*, 175.
128. Ibid., 199.
129. Ibid., 145.
130. Dümpelmann and Waldheim, *Airport Landscape*, 173.
131. Anita Berrizbeitia, et al., *Generalísimo Francisco de Miranda Air Base*. See Dümpelmann and Waldheim, *Airport Landscape* 147.
132. U.S. Army Corps of Engineers, San Francisco District California State Coastal Conservancy, *Wetland restoration at the former Hamilton Army Airfield*, Novato, California, SRF, Begun 1999.
133. Dümpelmann and Waldheim, *Airport Landscape*, 193.
134. See The Great Park DESIGN STUDIO, on behalf of the City of Irvine and the Orange County Great Park Corporation, *A Vision For The Great Park of The 21st Century. Comprehensive Master Plan Summary Report* (Approved by Board of Directors: September 27, 2007), 126.
135. Dümpelmann and Waldheim, *Airport Landscape*, 143.
136. Ken Smith Landscape Architect, *Orange County Great Park*.
137. National Park Service, Ashley Scott Kelly and Rikako Wakabayashi, *Floyd Bennett Field*.
138. Anita Berrizbeitia, et al., *Generalísimo Francisco de Miranda Air Base*. See Dümpelmann and Waldheim, *Airport Landscape*, 147.
139. Carol R. Johnson Associates, *Squantum Point Park*.
140. Dümpelmann and Waldheim, *Airport Landscape*, 175.
141. Agence Ter Reichen et Robert & Associés, *Anfa Airport*. See Dümpelmann and Waldheim, *Airport Landscape*, 149.
142. Dümpelmann and Waldheim, *Airport Landscape*, 127.
143. Ibid., 145.
144. Ken Smith Landscape Architect, *Orange County Great Park*. See Dümpelmann and Waldheim, *Airport Landscape*, 199.
145. Landscape Park Johannisthal, Berlin, Germany, 1996. Construction 1998–2010. Büro Kiefer Landschaftsarchitektur Berlin. See Dümpelmann and Waldheim, *Airport Landscape*, 163.
146. Carol R. Johnson Associates, *Squantum Point Park*. See Dümpelmann and Waldheim, *Airport Landscape*, 171.

147. Bjørbekk & Lindheim Landskapsarkitekter, *Oslo Airport*. See Dümpelmann and Waldheim, *Airport Landscape*, 143.

148. Studio Gang Architects, *Northerly Island Framework Plan*. See Dümpelmann and Waldheim, *Airport Landscape*, 197.

149. Referred to the following projects: AECOM, *Stapleton Redevelopment*, Denver, Colorado, DEN, Begun 1997; and Bjørbekk & Lindheim Landskapsarkitekter, *Oslo Airport*, Fornebu, Oslo, Norway, FBU, 2004–2008.

150. Anita Berrizbeitia, et al., *Generalísimo Francisco de Miranda Air Base*. See Dümpelmann and Waldheim, *Airport Landscape*, 147.

151. National Park Service, Ashley Scott Kelly and Rikako Wakabayashi, *Floyd Bennett Field*. See Dümpelmann and Waldheim, *Airport Landscape*, 155.

152. Agence Ter Reichen et Robert & Associés, *Anfa Airport*. See Dümpelmann and Waldheim, *Airport Landscape*, 149.

153. Lateral Office, *Reykjavík Airport*. See Dümpelmann and Waldheim, *Airport Landscape*, 131.

154. ASLA, *Orange County Great Park* (ASLA: 2011).

155. Dümpelmann and Waldheim, *Airport Landscape*, 41.

156. Boston Logan International Airport, BOS. See Dümpelmann and Waldheim, *Airport Landscape*, 42.

157. Kalamazoo / Battle Creek International Airport, AZO. See Dümpelmann and Waldheim, *Airport Landscape*, 39.

158. Competition proposal titled "Phase Shift Park." Mosbach Paysagistes et al., *Taichung Gateway Park*. See Dümpelmann and Waldheim, *Airport Landscape*, 123.

Glossary

abandon: airport; landing; takeoff area (for a period of one year or more); taxiway.
ACRP: Airport Cooperative Research Program
activate: runway; aircraft landing; take off area; taxiway.
adaptive reuse: the process of adapting old structures for new purposes.
ALP: Airport Layout Plan
alter: runway; aircraft landing; take off area.
alternative: land and facility uses; sources of revenue.
ancillary development: developments that contribute to airport operating revenue, but is not necessarily dependent on commercial air service or passengers. It includes activities such as: industrial, retail, commercial, natural resources, agriculture, recreation, utilities, easements, and temporary use.
APA: American Planning Association
basic airport: airports that link the community with the national airport system and supports general aviation activities (e.g., emergency services, charter or critical passenger service, cargo operations, flight training and personal flying).
bird strike: a collision between a bird and an aircraft which is in flight or on a takeoff or landing roll.
biodrying: the process by which biodegradable waste is rapidly heated through initial stages of composting to remove moisture from a waste stream and thereby reduce its overall weight.
change status: airport use (normally, from private use to an airport open to the public of from public-use to another status).
construct: airport; runway; aircraft landing; take off area; taxiway.
convert: facilities, particularly physical conversion.
deactivate: airport; landing; takeoff area (for a period of one year or more); taxiway.
demolish: airport or aeronautical facilities.
discontinue using: airport; landing; takeoff area (for a period of one year or more); taxiway (associated with a landing or takeoff area on a public-use airport).
diversify: airport revenue.
EIR: Environmental Impact Report
EIS: Environmental Impact Statement
EPA: Environmental Protection Agency
FAA: Federal Aviation Administration
functional obsolescence: of certain facilities.
HTRW: Hazardous, Toxic and Radiological Waste
hydrophilic plants: plant species that absorb water, particularly during rainy periods
large, medium, small, and non-hub airports: FAA defines large hubs as having 1% or more of total national annual passenger boardings. A medium hub airport has 0.25% to 1% of boardings; a small hub airport has at least 0.05%, but less than 0.25%; and a non-hub airport has more than 10,000 boardings, but less than 0.05%. There are 29 large hub, 33 medium hub, 76 small hub, and 251 non-hub airports.
local airport: airports that supplement communities by providing access to primarily intrastate and some interstate markets.
loss of status: by an airline hub.
national airport: airports that support the national and state system by providing communities with access to national and international markets in multiple states and throughout the United States.
National Plan of Integrated Airport Systems (NPIAS): FAA identifies NPIAS as the nearly 3,300 existing and proposed airports that are significant to national air transportation and thus eligible to receive federal grants under the AIP.
Natural Treatment System (NTS): a cost-effective, environmentally sound method for treating dry weather runoff and small storm events. It is modeled after the successful system of natural treatment ponds which remove nitrogen, phosphorus and bacteria from surface waters.
non-aeronautical activity (or development): defined by the FAA, these activities or developments encompass the passenger-dependent activities, as well as rent on land and non-terminal facilities and fees collected for activities and services on airport property.
NPIAS: National Plan of Integrated Airport Systems
phytoremediation: use of deep rooted plants to absorb metals from the soil into their tissues.
primary airports (378 airports): airports designated by the FAA as publically owned airports with scheduled air carrier service and more than 10,000 passenger boardings each year.
realign: runway; aircraft landing; take off area; taxiway (associated with a landing or takeoff area on a public-use airport).
regional airport: airports that support regional economies by connecting communities to statewide and interstate markets.
reliever airports: airports designated by the FAA to relieve congestion at Commercial Service Airports and to provide improved general aviation access to the overall community. These may be publicly or privately-owned.
replacement: tenant, with respect to leasing of buildings.
reuse: terminals; strategies.
soil vapor extraction: a brownfield remediation process where vapor from soil are pulled and treated, effectively removing contaminants from a site's soil and groundwater.
TRB: Transportation Research Board
unclassified airports: airports that provide access to the aviation system.
unused: buildings or land, particularly in active airports.
wildlife corridors: designated swaths of land that connect disparate natural areas.

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