

Appendix I

Shadow Supporting Information

EIR Alternatives Analysis Memo



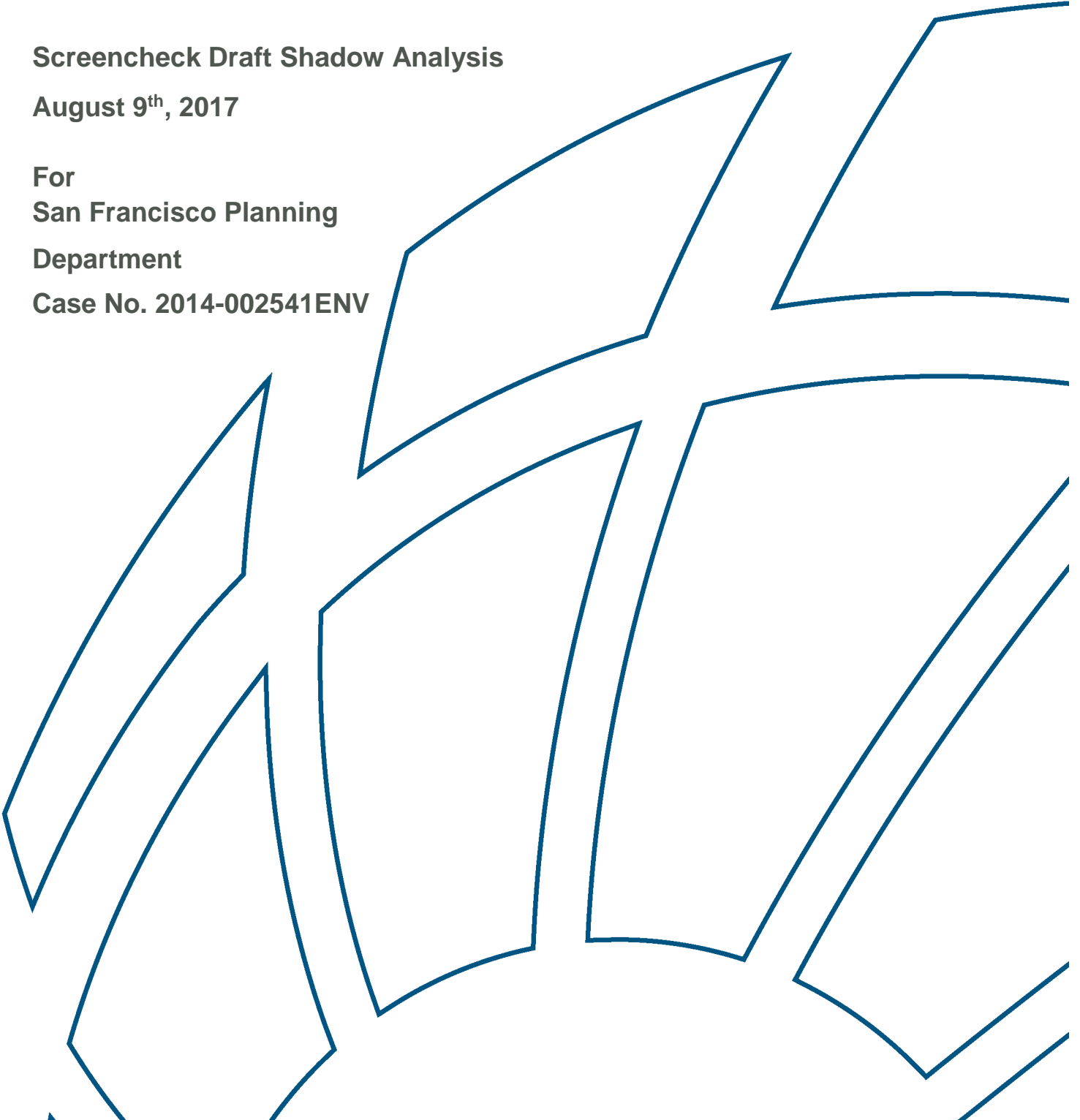
BMT Fluid Mechanics

India Basin Mixed-Use Project San Francisco, California

Screencheck Draft Shadow Analysis

August 9th, 2017

**For
San Francisco Planning
Department
Case No. 2014-002541ENV**



Report Title:	India Basin Mixed-Use Project Shadowing Study		
For:	San Francisco Planning Department		
Document No:	432091rep1v6	Release: 6	Copy No: 1
Status:	Final Report		
Report Date:	August 9th, 2017		
Holds:			
	Name:	Signature:	Date:
Prepared by:	Dr. S. Mijorski	<i>S. Mijorski</i>	August 8 th , 2017
Checked by:	Mr. J. Green	<i>[Signature]</i>	August 8 th , 2017
Approved by:	Dr. R. Stanfield	<i>[Signature]</i>	August 8 th , 2017
Distribution:	Copy no. to Client		
	Copy no. to BMT Records		
Previous Release History:	Release No:	Status:	Date:
432091rep1v1	1	Draft Report for Internal Review	October 4th, 2016
432091rep1v2	2	Draft Report for Client Review	October 5th, 2016
432091rep1v3	3	2nd Draft Report for Client Review	October 7th, 2016
432091rep1v4	4	3rd Draft Report for Client Review	March 13th, 2017
432091rep1v5	5	4th Draft Report for Client Review	August 8th, 2017

India Basin Mixed-Use Project Shadow Analysis

Contents

1. Introduction	7
2. The Assessment of Shadowing and Criteria	10
3. Assessment Methodology	12
4. Shadowing Results	14
5. Discussion of Results	16
6. References	18
Tables	19
Figures	20

EXECUTIVE SUMMARY

Background

BMT Fluid Mechanics Ltd. (BMT) has conducted a shadow analysis for the proposed India Basin Mixed-Use Project Variant (hereafter "project variant") along the India Basin shoreline of San Francisco Bay in San Francisco, California. The purpose of the study is to assess the potential for the project variant to cast new shadow on a park or open space in accordance with criteria specified in Section 295 of the San Francisco Planning Code. The proposed project variant scenario represents the conservative worst case. The proposed project scenario was not modelled separately as any shadow impacts would be less than the project variant scenario.

Test Criteria

The criteria for assessing the effect of shadows cast by new developments in San Francisco, CA, are established in the San Francisco Planning Code Section 295. The shadowing effect is assessed in terms of hourly shadow diagrams for selected days including the "worst case" shadow day, and as shadow calculations providing the amount of net new shadow and existing shadow on each day where the proposed project casts new shadows on parks and open spaces regulated by Section 295.

Proposed Project

The proposed project site, located in the Bayview Hunters Point neighbourhood in the southeast quadrant of San Francisco, comprises private-owned 700 Innes and publicly-owned 900 Innes, India Basin Shoreline Park and India Basin Open Space. The 700 Innes property consists of multiple parcels that would contain buildings ranging from one to 14 stories (20 to 150 feet tall). The 900 Innes property would only contain 3 structures ranging in height from 1-2 stories (10 to 25 feet tall). Shoreline Park would contain 3 structures also including a restroom, concessions and covered pavilion on the Bay that will be 1-2 stories (10 to 25 feet tall), see Figure 2.2 which contain the 6 structures. The India Basin Open Space also plans to include some 1 story uses, potentially a café, maintenance facility, rentals, and concessions.

Test Scenarios

The study included the assessment of the main shadowing effects in terms of shadow diagrams for the proposed project site and shadow calculations for the India Basin Open Space under different configurations, namely:

- **Existing Scenario**, assessing baseline shadow conditions in the area; and
- **Project Variant Scenario**, representing the worst case scenario between the proposed project and the maximum commercial project variant.

The maximum commercial project variant, due to its addition in massing, has been determined to be the worst case between the two build scenarios, the proposed project and variant. The structures proposed under the variant generally have the same heights but contain more square feet by approximately 20,000.

As the relevant cumulative projects are relatively far away from the proposed project site and the study area (more than 1,500 feet away), the shadowing effect of the project scenario or project variant scenario under the cumulative surrounding conditions is expected to be materially the same as for the same configurations within existing surrounding conditions. Thus, as agreed with the San Francisco Planning Department, the quantitative shadowing assessment in the project scenario or project variant scenario under the cumulative surrounding conditions is not required.

Summary Results

The results of the study is summarized on the following page.

Theoretical Annual Available Sunlight	India Basin Open Space	Big Green
Park area	287,334 sq. ft. (6.6 acres)	245,243 sq. ft. (5.63 acres)
Hours of annual available sunlight (from one hour after sunrise to one hour before sunset on each day)	3,721.4 hours	3,721.4 hours
Theoretical Annual Available Sunlight (TAAS)	1,069,284,748 sfh	912,646,556 sfh

	India Basin Open Space		Big Green	
	Annual shading (sfh)	Annual shading (% of TAAS)	Annual shading (sfh)	Annual shading (% of TAAS)
Existing Conditions	363,855	0.03%	817,661	0.09%
Proposed Development	39,506,930	3.69%	132,875,433	14.56%
Net New Shading	39,143,075	3.66%	132,057,772	14.47%

Days of Maximum Shading	India Basin Open Space	Big Green
Date(s) when maximum new shading occurs	December 27 th	December 27 th
Percentage net new shading on date(s) of maximum shading	7.78%	19.57%
Total net new shading on date(s) of maximum shadow	248,399 sfh	567,336 sfh

Time and Date of Maximum Shading	India Basin Open Space	Big Green
Time and date when maximum new shading occurs	February 2 nd , 16:33	January 1 st , 16:00
Percentage net new shading on time and date of maximum shading	26.25%	56.53%
Total net new shading on time and date of maximum shadow	75,427 ft ²	138,637 ft ²

India Basin Mixed-Use Project San Francisco, CA Shadow Analysis

1. Introduction

BMT Fluid Mechanics Ltd. (BMT) has conducted a shadow analysis for the proposed India Basin Mixed-Use Project (hereafter “proposed project”) along the India Basin shoreline of San Francisco Bay in San Francisco, California.

The purpose of the shadowing study is to assess the potential for the proposed project to cast new shadow on a park or open space in accordance with criteria specified in Section 295 of the San Francisco Planning Code.

1.1. Study Area

1.1.1. Project Site

The proposed project site is in the Bayview Hunters Point neighborhood, in the southeast quadrant of San Francisco. The site is generally bounded by the Bay to the north, the Candlestick Point–Hunters Point Phase I and Phase II Shipyard Development Plan areas to the east, Innes Avenue 2 to the south, and Hunters Point Boulevard and Hawes Street to the west. Portions of Innes Avenue adjacent to the site are included in the project boundary. The proposed project site is generally flat between Hudson Street and Earl Street to the India Basin Open Space boundary, with slope toward the Bay. The elevation of the site is highest along Innes Avenue at approximately 50 feet above mean sea level, and lowest along the shoreline at approximately 5 feet above mean sea level.

The site location is presented within the context of the wider surrounding area in Figure 1.1. The buildings immediately surrounding the proposed project have also been included in the model.

1.2. Proposal

The proposed project consists of private-owned 700 Innes and publicly-owned 900 Innes, India Basin Shoreline Park and India Basin Open Space. The 700 Innes property consists of multiple parcels that would contain buildings ranging from one to 14 stories (20 to 150 feet tall), see Figure 2.1. The 900 Innes property would only contain 3 structures ranging in height from 1-2 stories (10 to 25 feet tall). Shoreline Park would contain 3 structures also including a restroom, concessions and covered pavilion on the Bay that will be 1 story tall, as illustrated in Figure 2.2. The India Basin Open Space also plans to include some 1 story uses, potentially a café, maintenance facility, rentals, and concessions. Pathways in the form of boardwalks, trails, and stairways would connect the India Basin Open Space property with an approximately 5.63-acre, publicly accessible open space area, referred to as the "Big Green."

1.3. Test Scenarios

The study included the assessment of the main shadowing effects in terms of shadow diagrams and shadow calculations for the proposed development site under different configurations, namely:

- **Existing Scenario**, assessing baseline shadow conditions in the area; and
- **Project Variant Scenario**, representing the worst case scenario between the proposed project and the maximum commercial project variant.

The maximum commercial project variant, due to its addition in massing, has been determined to be the worst case of the two, the proposed project and project variant scenarios. The buildings in the project variant generally have the same heights and contain more square feet by approximately 20,000.

As the relevant cumulative projects are relatively far away from the proposed project site and the study area (more than 1,500 feet away), the shadowing effect of the project scenario or project variant scenario under the cumulative surrounding conditions is expected to be materially the same as for the same configurations within existing surrounding conditions. Thus, as agreed with the San Francisco Planning Department, the quantitative shadowing assessment in the project scenario or project variant scenario under the cumulative surrounding conditions is not required.

Figures 1.1 to 1.3 show the Existing Scenario, Project Scenario and Project Variant Scenario, respectively. The buildings immediately surrounding the proposed project indicated in the Existing Scenario have also been included in modeling the project variant scenario, which represents the conservative worst case. The proposed project scenario was not modelled separately as any shadow impacts would be less than the project variant scenario.

2. The Assessment of Shadowing and Criteria

Criteria for assessing the effect of shadows cast by new developments in San Francisco, CA, are outlined in the San Francisco Planning Code Section 295 ^[1].

New developments in San Francisco over 40 feet in height which have the potential to cast new shadows on parks under the jurisdiction of the San Francisco Recreational and Parks Department are subject to review under the San Francisco Planning Code Section 295 ^[1]. Section 295 of the San Francisco Planning Code requires that shadows cast by any project in excess of 40 feet in height do not adversely affect use of parks and open spaces under the jurisdiction of the San Francisco Recreational and Parks Department.

The shadowing effect is assessed in terms of hourly shadow diagrams and shadow calculations, from one hour after sunrise through one hour before sunset. These are respectively qualitative and quantitative approaches to the assessment of new shadows cast by the proposed variant scenario ^[2]:

- Shadow Diagrams: Shadow diagrams are graphical illustrations of the shadows cast by the proposed variant scenario and the surrounding developments on the parks / open spaces regulated by the San Francisco Planning Code Section 295 ^[1] for both existing and future surrounds configurations. Shadow diagrams are produced hourly, starting one hour after sunrise and ending one hour before sunset, for up to five days of the year:
 - Winter solstice (December 21st) – midday sun is lowest and shadows are at their longest;
 - Summer solstice (June 21st) – midday sun is at its highest and shadows are at their shortest;
 - Spring equinox (March 21st) – shadows are midway through a period of lengthening;
 - The “worst case” shadow day (area) – the day on which the net new shadows cover the largest area;
 - The “worst case” shadow day (duration) – the day on which the overall sfh of net new shadow cast by the variant on the India Basin Open Space has been identified.
- Shadow Calculations: Tabulated data indicating the amount of net new shadow and existing shadow, expressed in square foot hours, in fifteen minute increments throughout the day between one hour after sunrise and one hour before sunset on each day where the proposed variant scenario would cast net new shadows on parks/open spaces regulated

by Section 295 of the Planning Code ^[1]. The aforementioned tabulated data is provided for the project and represents conditions in the existing surrounding area.

3. Assessment Methodology

3.1. Model Details

3D models were constructed and used to represent the existing site conditions and proposed commercial development for the variant scenario within the existing surrounding conditions. The models included a sufficiently detailed representation of adjacent developments, within a distance judged to have an influence on the shadowing conditions around the proposed development site.

Any local topography that may affect the shadowing is included in the model. The model of the proposed variant scenario was constructed based on 3D CAD models supplied to BMT by the project sponsor and the design team. Inputs entered represented the proposed size and heights of structures into the model for calibration.

3.2. Shadowing Analysis

The software used was DIVA for Rhino ^[3] which computes the level of shadows cast by existing buildings and by the proposed variant scenario on the open spaces and parks regulated by Section 295 of the San Francisco Planning Code. Computations are carried out at 15-minute intervals from one hour after sunrise to one hour before sunset, every seven days, between the summer and winter solstices. The difference between the existing levels of shading and the level of shading occurring with the introduction of the proposed variant scenario generates the annual increase in square-foot-hours of shade. The Theoretical Available Annual Sunlight, or TAAS, is used to compute the baseline amount square foot hour of sunshine that would fall within the park / open space under the hypothesis that no shadow is cast on it throughout the year. It is calculated by multiplying the area of the park / open space by the total number of annual hours that fall between one hour after sunrise and one hour before sunset. The TAAS is thus used to present the increase in square foot hour of shade as percentage of theoretical square foot hour of sun in the park / open space.

3.3. Affected Parks / Open Spaces

A shadow fan (Figure 3.1) was pre-defined by the San Francisco Planning Department as part of the Preliminary Project Assessment on September 10th, 2015. The shadow fan indicated the susceptibility of the proposed project to cast

new shadows on parks / open spaces which are protected by Section 295 of the San Francisco Planning Code. This initial assessment identified India Basin Open Space as the only park / open space regulated under Section 295 of the San Francisco Planning Department ^[1] susceptible to be adversely affected by the proposed project, in terms of shadowing. Additionally, after assessing the shadow diagram, it has been identified that the proposed "Big Green" would receive new shadows from the proposed project. Note the Big Green will not be under the Recreation and Park Department (RPD) jurisdiction.

4. Shadowing Results

The India Basin Open Space is a publicly-accessible restored wetland and natural area located along the India Basin waterfront, north of Hudson Avenue. Its main entry point is at the end of Arelious Walker Drive, off Innes Avenue. The India Basin Open Space is an existing 6.6 acre RPD open space consisting of benches, walking path, upland habitat, tidal salt marsh, mudflats, sand dunes, and native vegetation that borders the Bay. This property includes a portion of the Blue Greenway/Bay Trail along its shoreline, consisting of features that improve the region wide Bay Trail from Mission Creek on the north to the City limits on the south.

Improvements to the open space including enhancements for public access, recreation, and ecological functions could include sand dunes, bird islands, a recreational beach area, a boat launch (directly from the land), a bioengineered breakwater, brackish lagoons, scrub upland planting, tree stands for wind buffering, and new wetlands and ponds. In addition, potentially 2,000 gsf of commercial use (specifically a café, maintenance facility, rentals, and concessions) may be built on the India Basin Open Space property serving the publicly accessible beach and open space. Pathways in the form of boardwalks, trails, and stairways would connect the India Basin Open Space property with an approximately 5.63-acre, publicly accessible open space area, referred to as the "Big Green."

Table 4.1 summarises the existing conditions data and quantitative shadowing results of the proposed project on the India Basin Open Space and "Big Green" park.

The shadow diagrams provided in Figures 4.1 to 4.47 provide a visual representation of the new shadows cast by the proposed project variant on parks / open spaces around the site, on an hourly basis, starting one hour after sunrise and ending one hour prior to sunset. These are provided for the following days:

- Figures 4.1 to 4.12 - Spring equinox: March 21st: New shadows are cast on the India Basin Open Space all day long, from 07:10, predominantly on the south-west corner of the park space, with the maximum net new shadow occurring at 09:00;
- Figures 4.13 to 4.27 - Summer solstice: June 21st: New shadows are cast on the India Basin Open Space all day long, with the minimum net new shadow occurring at an hour after sunrise, at 06:48 and the maximum in the afternoon, at 18:34, principally to the south east of the open space;

- Figures 4.28 to 4.36 - Winter solstice: December 21st: The India Basin Open Space is exposed to new shadows all day long, with a minimum net new shadow occurring at 09:00 and the maximum at 15:54, principally covering the south east and south west corners of the open space;
- Figures 4.37 to 4.45 - "Worst case" shadow day: December 27th: The worst day of the year, in terms of overall sfh of net new shadow cast by the variant on the India Basin Open Space has been identified to be December 27th. The maximum net new shadow cast by the proposed project on the India Basin Open Space would occur at 15:58;
- Figure 4.46 - "Worst case" shadow time and day for the India Basin Open Space: February 2nd, 16:33. This figure represents the moment when net new shadow cast by the variant on the India Basin Open Space reaches its maximum area;
- Figure 4.47 - "Worst case" shadow time and day for the Big Green: January 1st, 16:00: This figure represents the moment when net new shadow cast by the variant on the Big Green reaches its maximum area.

It is noted that topography is taken into account when preparing the shadow diagrams. This results in existing shading (grey) of the topography not contributing to the net new shading (green).

5. Discussion of Results

5.1. India Basin Open Space

The India Basin Open Space has a total area of 287,334 square feet (6.6 acres) which currently has 363,855 sfh of shade annually. Based on Theoretical Annual Available Sunlight (TAAS) of 1,069,284,748 sfh, the open space is currently shaded 0.034% of the year.

The proposed project has 39,506,930 sfh of shade annually, contributes to 39,143,075 sfh, or 3.66%, net additional shading throughout the year. The day of maximum shading throughout the year occurs on December 27th where new shadows from the proposed project would create an increase of 248,399 sfh, or 7.78%, above current shading levels on this day. New shadows from the proposed project on the open space this day would occur in the afternoon hours. The combination of the proposed project massing, the sun path in afternoon hours in winter months and the position of the India Basin Open Space, to the north of the proposed project results in new shadows being cast on the open space at this period of time.

The largest net new shadow area being cast on the India Basin Open Space is 75,427 ft², or 26.25% of the total India Basin Open Space area. This shadow occurs on February 2nd at 16:33.

5.2. Big Green

The Big Green will be a publically accessible open space but will not be under the jurisdiction of the San Francisco Recreation and Park Department. The Big Green has a total area of 245,243 square feet (5.63 acres) which currently has 817,661 sfh of shade annually. Based on Theoretical Annual Available Sunlight (TAAS) of 912,646,556 sfh, the open space is currently shaded 0.090% of the year.

The proposed project has 132,875,433 sfh of shade annually, contributes to 132,057,772 sfh, or 14.47%, net additional shading throughout the year. The day of maximum shading throughout the year occurs on December 27th where new shadows from the proposed project would create an increase of 567,336 sfh, or 19.57%, above current shading levels on this day. New shadows from the proposed project on the open space this day would occur in the afternoon hours.

The largest net new shadow area being cast on the Big Green is 138,637 ft², or 56.53% of the total Big Green area. This shadow occurs on January 1st at 16:00.

6. References

- [1] San Francisco Planning Department, "Section 295. Height Restrictions on Structures Shadowing Property under the Jurisdiction of the recreation and park Commission," April 2015.
- [2] San Francisco Planning Department, "Shadow Analysis Procedures and Scope Requirements," Memo, July 2014.
- [3] Solemna, LLC, "DIVA for Rhino Version 4.0.2.5," Solemna, LLC, 2016.

Tables

Table 4.1: India Basin Open Space and Big Green Analysis Summary Table

Theoretical Annual Available Sunlight	India Basin Open Space	Big Green
Park area	287,334 sq. ft. (6.6 acres)	245,243 sq. ft. (5.63 acres)
Hours of annual available sunlight (from one hour after sunrise to one hour before sunset on each day)	3,721.4 hours	3,721.4 hours
Theoretical Annual Available Sunlight (TAAS)	1,069,284,748 sfh	912,646,556 sfh

	India Basin Open Space		Big Green	
	Annual shading (sfh)	Annual shading (% of TAAS)	Annual shading (sfh)	Annual shading (% of TAAS)
Existing Conditions	363,855	0.03%	817,661	0.09%
Proposed Development	39,506,930	3.69%	132,875,433	14.56%
Net New Shading	39,143,075	3.66%	132,057,772	14.47%

Days of Maximum Shading	India Basin Open Space	Big Green
Date(s) when maximum new shading occurs	December 27 th	December 27 th
Percentage net new shading on date(s) of maximum shading	7.78%	19.57%
Total net new shading on date(s) of maximum shadow	248,399 sfh	567,336 sfh

Time and Date of Maximum Shading	India Basin Open Space	Big Green
Time and date when maximum new shading occurs	February 2 nd , 16:33	January 1 st , 16:00
Percentage net new shading on time and date of maximum shading	26.25%	56.53%
Total net new shading on time and date of maximum shadow	75,427 ft ²	138,637 ft ²

Figures

Figure 1.1: Existing Scenario

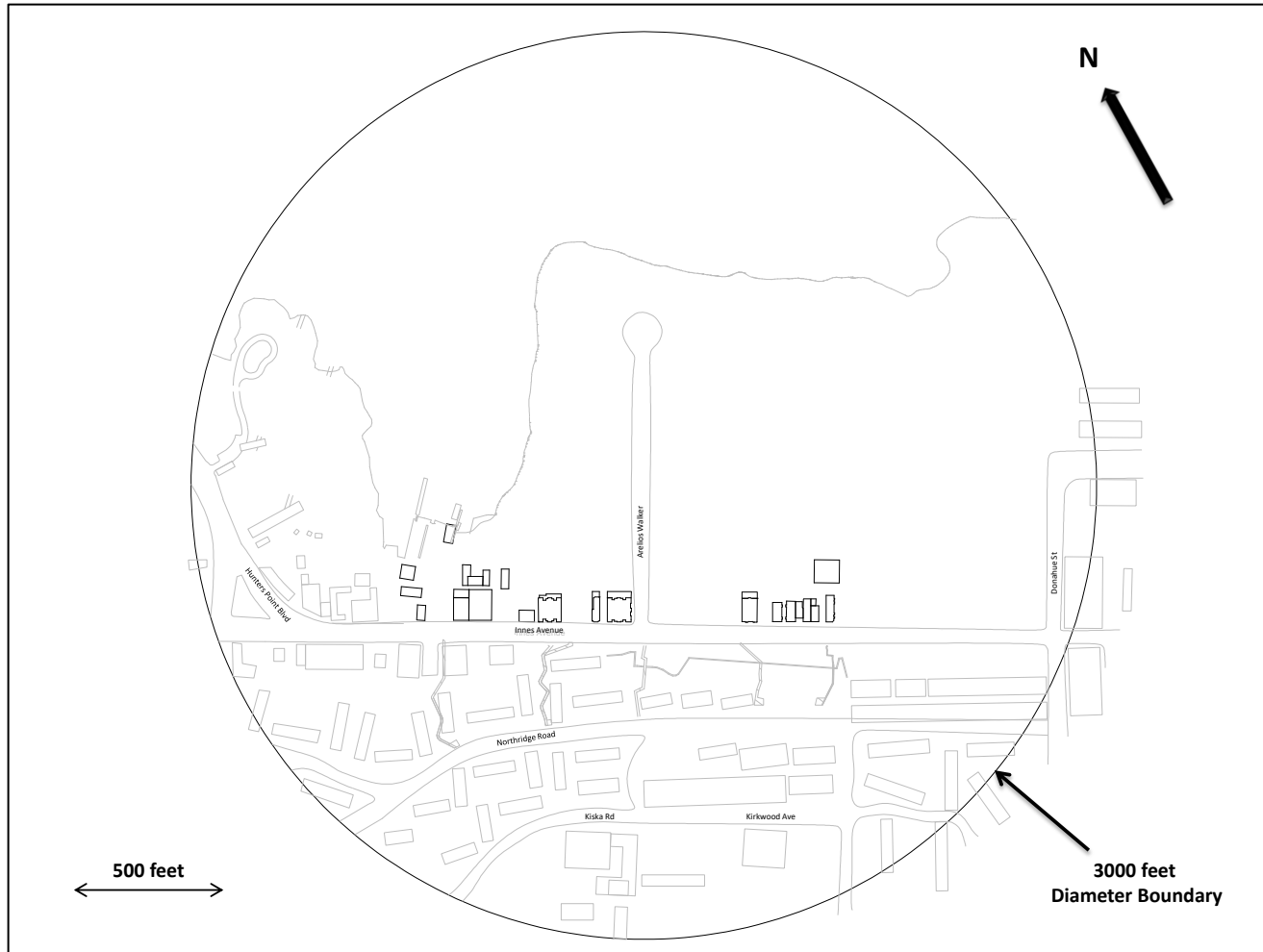


Figure 1.2: Project Scenario

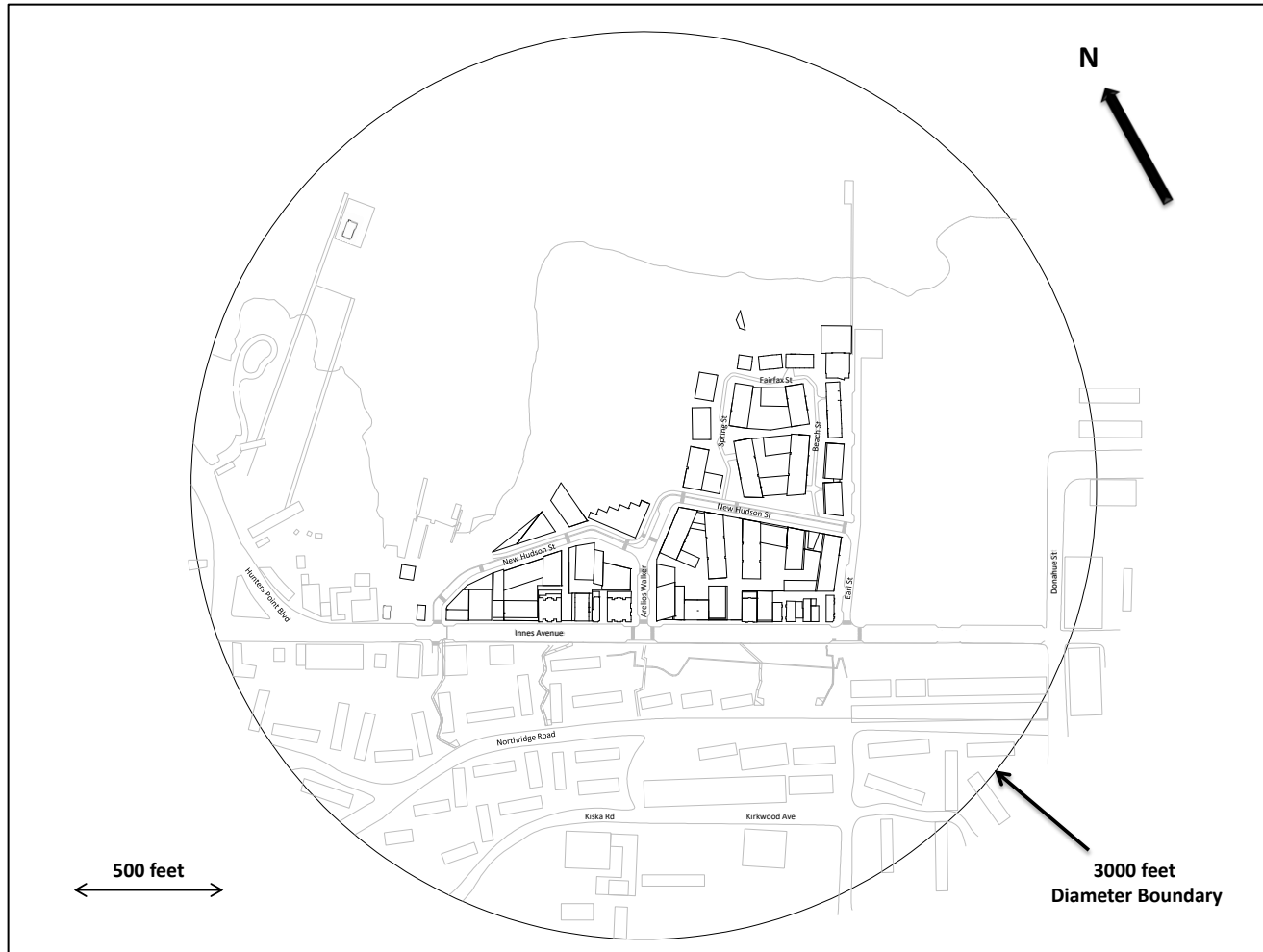


Figure 1.3: Project Variant Scenario

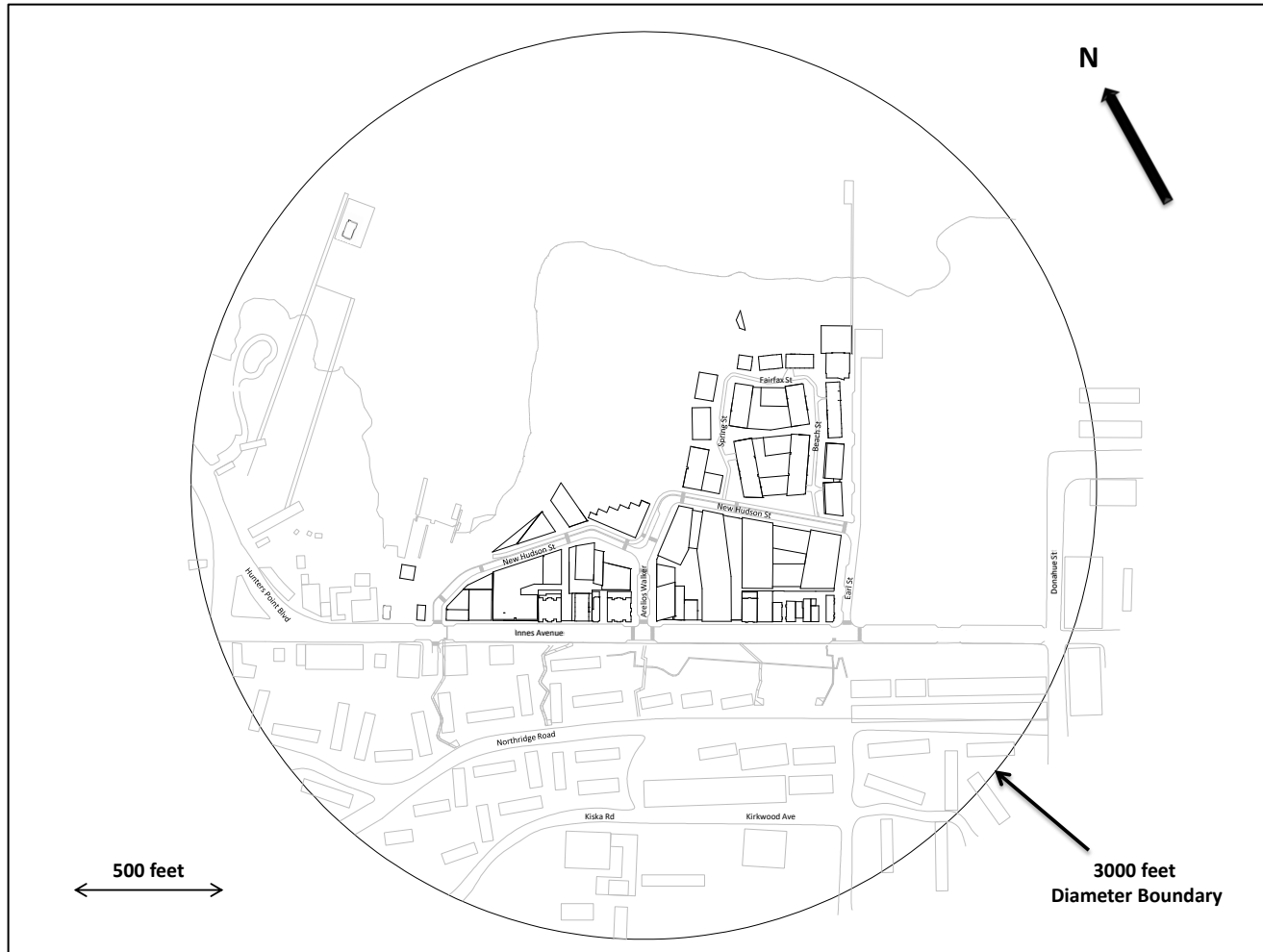


Figure 2.1: 700 Innes



Figure 2.2: 700 Innes



Figure 3.1: Shadow Fan



Figure 4.1: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 08:10

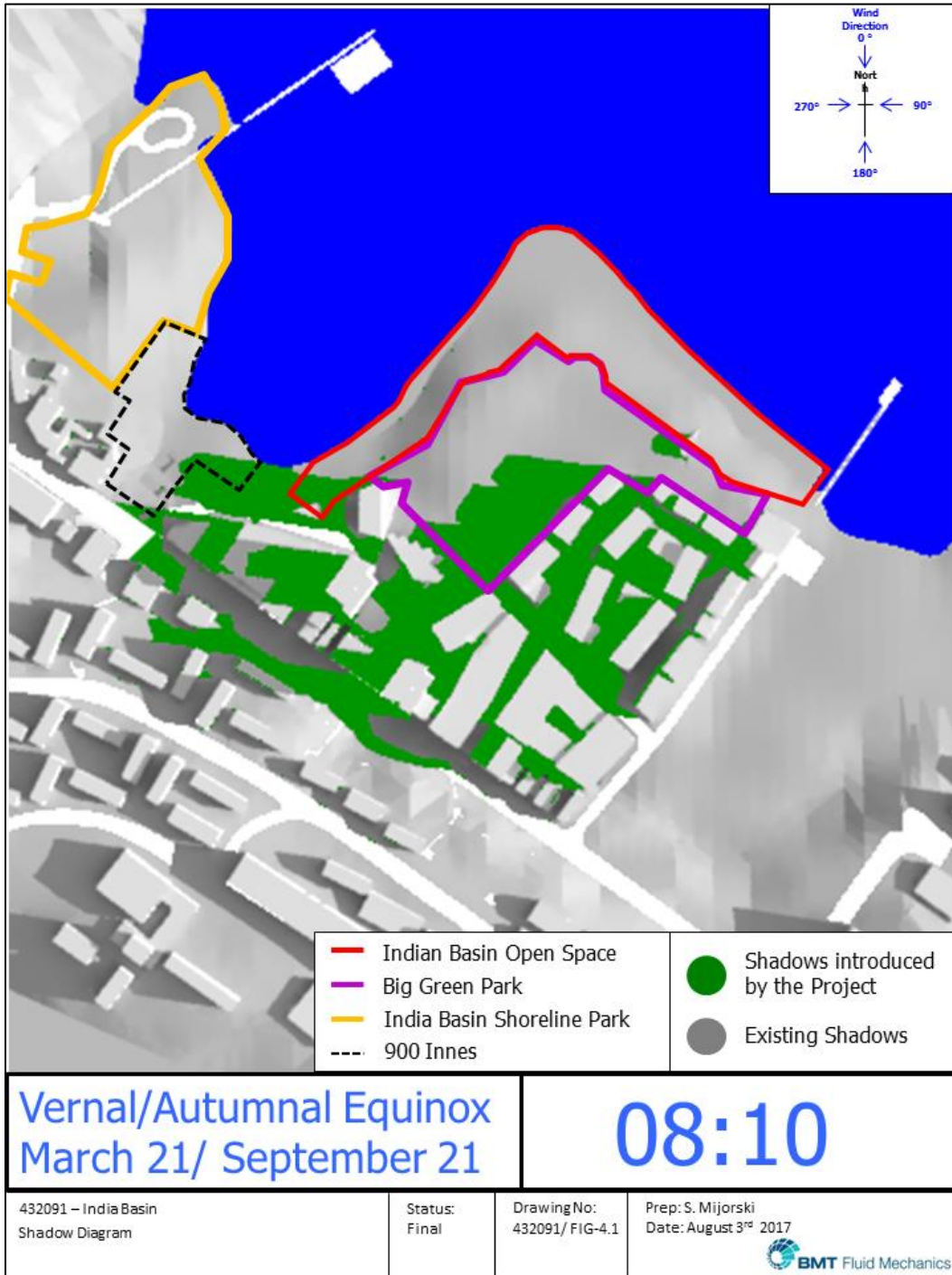


Figure 4.2: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 09:00

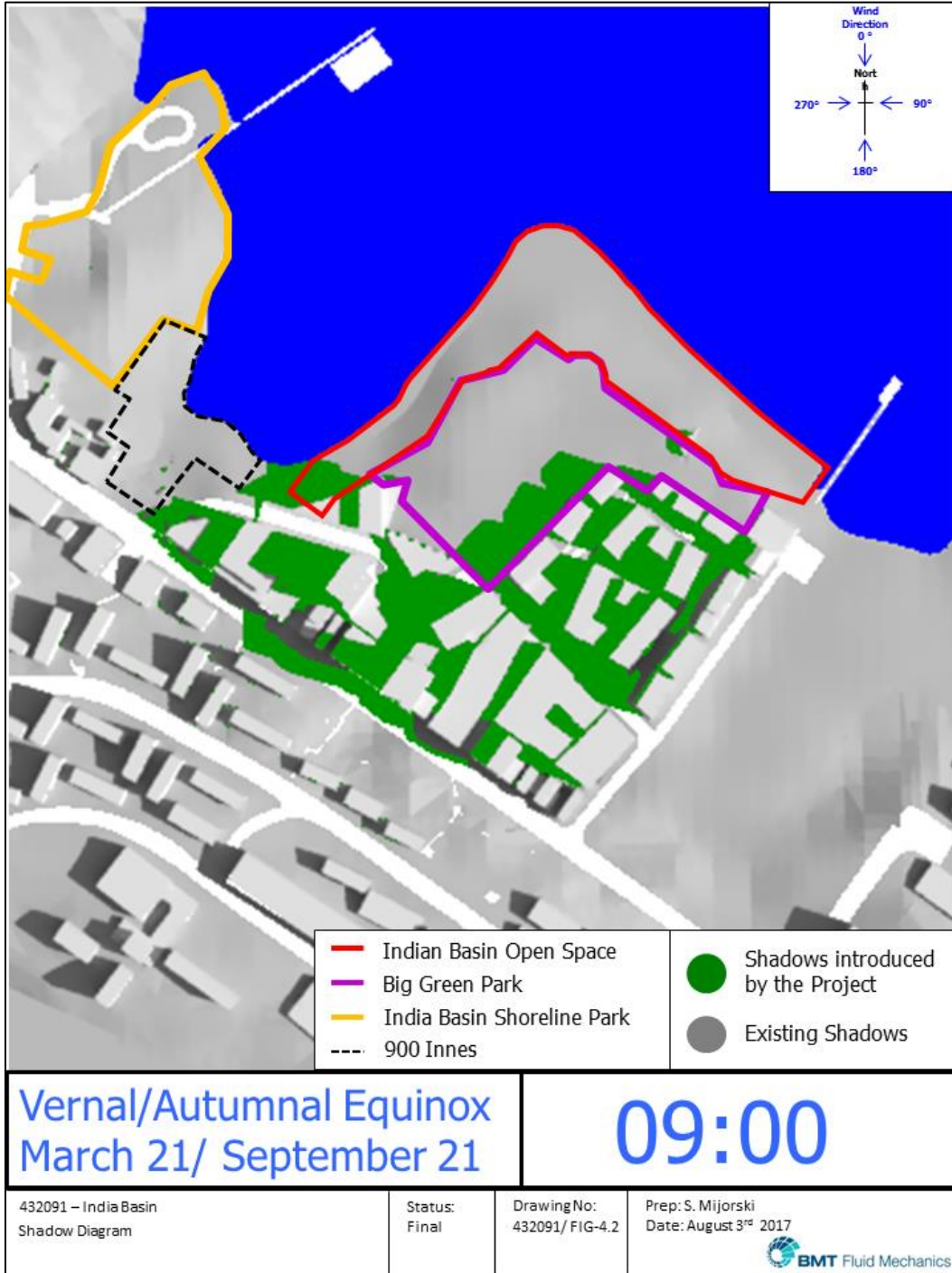


Figure 4.3: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 10:00

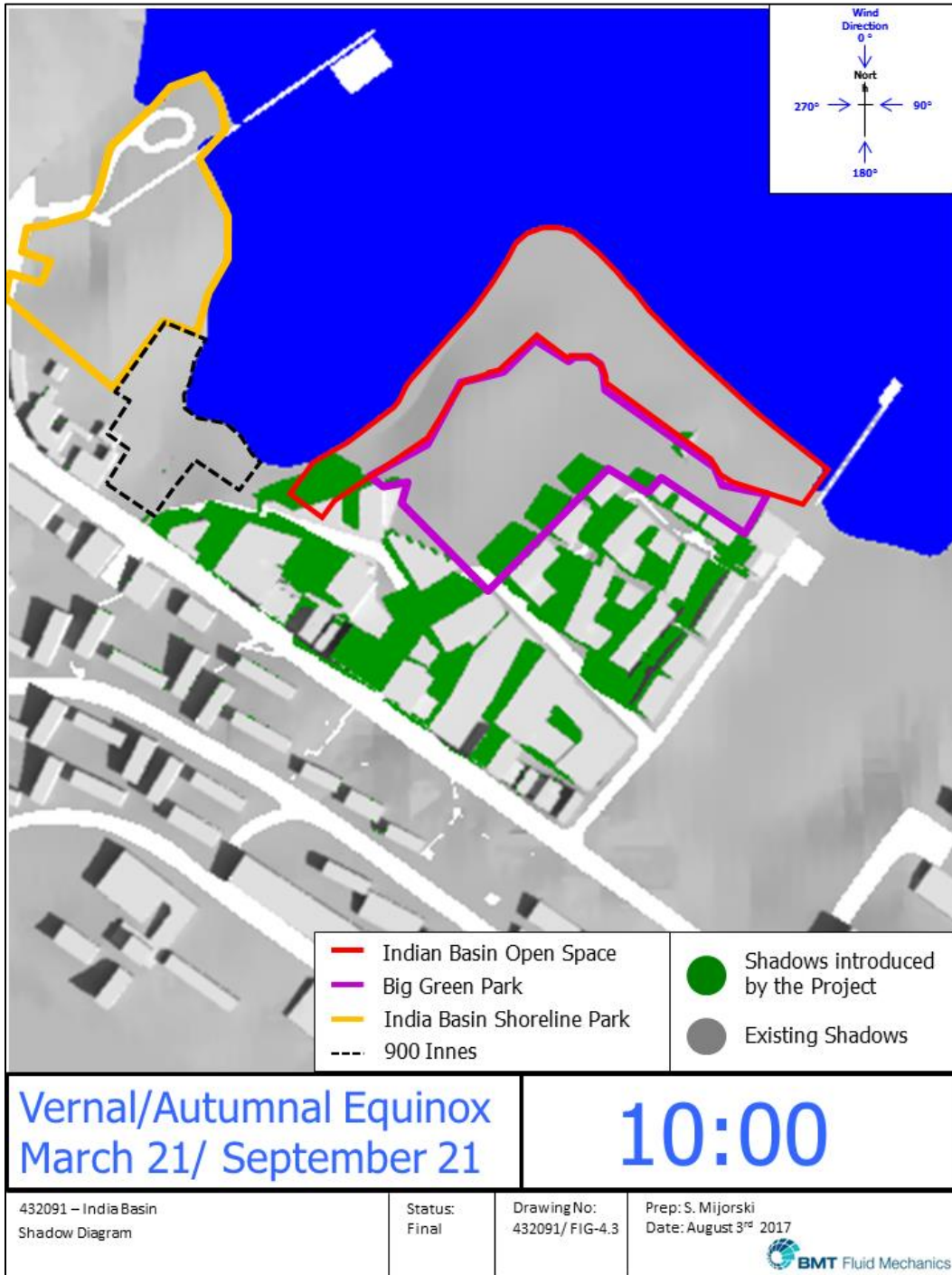


Figure 4.4: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 11:00

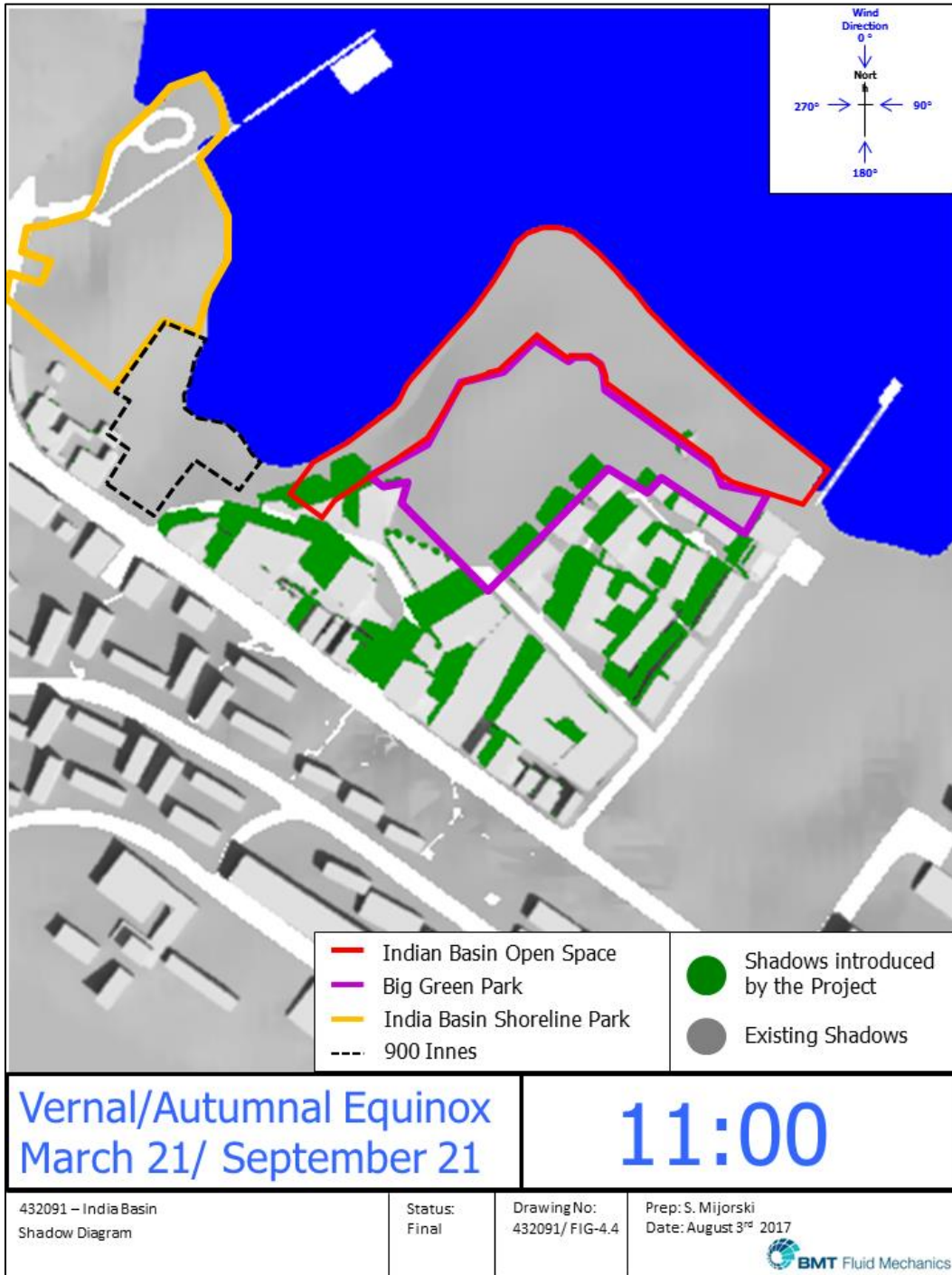


Figure 4.5: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 12:00

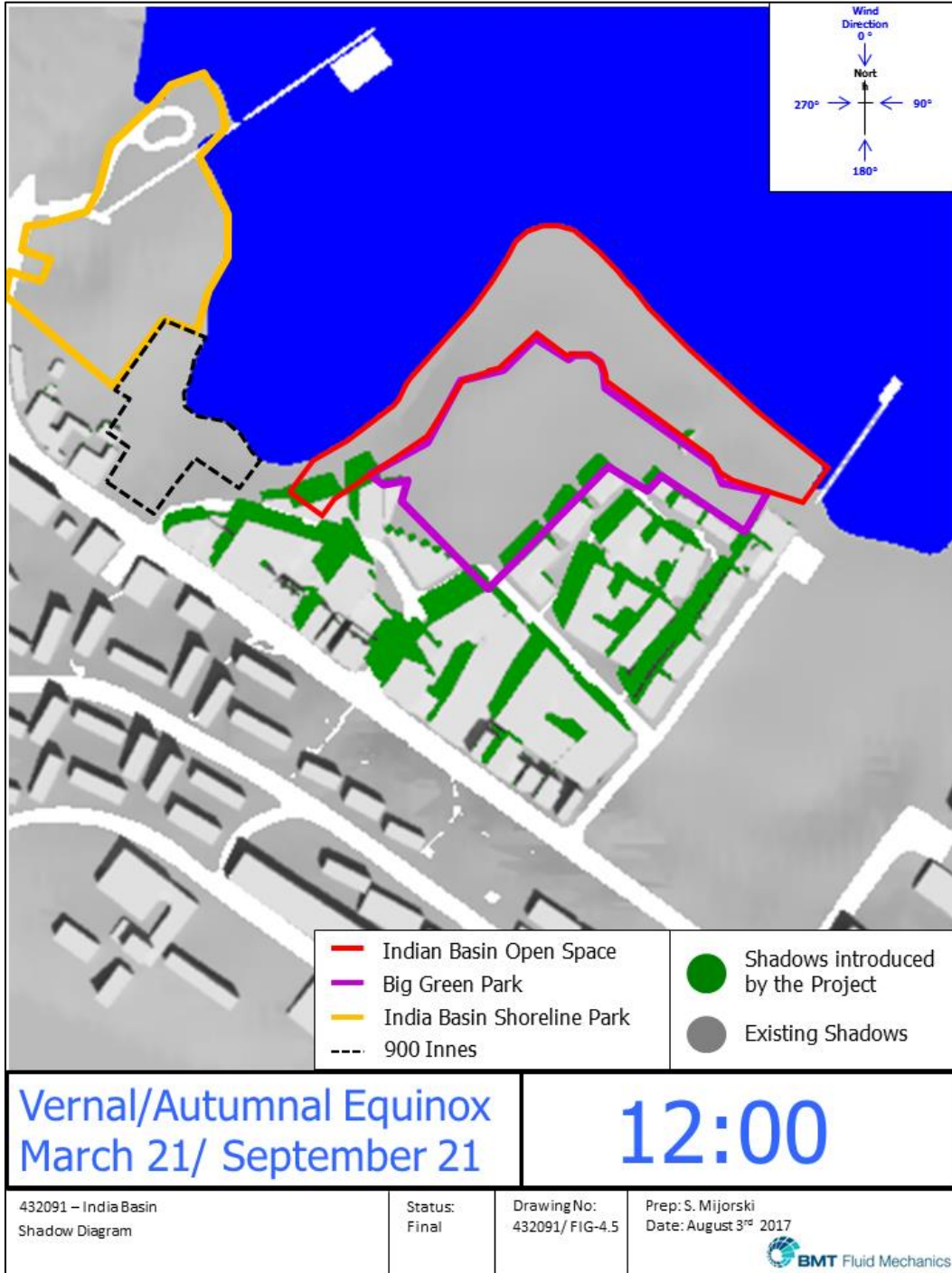


Figure 4.6: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 13:00

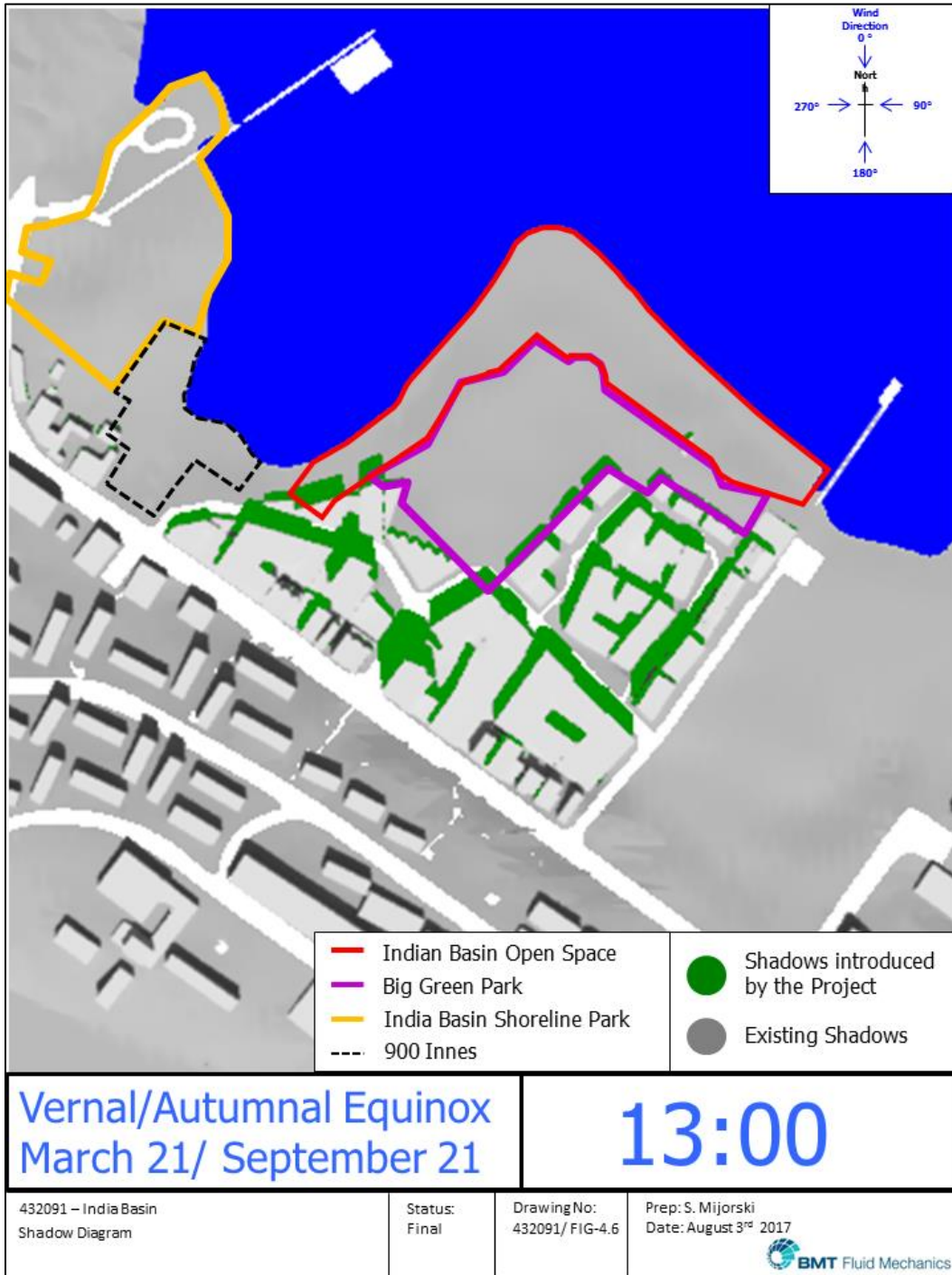


Figure 4.7: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 14:00

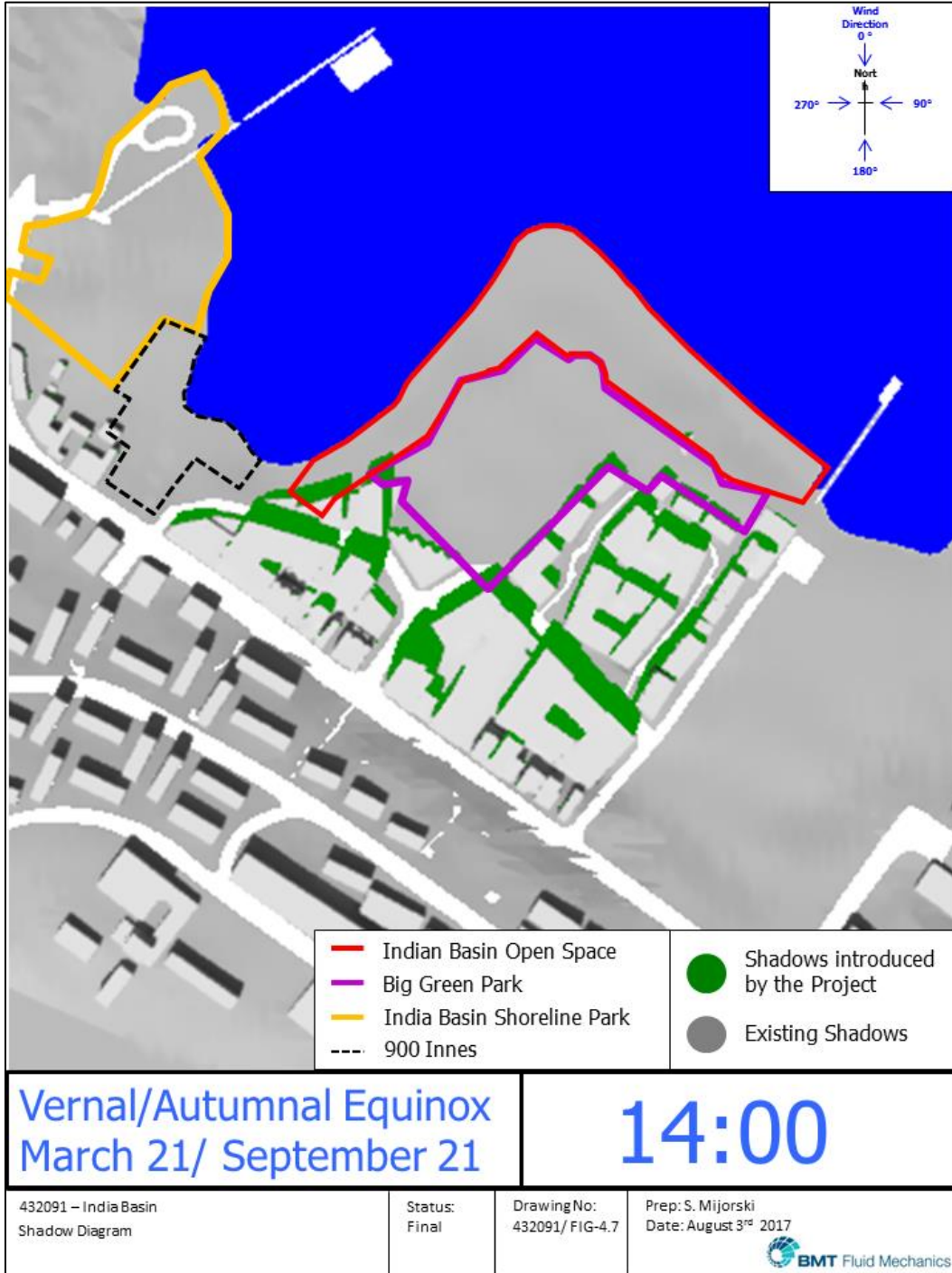


Figure 4.8: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 15:00

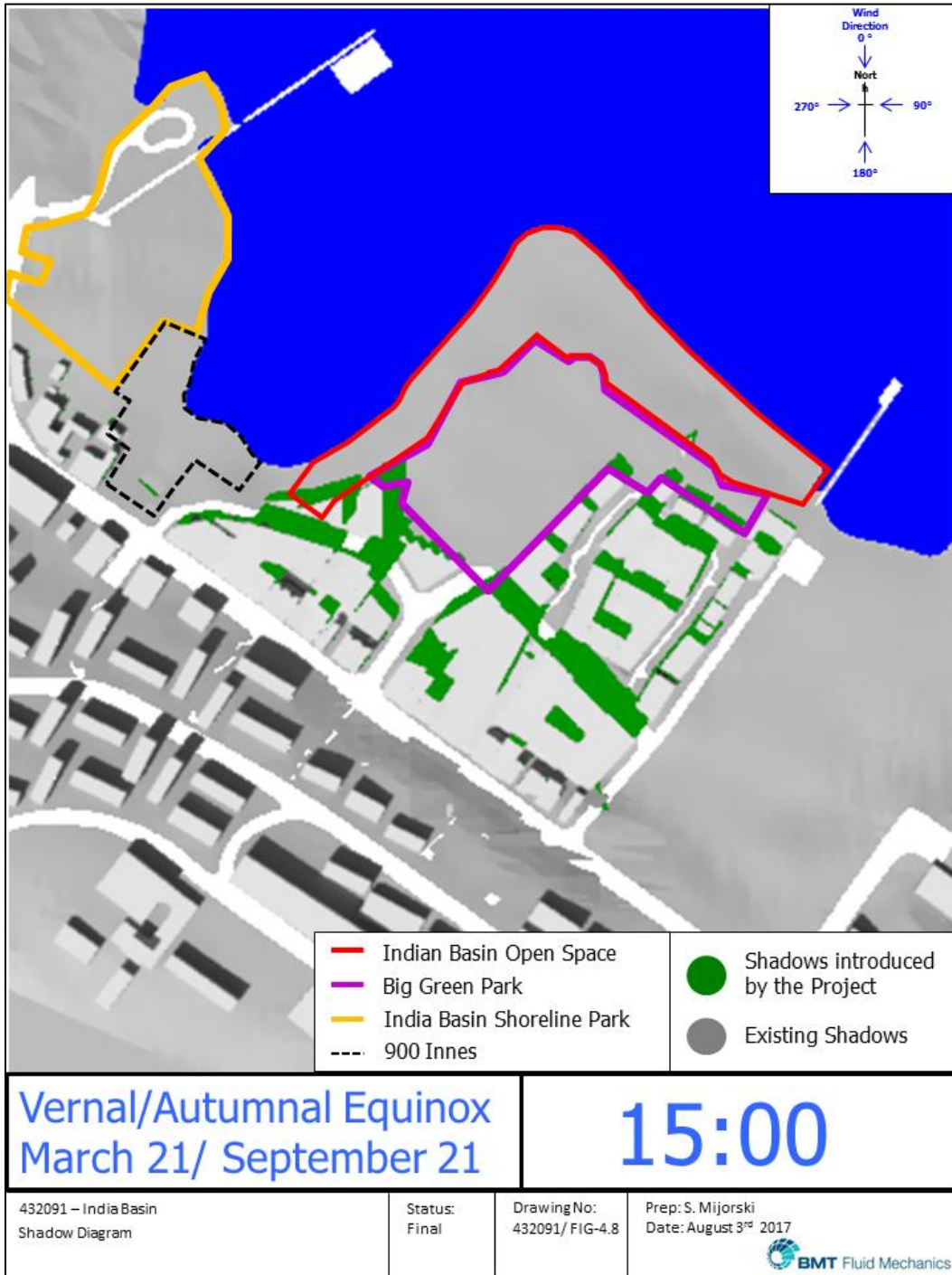


Figure 4.9: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 16:00

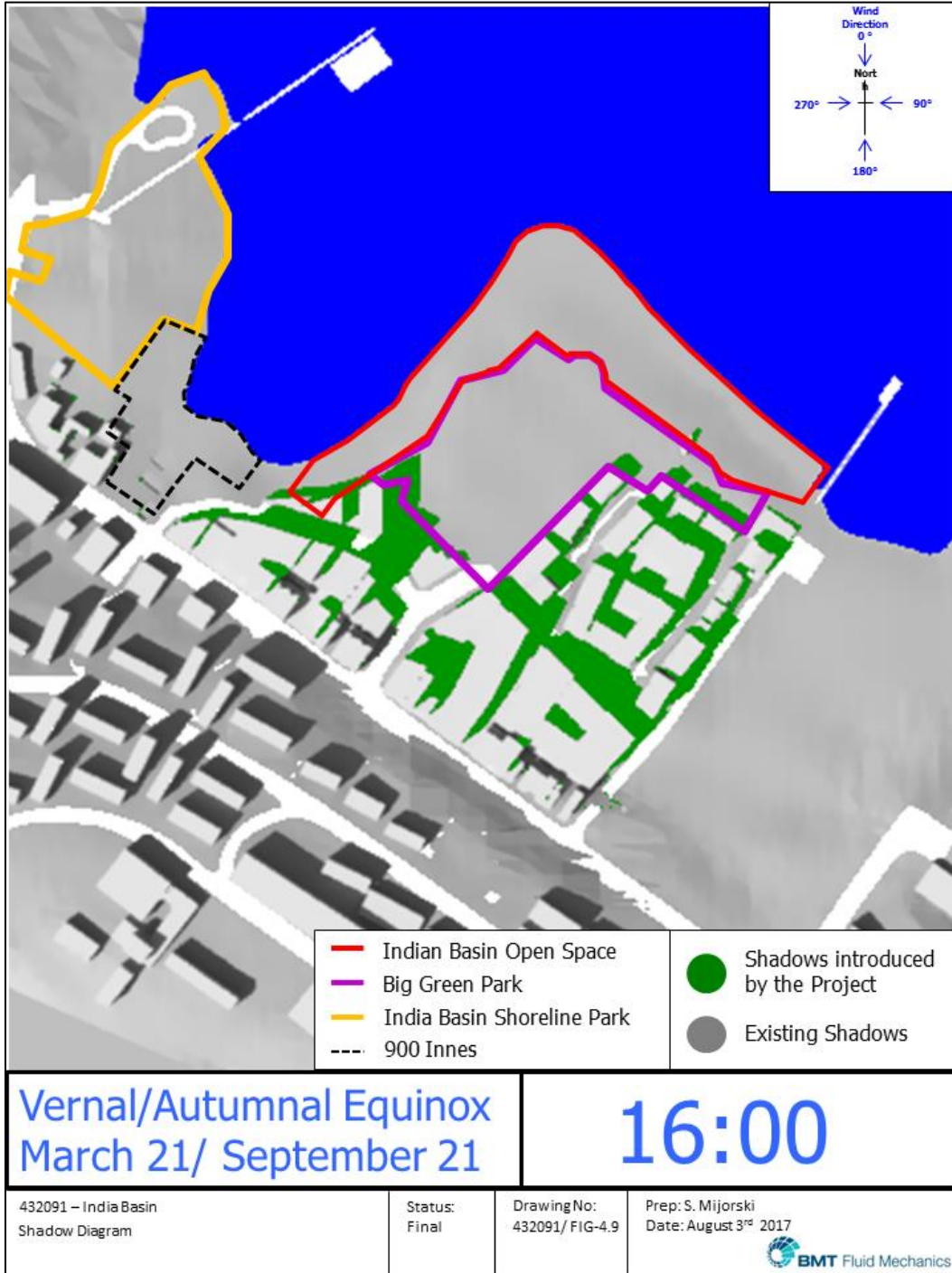


Figure 4.10: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 17:00

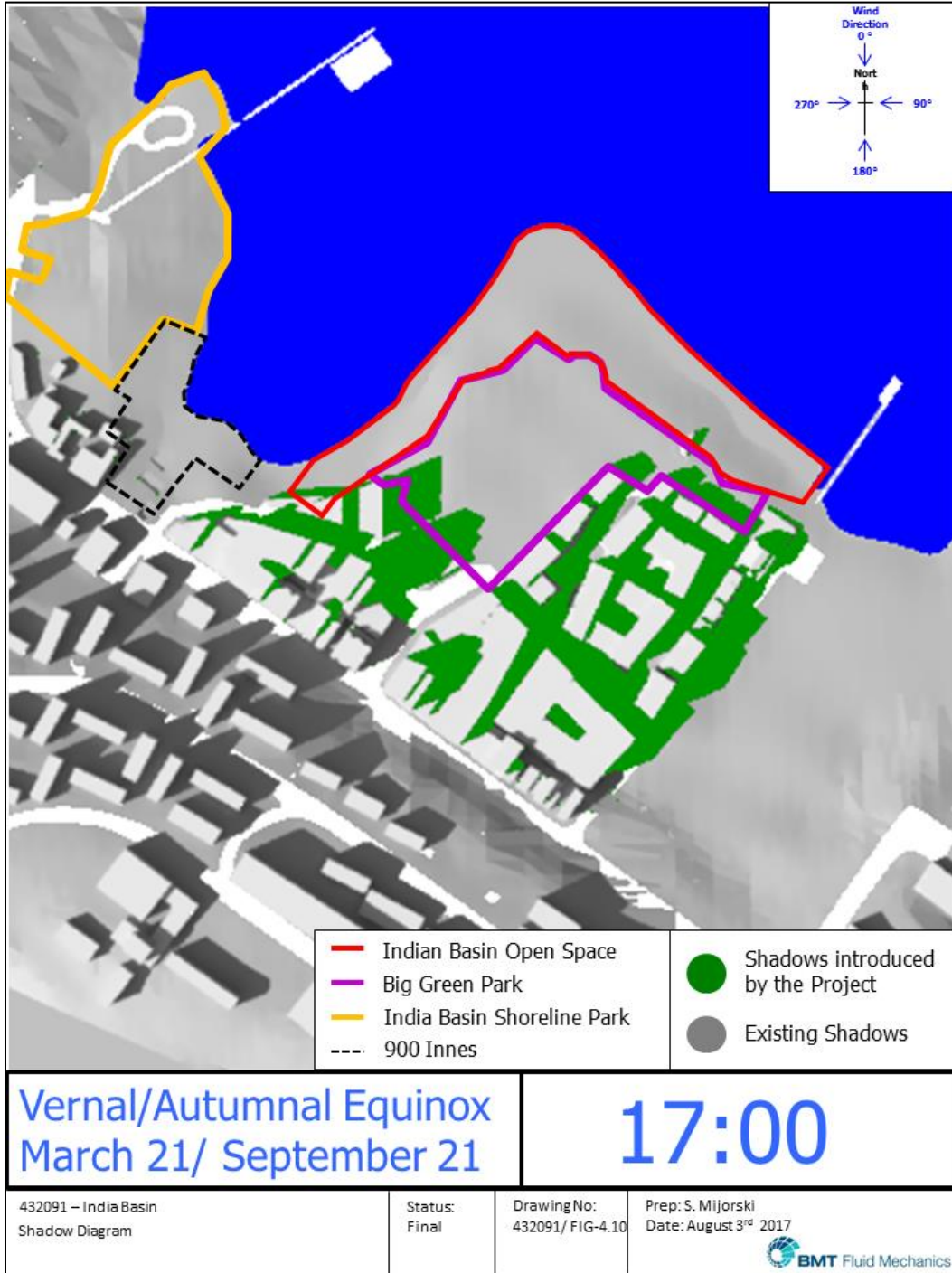


Figure 4.11: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 18:00

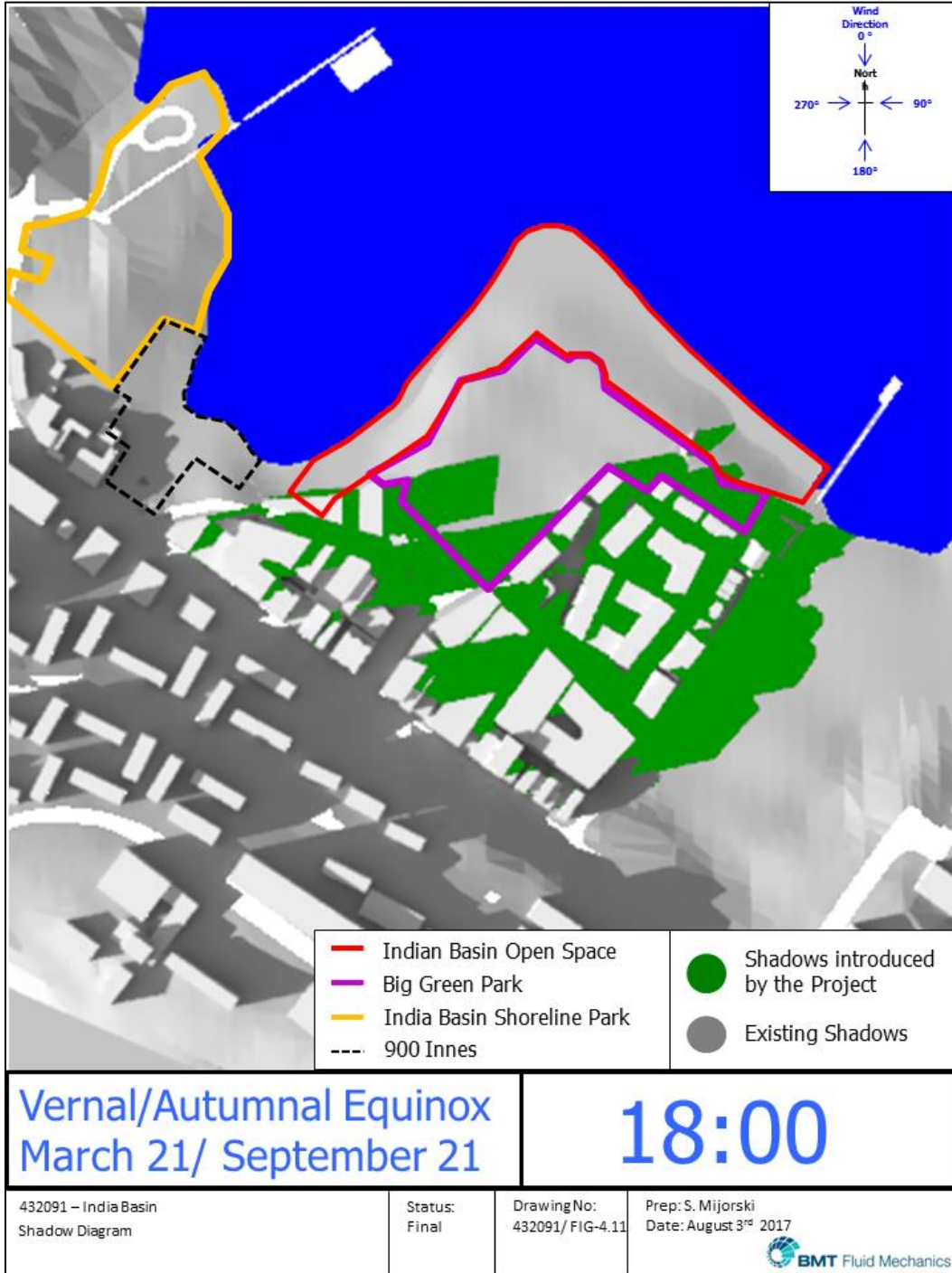


Figure 4.12: Shadow Diagrams, Vernal/Autumnal Equinox, March 21 / September 21, 18:22

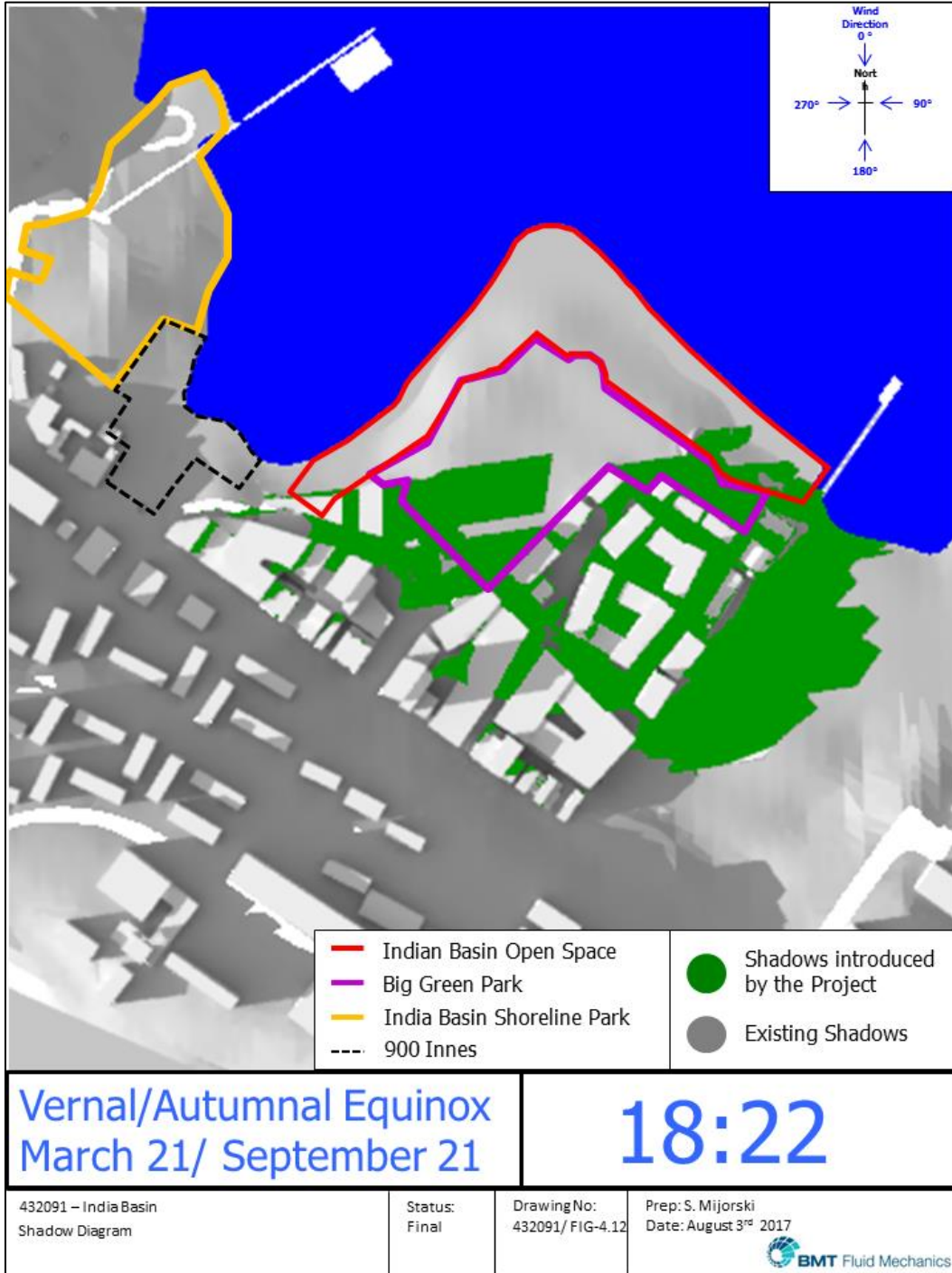


Figure 4.13: Shadow Diagrams, Summer Solstice, June 21, 06:48

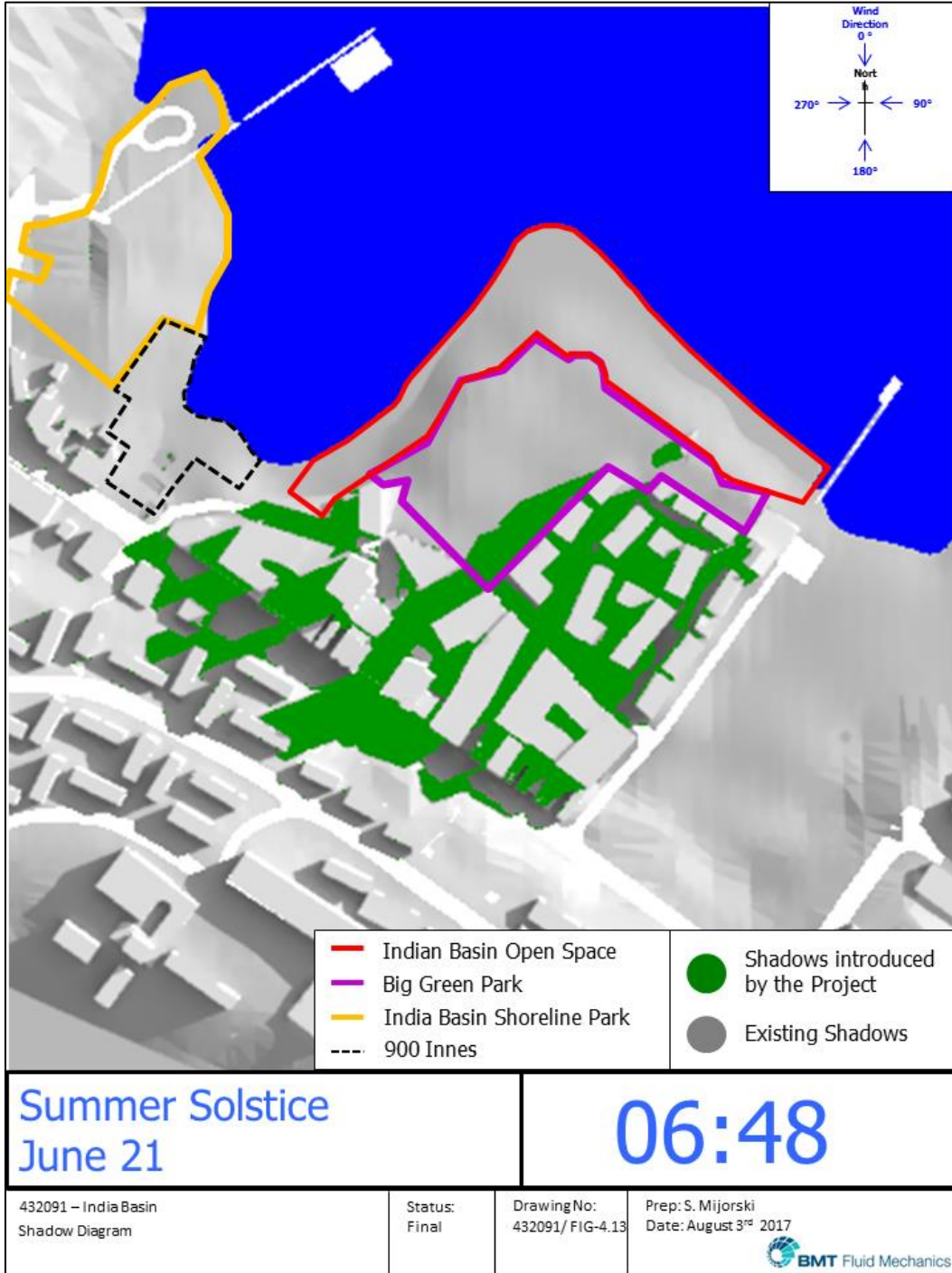


Figure 4.14: Shadow Diagrams, Summer Solstice, June 21, 07:00

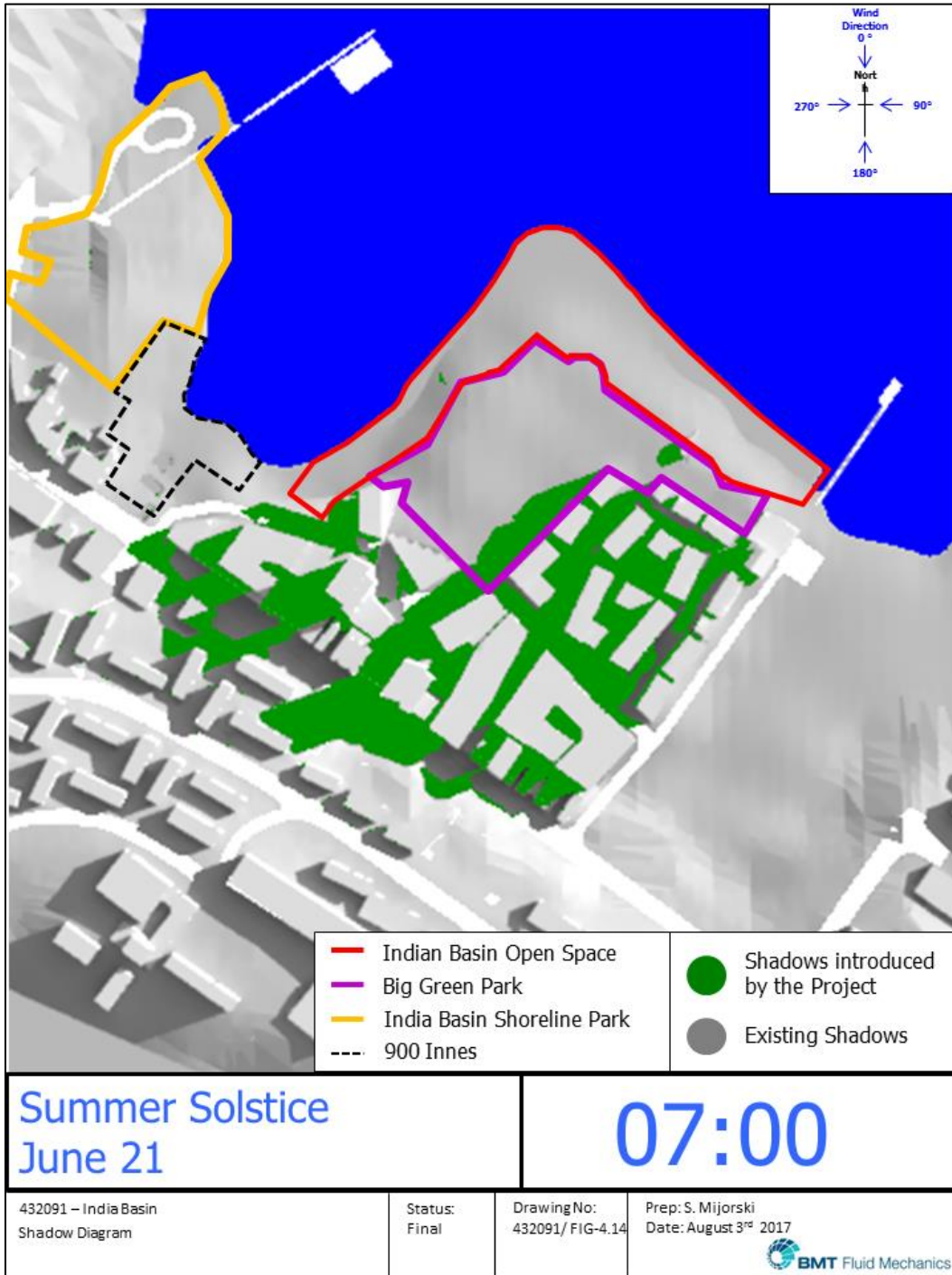


Figure 4.15: Shadow Diagrams, Summer Solstice, June 21, 08:00

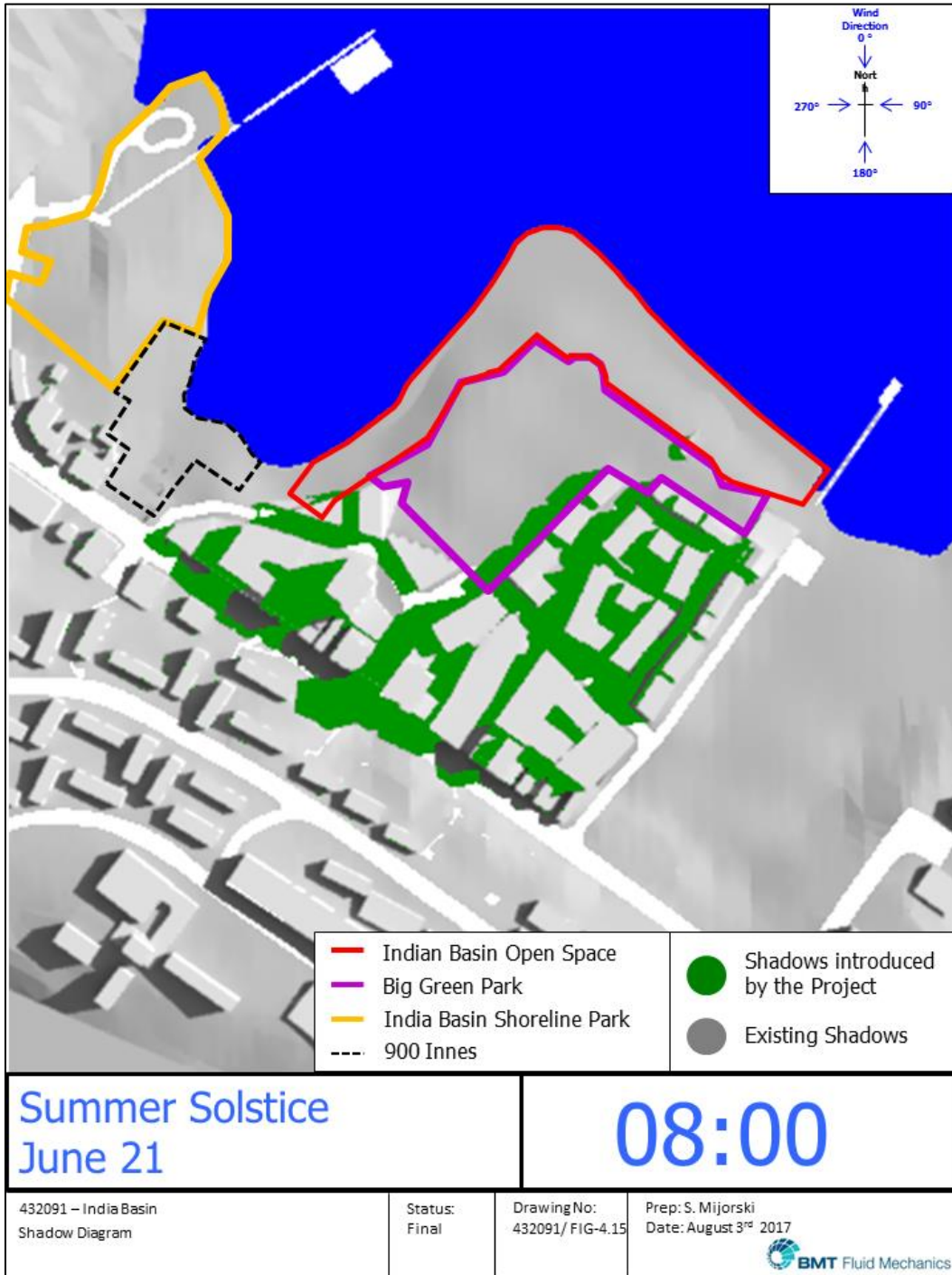


Figure 4.16: Shadow Diagrams, Summer Solstice, June 21, 09:00

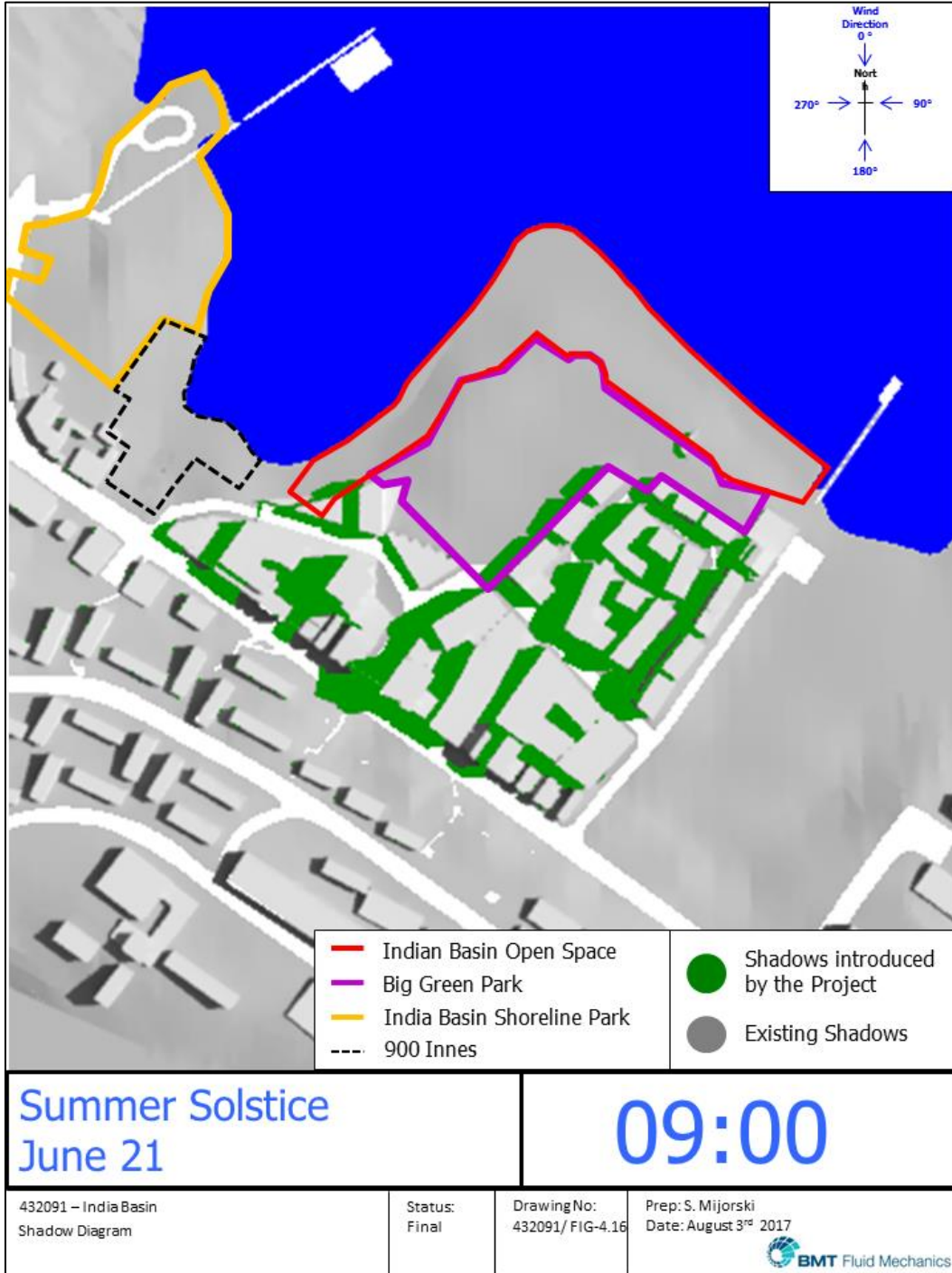


Figure 4.17: Shadow Diagrams, Summer Solstice, June 21, 10:00

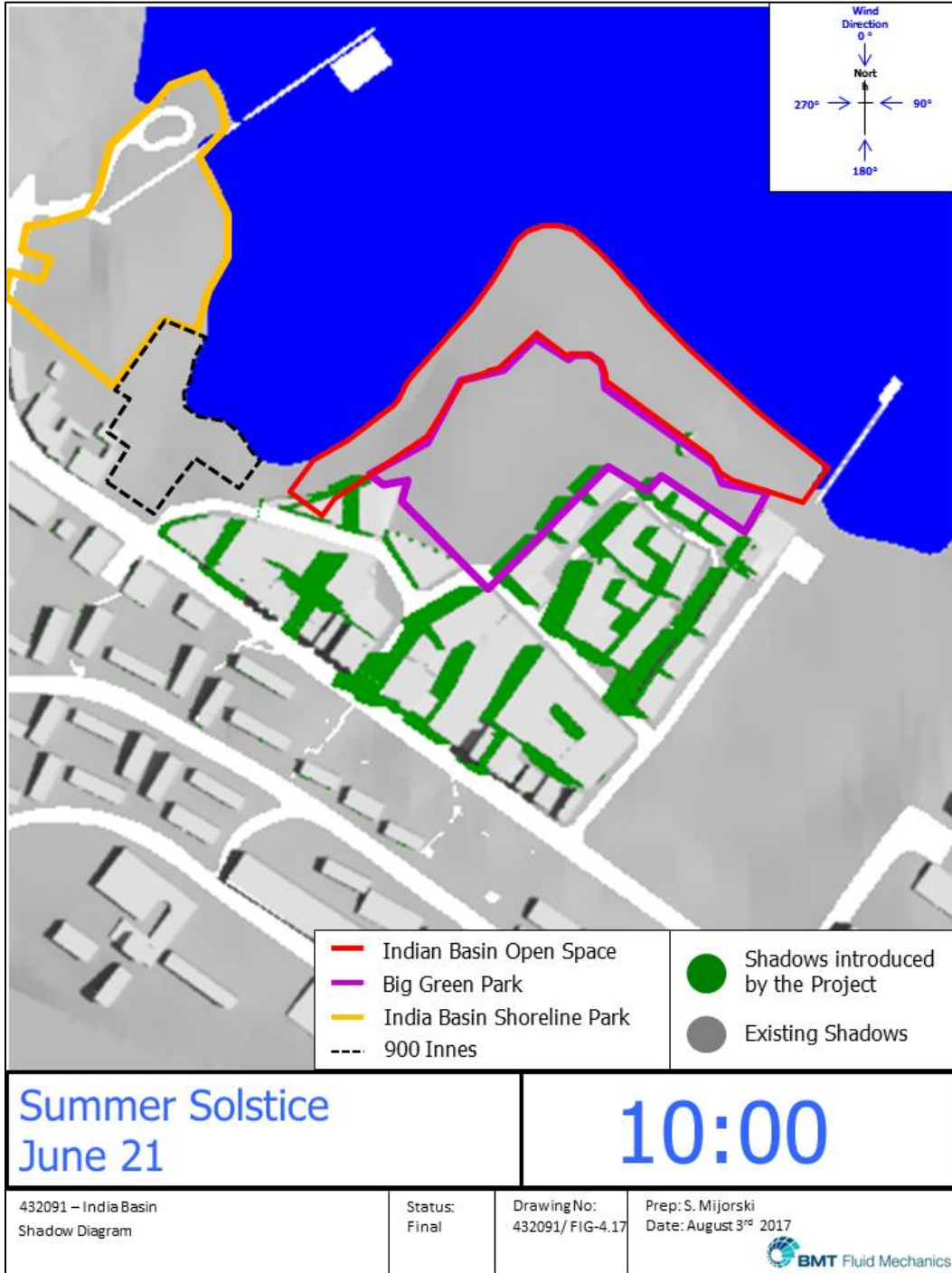


Figure 4.18: Shadow Diagrams, Summer Solstice, June 21, 11:00

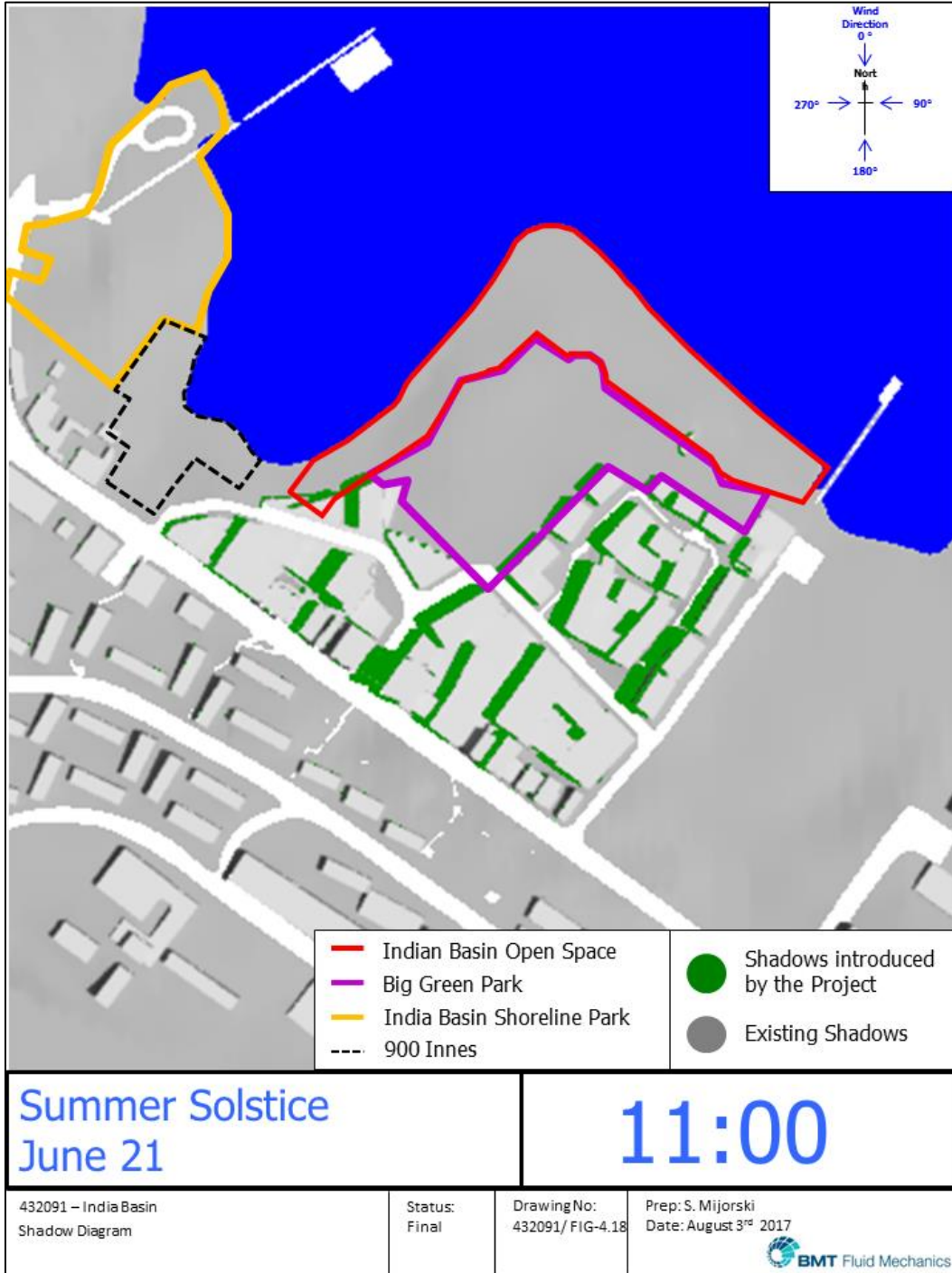


Figure 4.19: Shadow Diagrams, Summer Solstice, June 21, 12:00

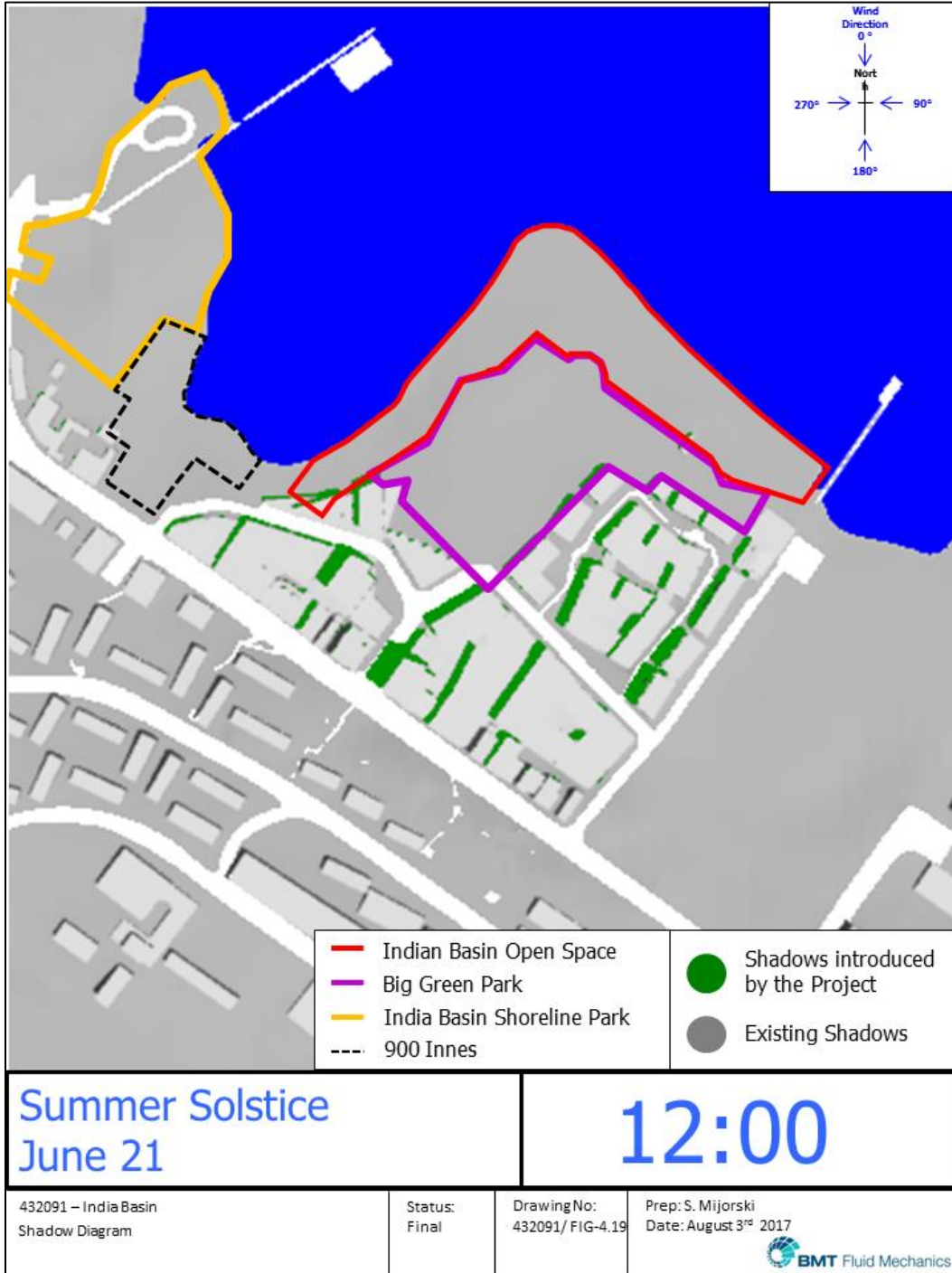


Figure 4.20: Shadow Diagrams, Summer Solstice, June 21, 13:00

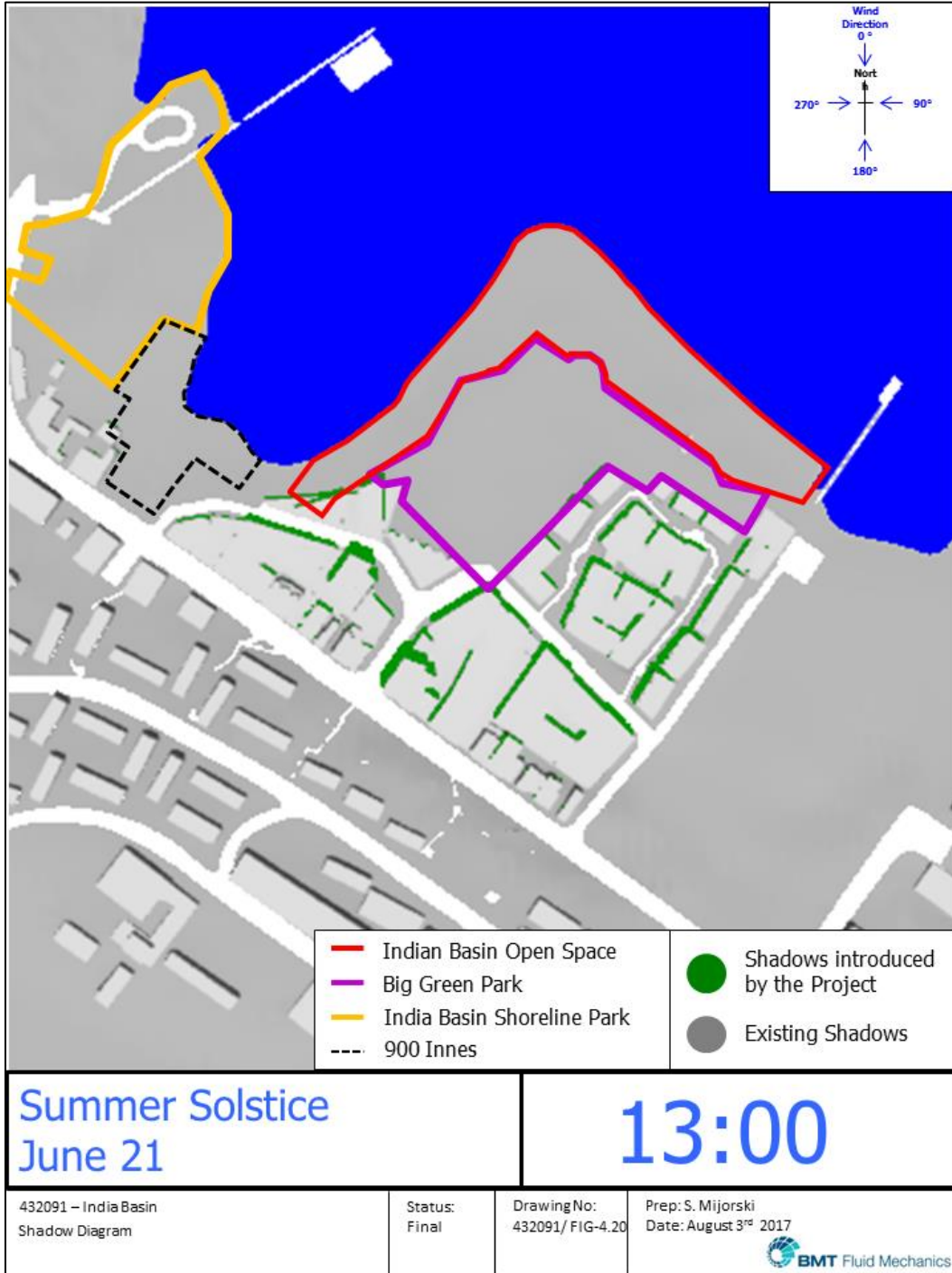


Figure 4.21: Shadow Diagrams, Summer Solstice, June 21, 14:00

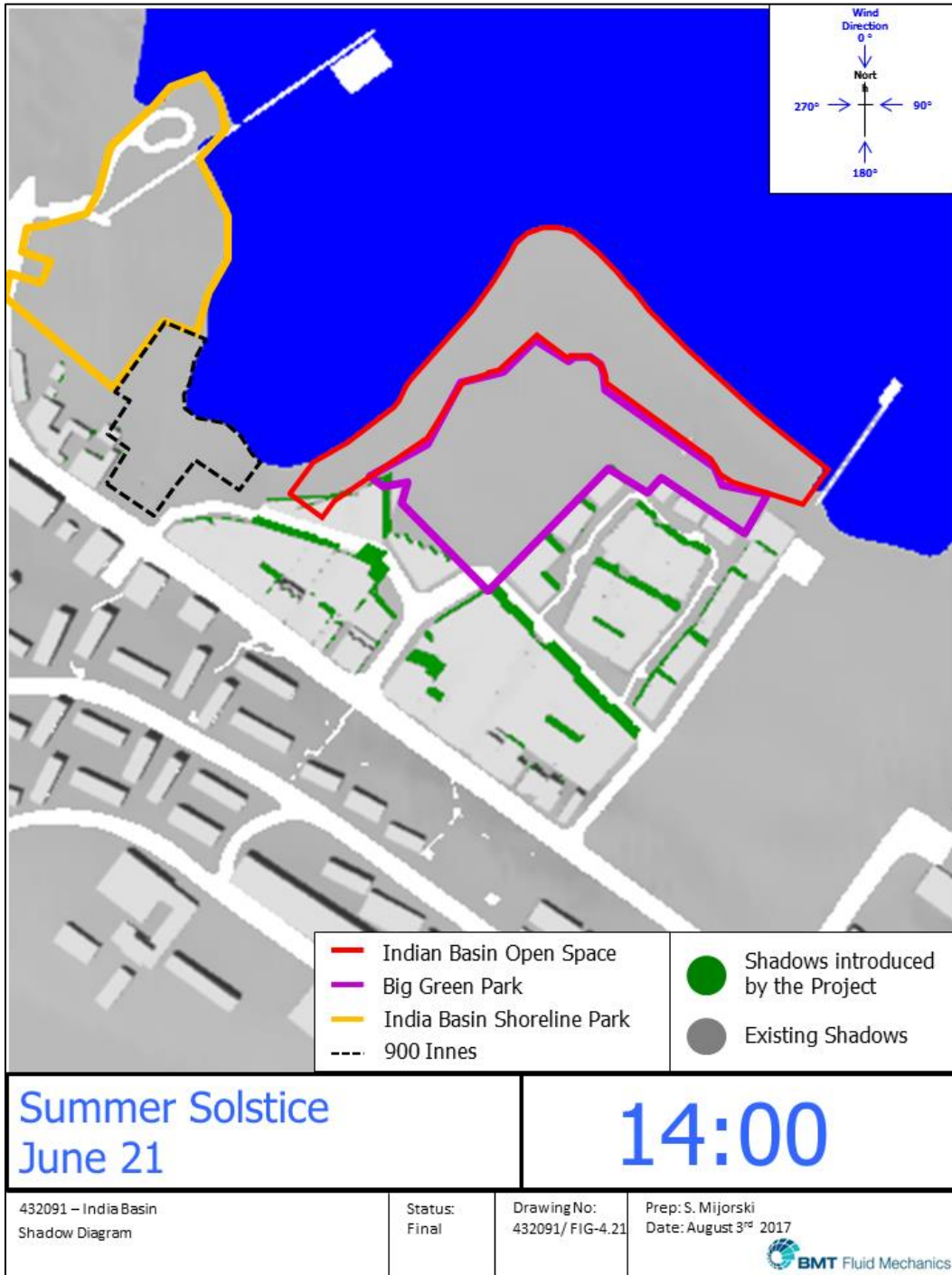


Figure 4.22: Shadow Diagrams, Summer Solstice, June 21, 15:00

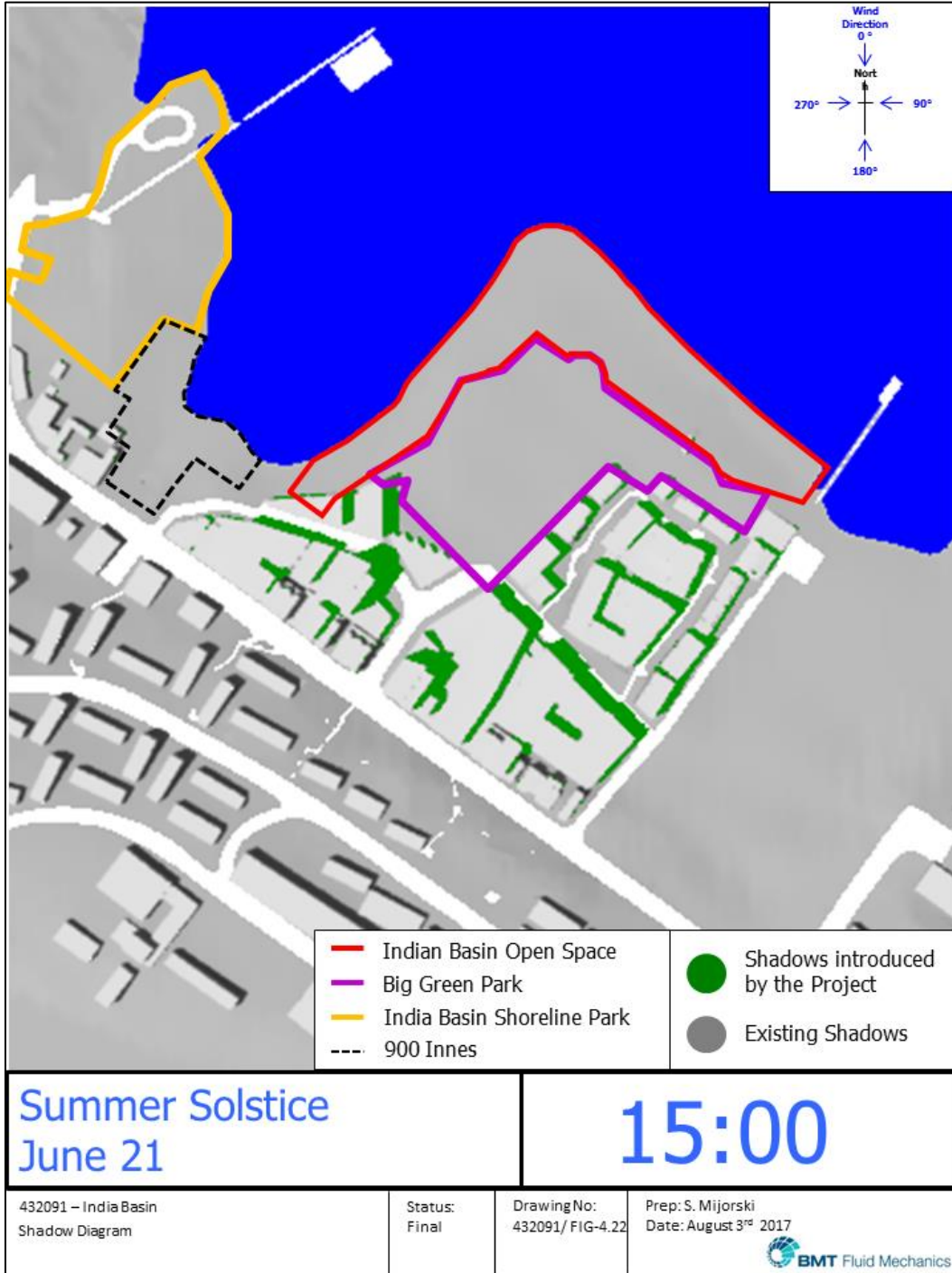


Figure 4.23: Shadow Diagrams, Summer Solstice, June 21, 16:00

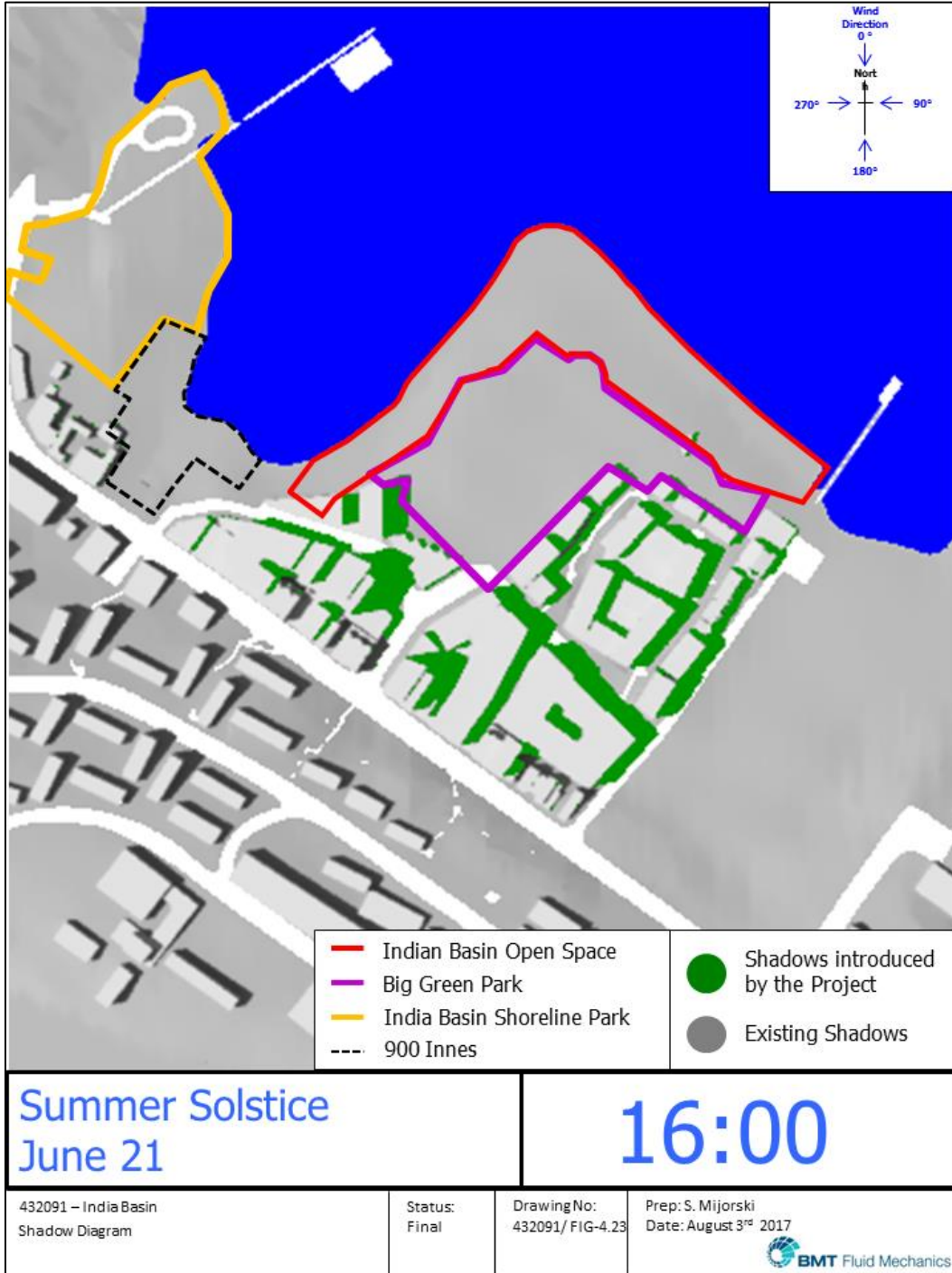


Figure 4.24: Shadow Diagrams, Summer Solstice, June 21, 17:00

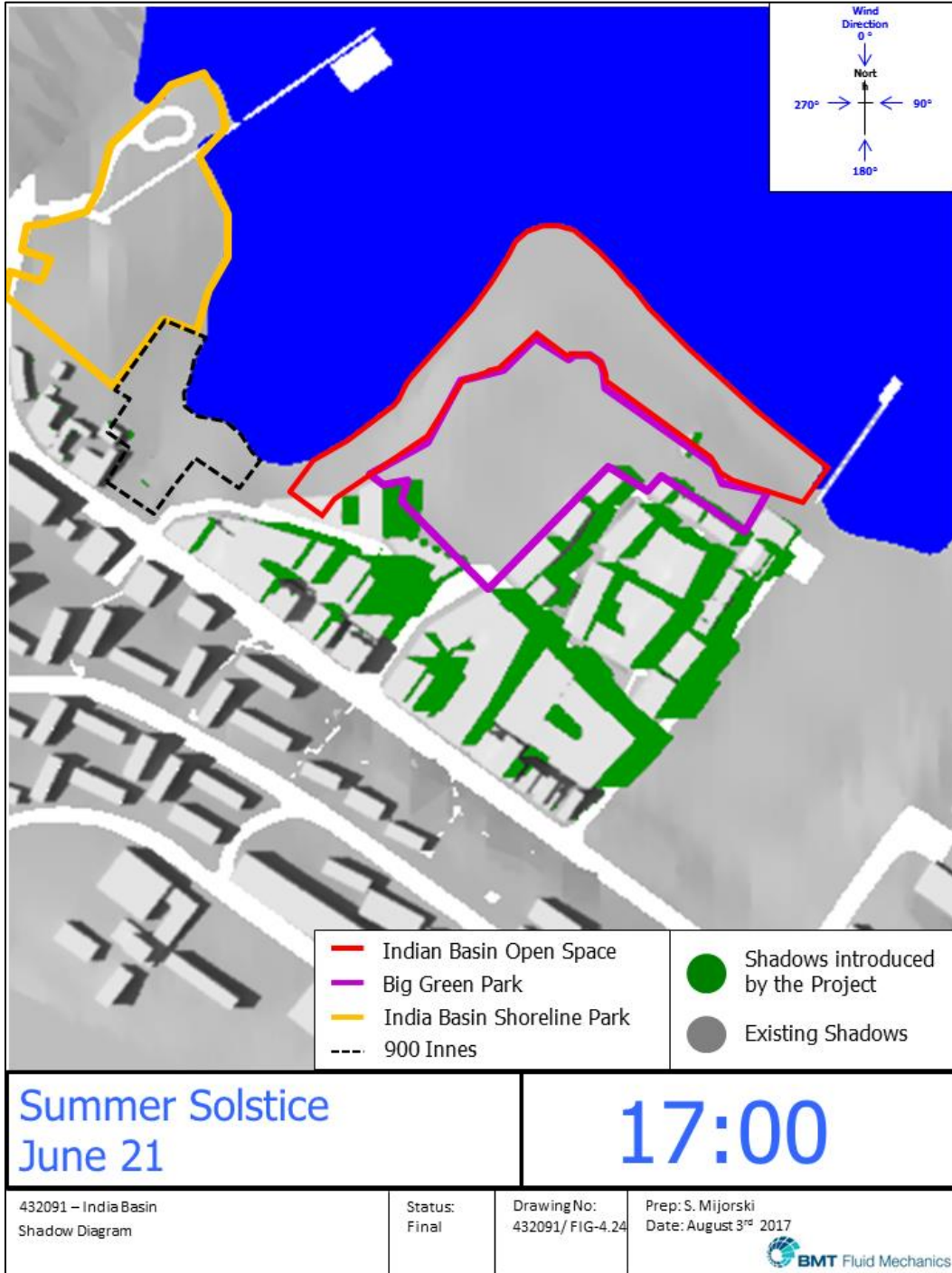


Figure 4.25: Shadow Diagrams, Summer Solstice, June 21, 18:00

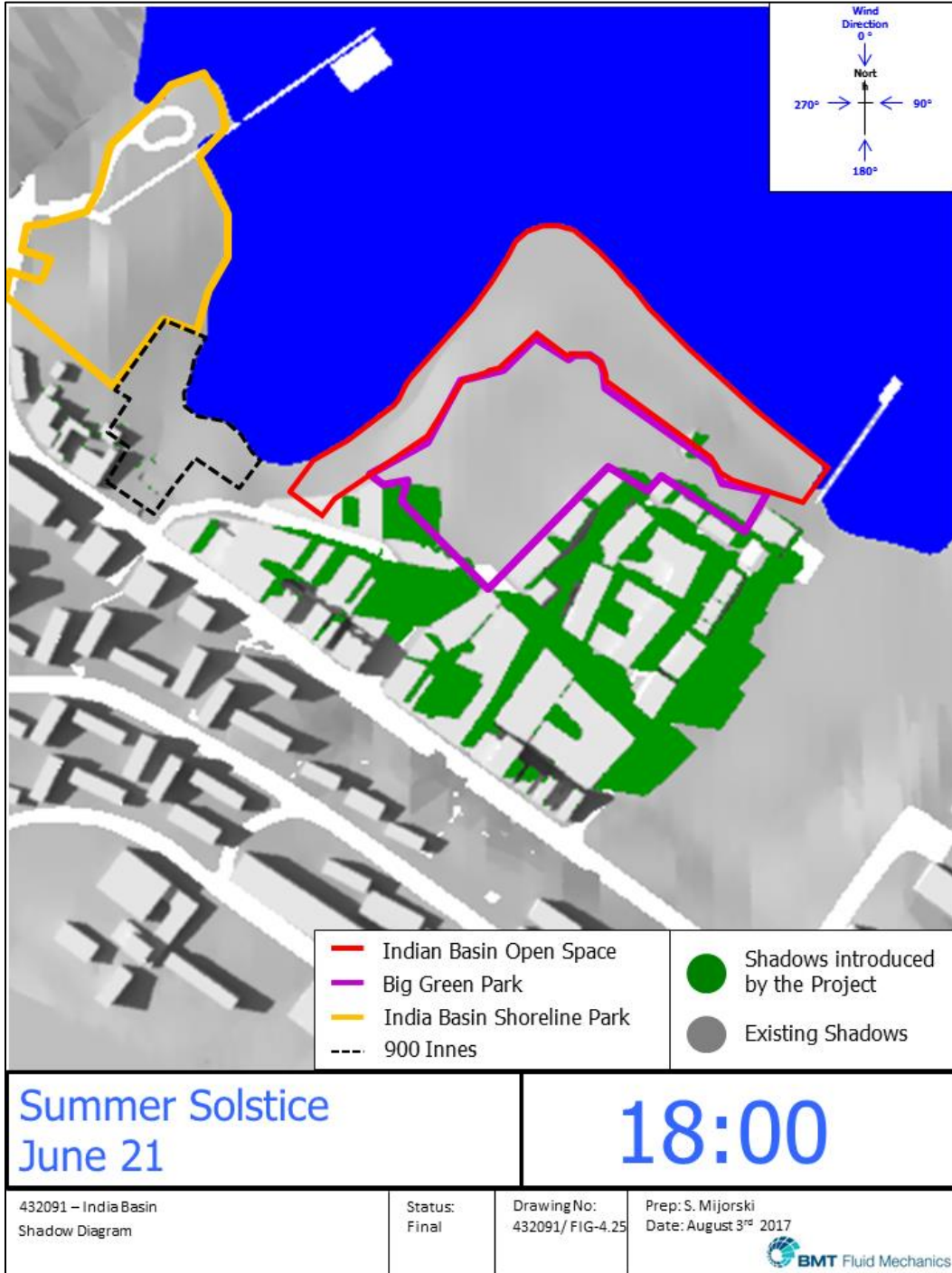


Figure 4.26: Shadow Diagrams, Summer Solstice, June 21, 19:00

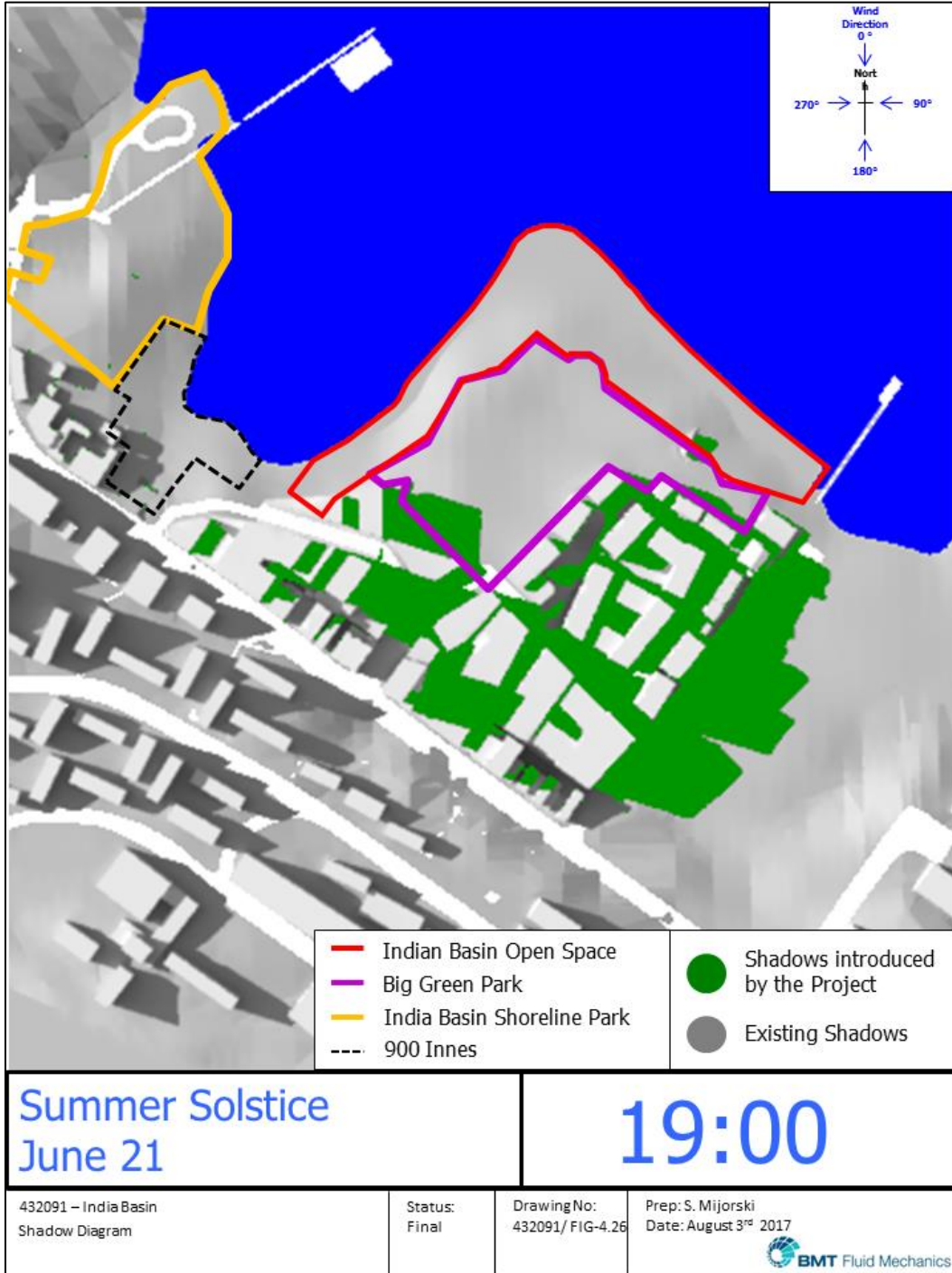


Figure 4.27: Shadow Diagrams, Summer Solstice, June 21, 19:34

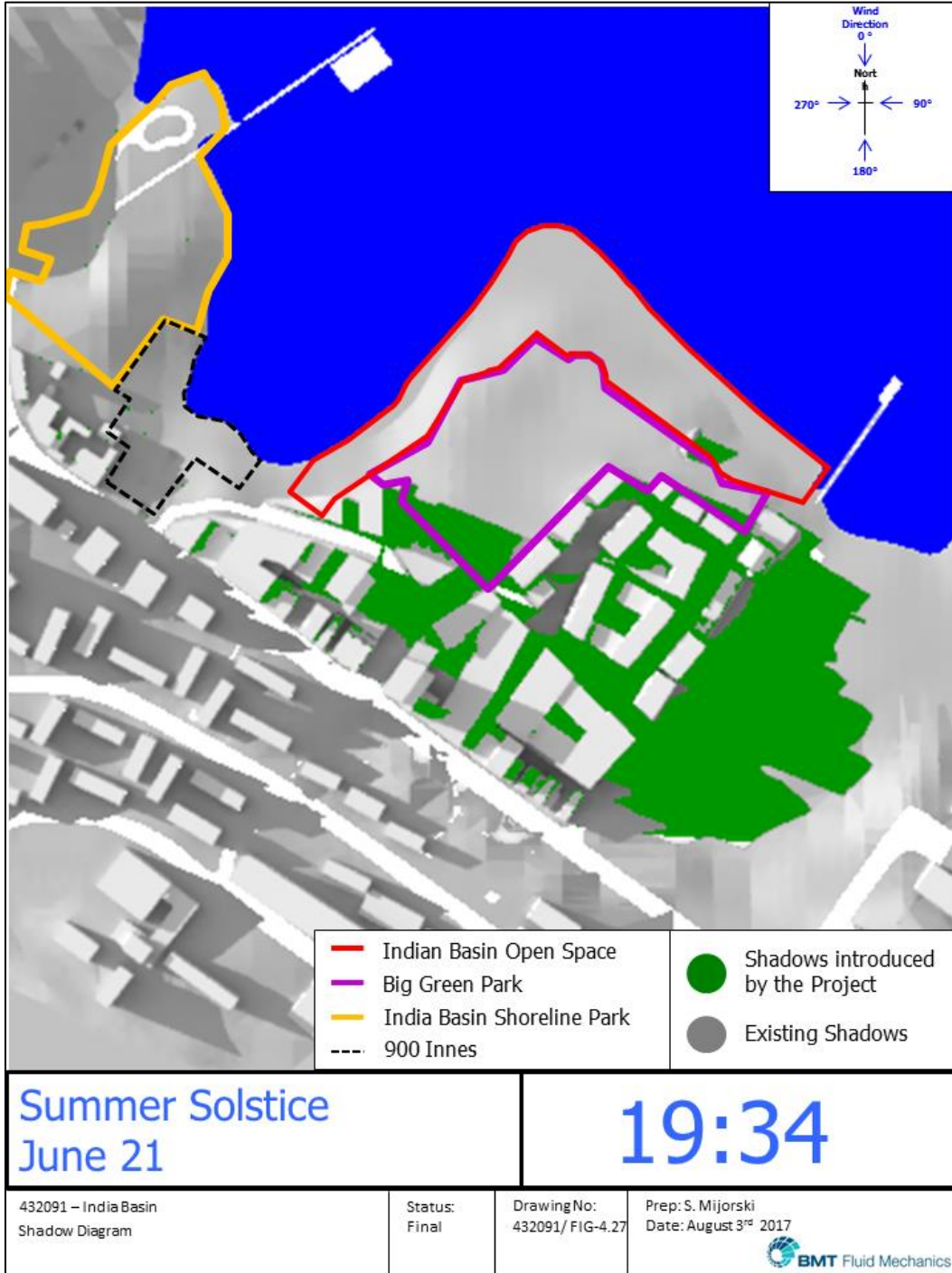


Figure 4.28: Shadow Diagrams, Winter Solstice, December 21, 08:21



Figure 4.29: Shadow Diagrams, Winter Solstice, December 21, 09:00



Figure 4.30: Shadow Diagrams, Winter Solstice, December 21, 10:00

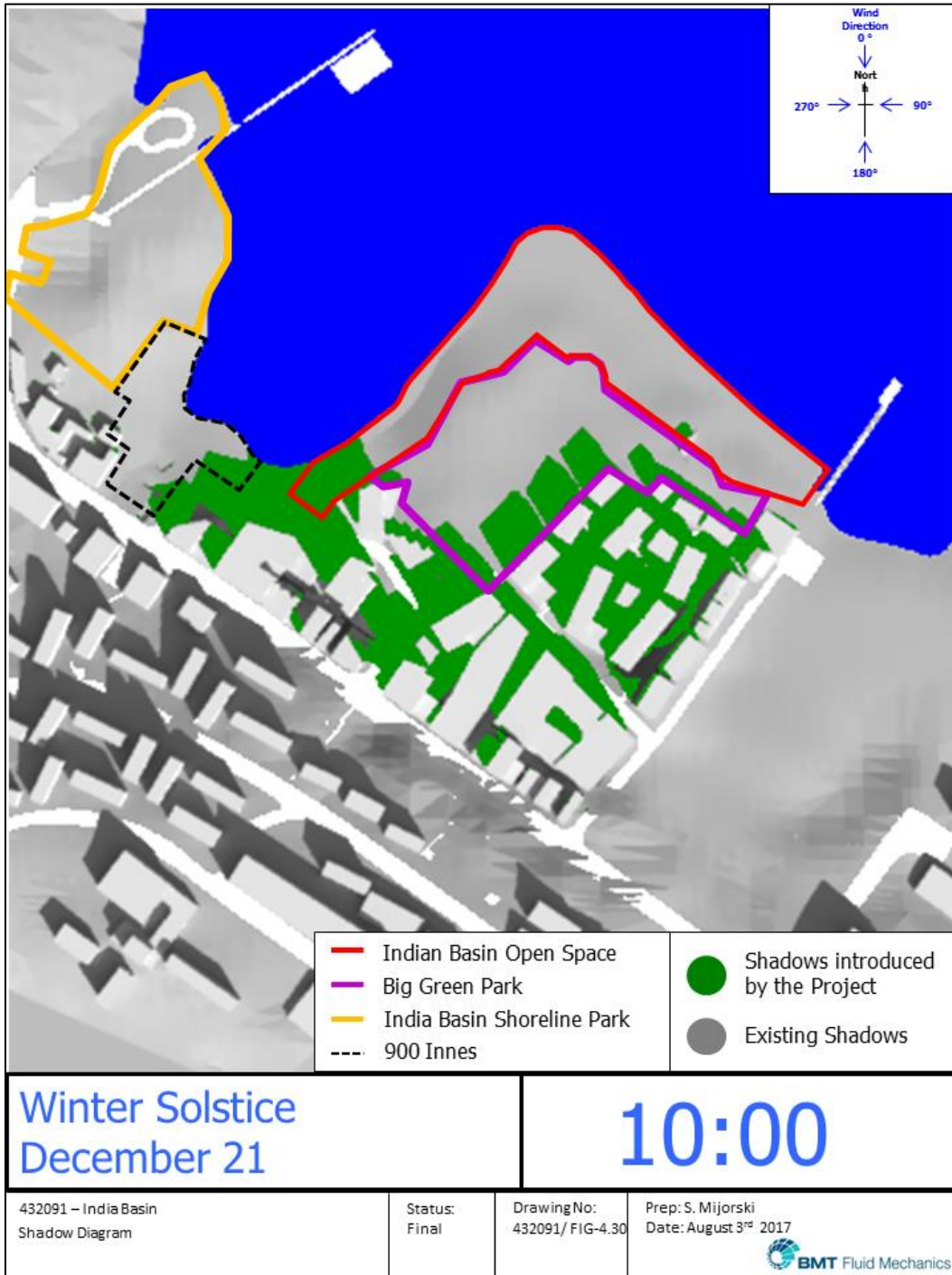


Figure 4.31: Shadow Diagrams, Winter Solstice, December 21, 11:00



Figure 4.32: Shadow Diagrams, Winter Solstice, December 21, 12:00

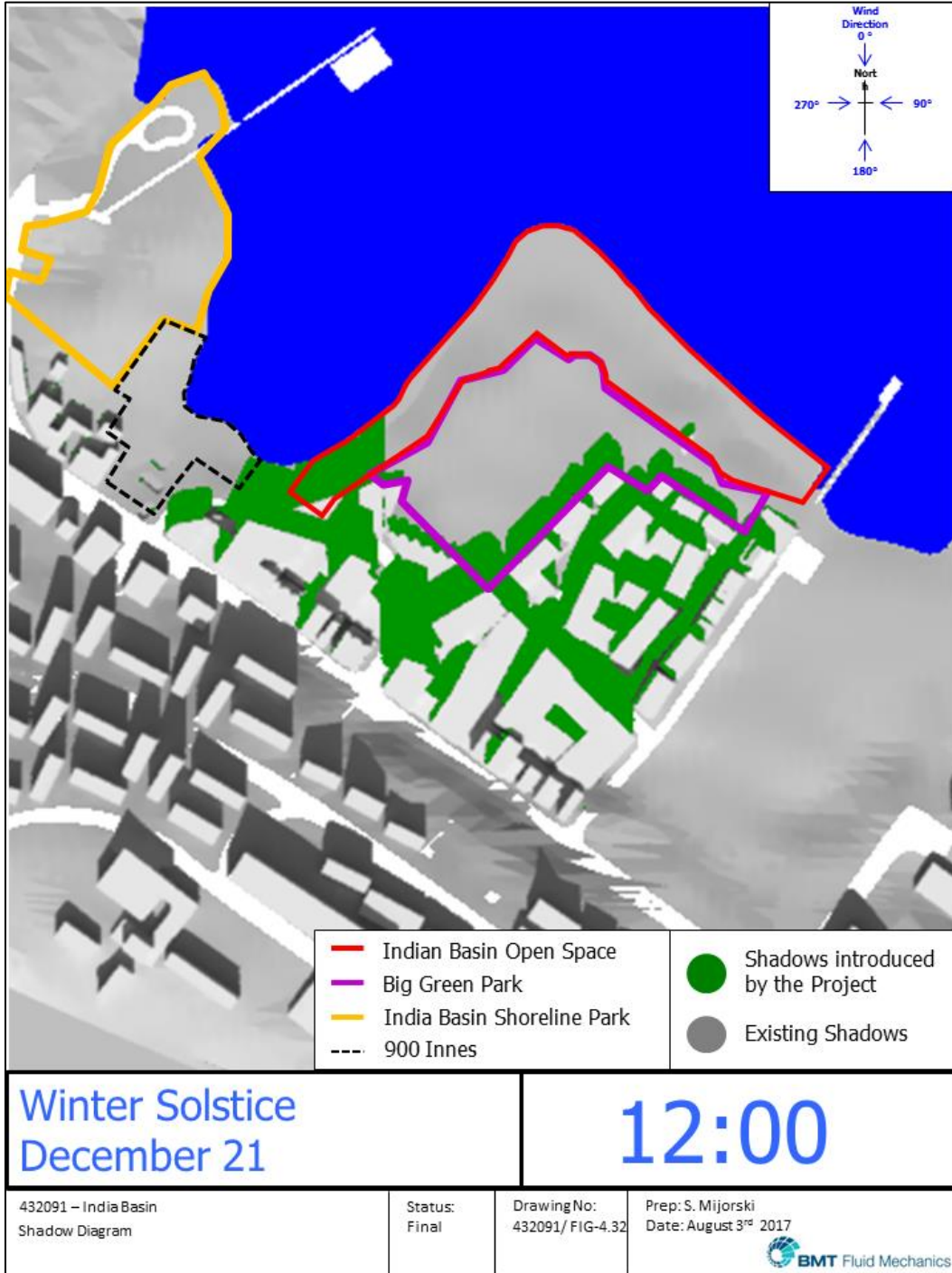


Figure 4.33: Shadow Diagrams, Winter Solstice, December 21, 13:00

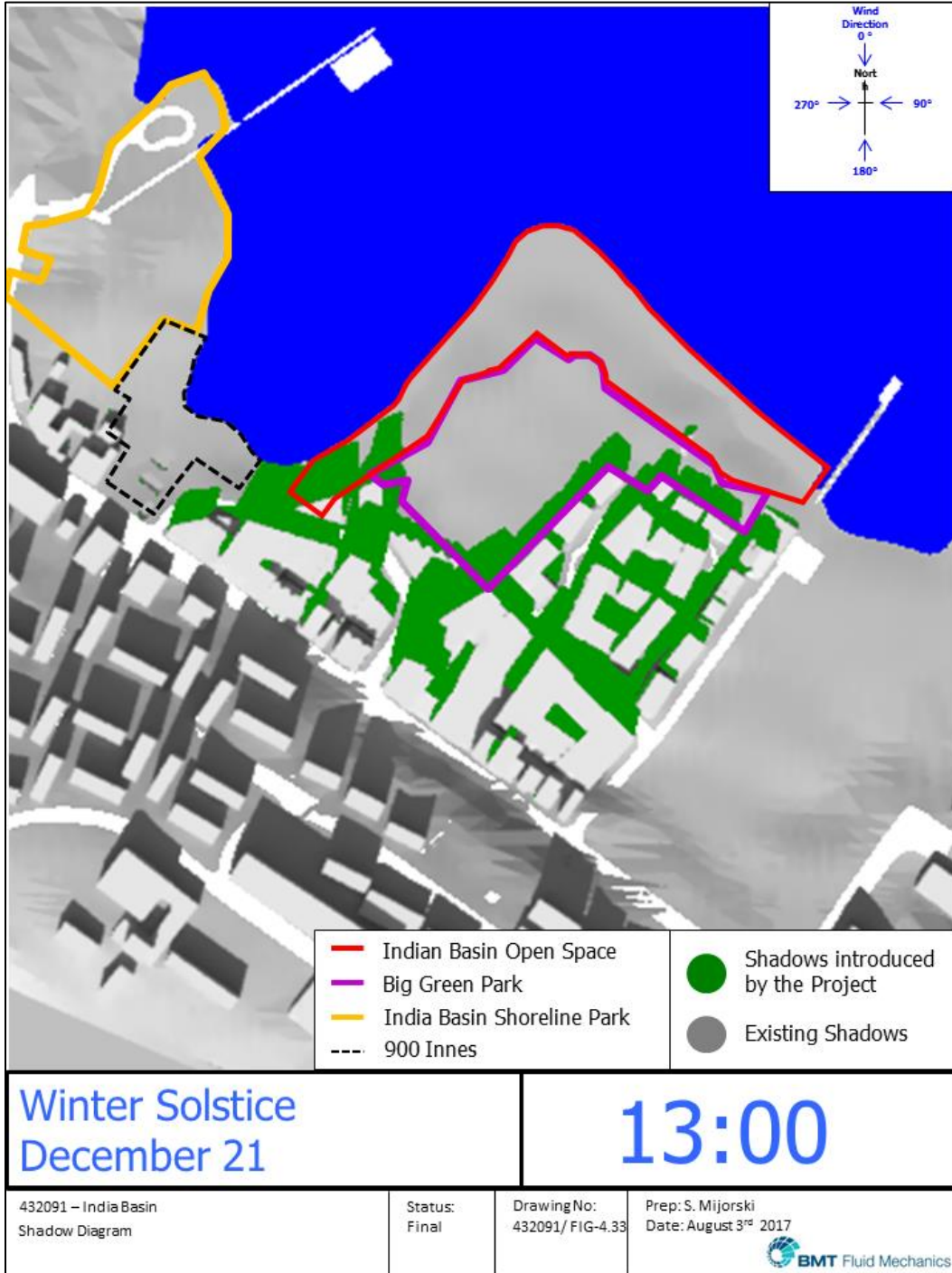


Figure 4.34: Shadow Diagrams, Winter Solstice, December 21, 14:00



Figure 4.35: Shadow Diagrams, Winter Solstice, December 21, 15:00



Figure 4.36: Shadow Diagrams, Winter Solstice, December 21, 15:54



Figure 4.37: Shadow Diagrams, Maximum Overall Shading, December 27, 08:23

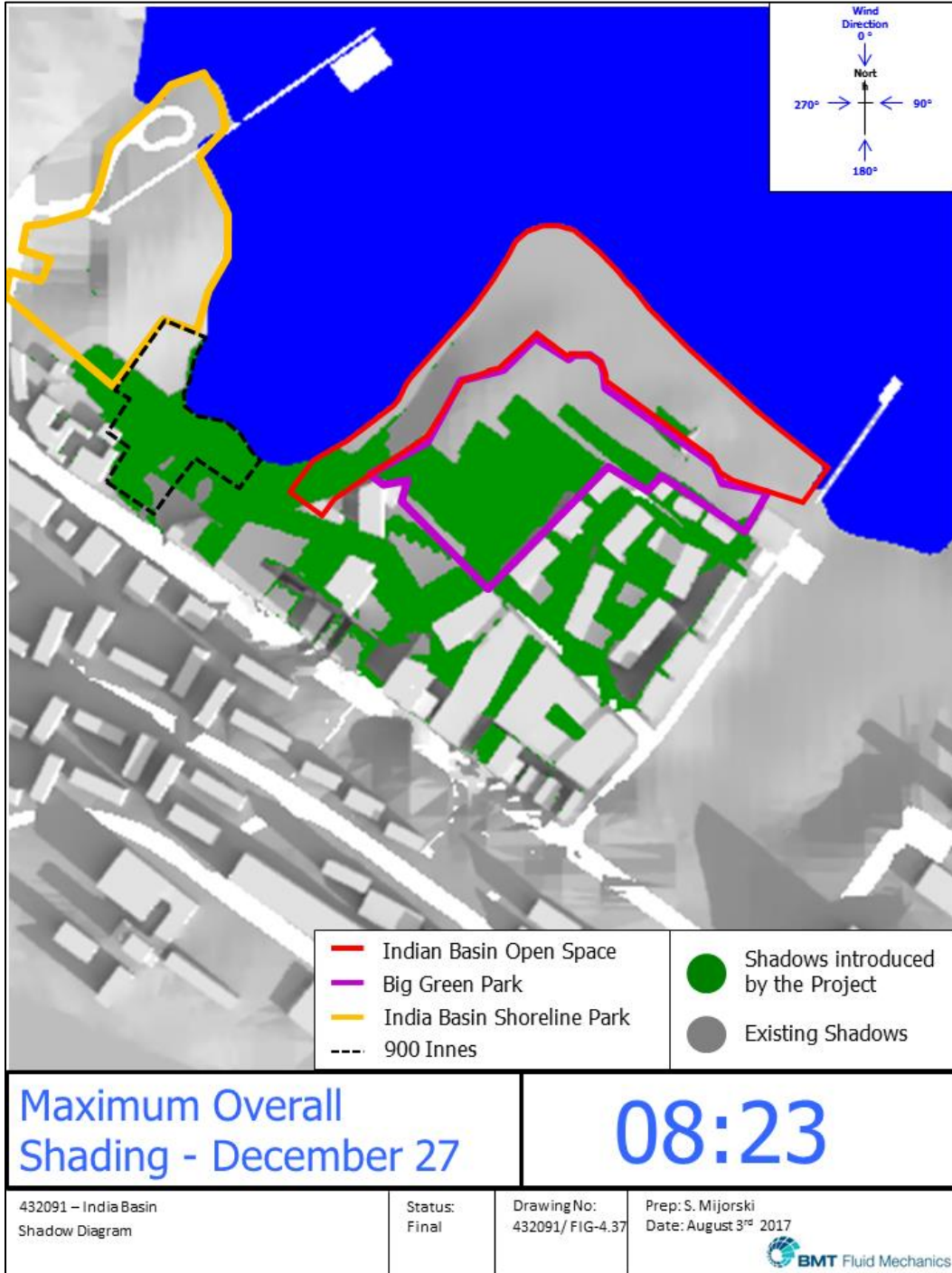


Figure 4.38: Shadow Diagrams, Maximum Overall Shading, December 27, 09:00

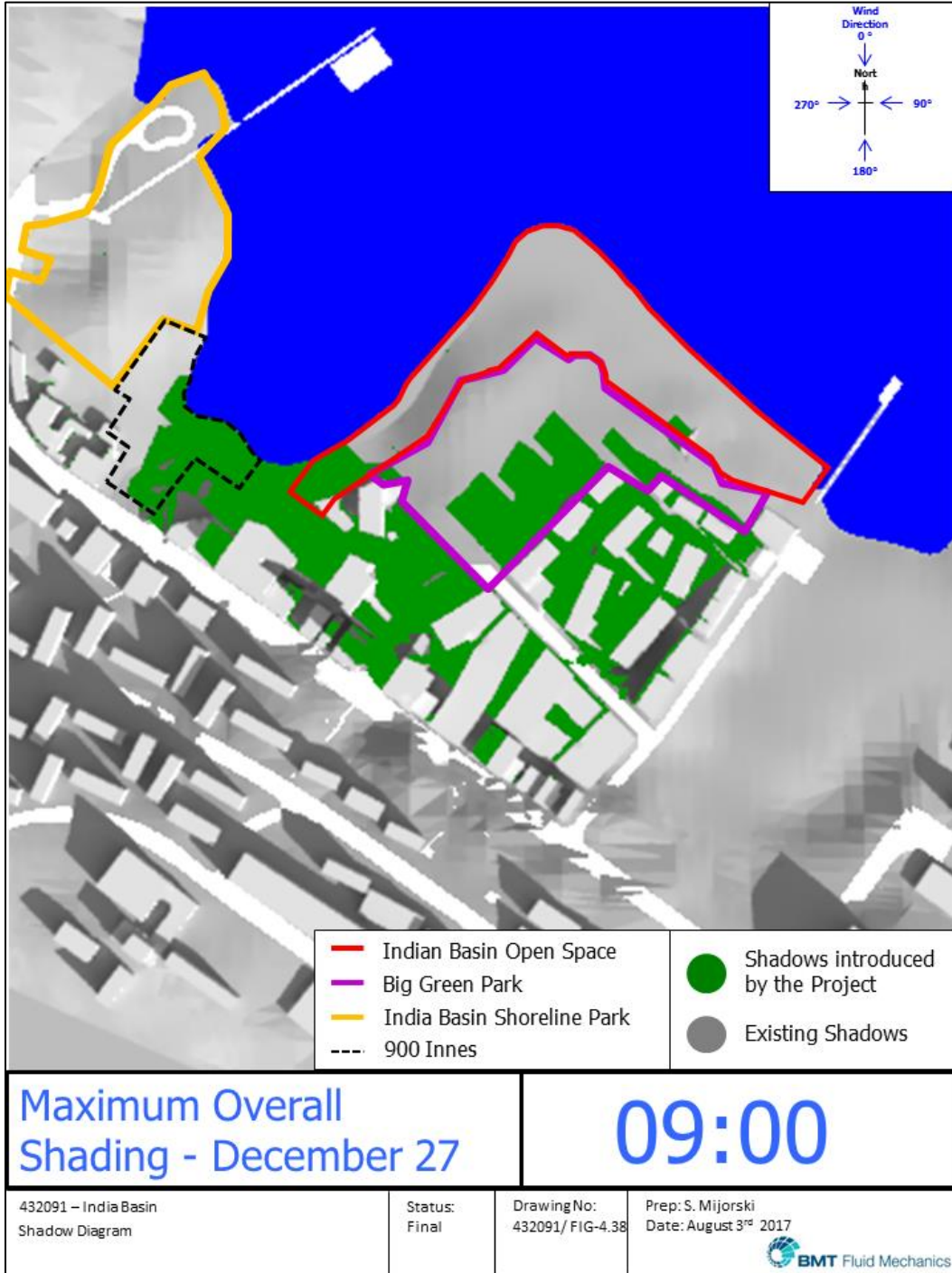


Figure 4.39: Shadow Diagrams, Maximum Overall Shading, December 27, 10:00



Figure 4.40: Shadow Diagrams, Maximum Overall Shading, December 27, 11:00



Figure 4.41: Shadow Diagrams, Maximum Overall Shading, December 27, 12:00



Figure 4.42: Shadow Diagrams, Maximum Overall Shading, December 27, 13:00



Figure 4.43: Shadow Diagrams, Maximum Overall Shading, December 27, 14:00



Figure 4.44: Shadow Diagrams, Moment of Maximum Shading, December 27, 15:00



Figure 4.45: Shadow Diagrams, Moment of Maximum Shading, December 27, 15:58

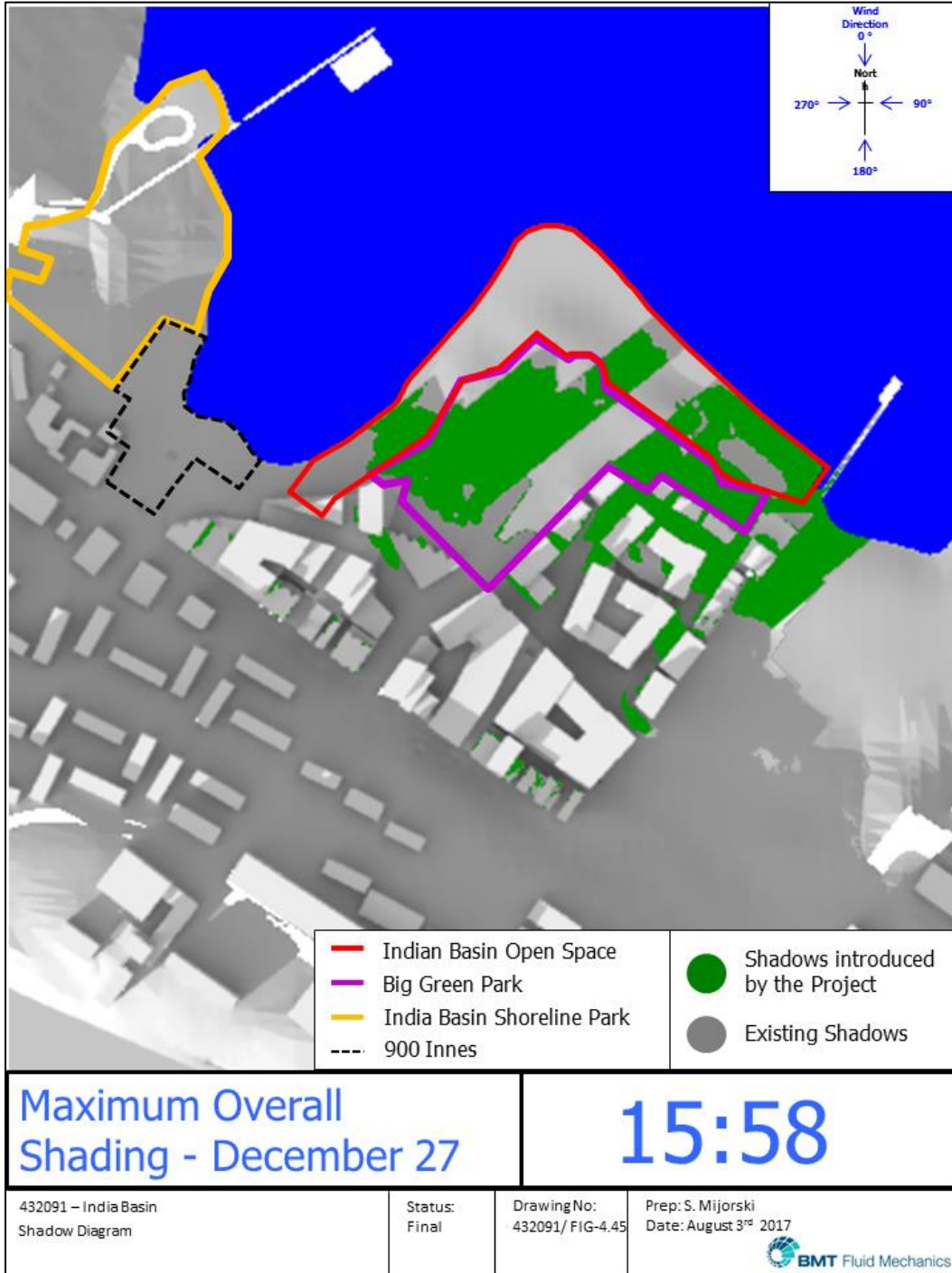


Figure 4.46: Shadow Diagrams, Moment of Maximum Shading, February 2, 16:33

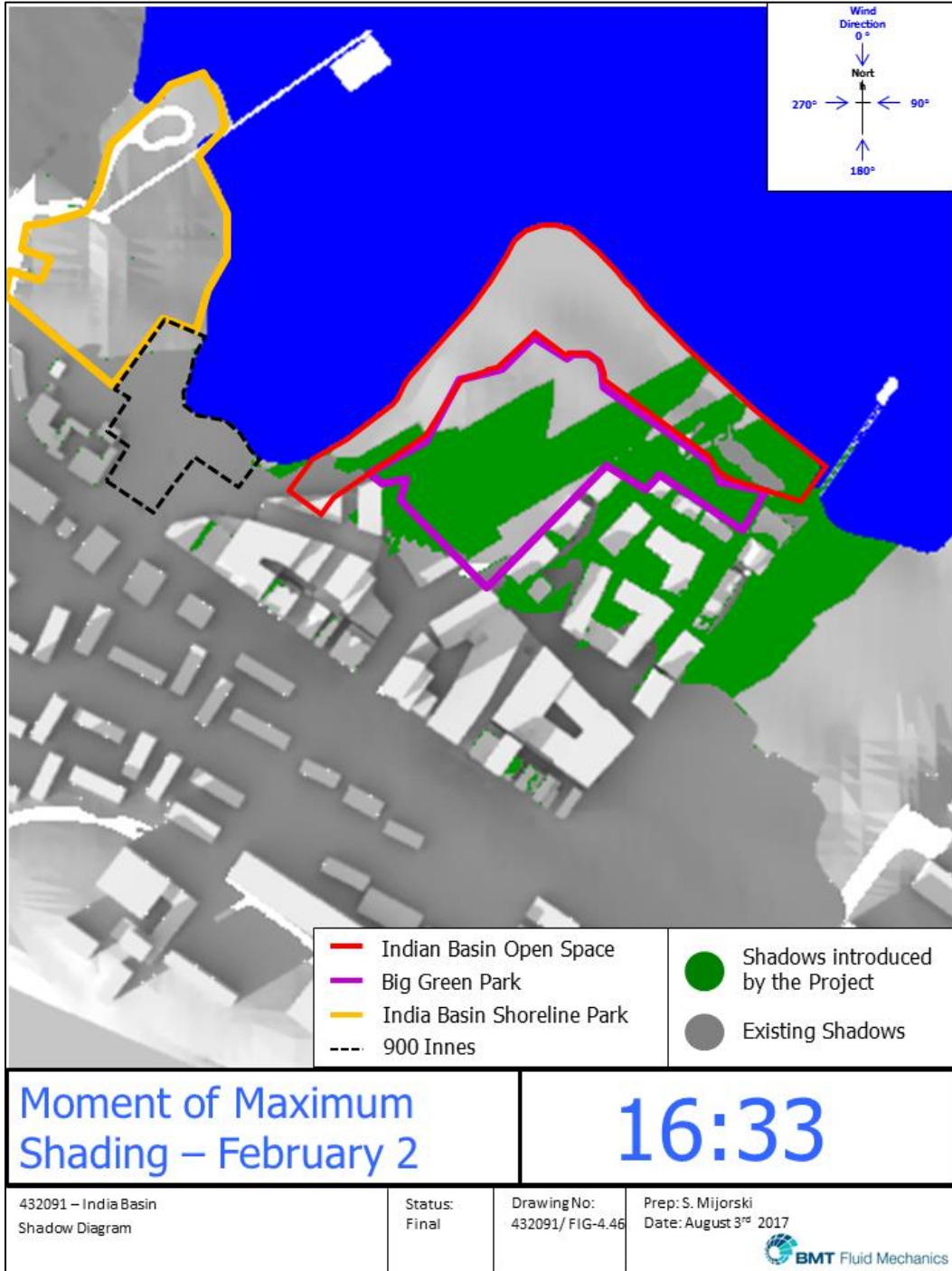


Figure 4.47: Shadow Diagrams, Moment of Maximum Shading, January 1, 16:00



Case No. 2014-002541ENV

July 25th, 2017

India Basin Development – Sunlight Ordinance Studies

As an addendum to BMT's Shadow Analysis Report dated March 13th, 2017 for the proposed India Basin development (the Project), BMT have prepared a qualitative appraisal of a Revised Heights Scheme to evaluate the potential for any material changes to the conclusions contained in BMT's original Shadow Analysis Report.

BMT evaluated the Revised Heights Scheme based on our extensive professional experience preparing shadow analyses for similarly massed schemes in the San Francisco urban environment, including previous quantitative analyses on the India Basin development already studied in the original Shadow Analysis Study.

The Project Sponsor, BUILD, provided BMT with a plan view figure dated July 13th, 2017, that identified all proposed revisions to the heights previously studied in BMT's Shadow Analysis Report dated March 13th, 2017. BUILD confirmed that the changes in the Revised Heights Scheme only affected building heights and not parcel size, building floorplates, and/or allowable bulk.

The Revised Heights Scheme increases allowable heights on some parcels and decreases allowable heights on others. When looking at all parcels, the proposed changes result in a cumulative net reduction of 60 feet in maximum building heights compared to the maximum building heights studied in the original Project, and a cumulative net reduction of 55 feet in maximum building heights compared to the maximum building heights studied in the original Project Variant.

The original Project and Project Variant allowed heights up to 150-155 feet on the two 'tower' parcels. The Revised Heights Scheme increases the maximum allowable height on the two tower parcels to 160 feet, a net increase of 5 feet. As these changes would increase allowable heights on the tallest buildings within the Project site, we would expect there to be a marginal increase in the shadow cast on the Big Green and India Basin Open Space in the morning and afternoon evening for all seasons (Vernal Equinox, Autumnal Equinox, Summer Solstice, and Winter Solstice) compared to the Project and Project Variant.

Additionally the Revised Heights Scheme reduces maximum allowable heights between -5 feet and -15 feet on 7 of the 17 parcels immediately adjacent to the Big Green and India Open Space. Because of their adjacency, these changes in allowable heights would result in a reduction in future shadow on the Big Green and India Open Space, and consequently would represent an improvement over the shadow results previously identified in the March 13th, 2017 Shadow Analysis Report.

Other changes to the maximum allowable heights in the Revised Heights Scheme range between -20 feet and +20 feet and occur on parcels located within the middle of the proposed development area or to the

north of the edge of the future Northside Park. Therefore any resulting minor reductions and/or increases in shadow would fall on adjacent building sites and/or streetscape areas and not directly affect the Big Green or India Basin Open Space.

Based on the completed qualitative assessment, the reductions in shadow caused by decreases in allowable heights on parcels adjacent to the Big Green and India Basin Open Space are expected to offset the marginal increase in shadow caused by the increase in allowable heights on the two tower parcels. Accordingly, our conclusion is that these changes would not affect the overall conclusions contained in BMT's Shadow Analysis Report dated March 13th, 2017.

Best Regards,



Dr. Sergey Mijorski
Project Manager
BMT Fluid Mechanics Ltd



Mr. Johnathan Green
Line Manager, Numerical Modelling
BMT Fluid Mechanics Ltd

July 17th, 2017
Case No. 2014-002541ENV
Correspondence Reference: 432091/RC/040

India Basin Development – Sunlight Ordinance Studies

As an addendum to BMT's Shadow Analysis Report (432091rep1v4) dated March 13th, 2017 for the India Basin Development, a qualitative appraisal of three additional Project Alternatives has been undertaken to evaluate the potential for changes to the sunlight ordinance. The following project alternatives are considered:

- No Project Alternative
- Code Compliant Alternative
- Reduced Development Alternative

The No Project Alternative would involve no construction and the site would remain the same as currently exists. The Code Compliant Alternative would include more total built square footage. However, the proposed structures would be lower in height with approximate 10-100 feet when compared to the proposed Project Variant. The Reduced Development Alternative would include less total built square footage with structures lower in height with approximate 10-70 feet than the Project Variant. A complete summary of the alternative descriptions was issued to BMT by AECOM on June 27th, 2017.

The sunlight ordinance for the alternatives was evaluated based on BMT's considerable experience, formed from multiple shadow analyses for similarly massed schemes in the urban environment around San Francisco, including previous numerical analysis on the India Basin Development.

No Project Alternative

The No Project Alternative would involve no additional construction to the site and therefore would match the Existing Scenario which was assessed in the shadow analyses. The existing buildings are sparse and consist of low-rise structures on a portion of the site. Therefore, no shadows are casted over India Basin Shoreline Park, Big Green Park, or India Basin Open Space. The Big Green will be a publically accessible open space but will not be under the jurisdiction of the San Francisco Recreation and Park Department. Accordingly, the No Project Alternative would cast less shadow compared to the Project Variant.

Code Compliant Alternative

The Code Compliant Alternative would include the same recreational and commercial development, and associated parking and access, on the 900 Innes and India Basin Shoreline Park properties as under the

Project Variant. Therefore, the sunlight ordinance in this area would be materially the same as the Project Variant. On the 700 Innes property, the Code Compliant Alternative would have seven buildings placed within the Big Green Park area, while the Project Variant would have none. Therefore, the Code Compliant Alternative would cast additional shadows in this area. Note that the Big Green will be a publically accessible open space but will not be under the jurisdiction of the San Francisco Recreation and Park Department.

For the India Basin Open Space, it is expected during the early morning and afternoon hours at the Winter Solstice and Vernal / Autumnal Equinox, the Code Compliant Alternative to cast additional shadows compared to the Project Variant. However, during mid-day hours the Project Variant would cast additional shadows. The Summer Solstice shadows cast for both the Code Compliant Alternative and the Project Variant are expected to be limited, and it is expected that the Project Variant would have a marginally larger shadowed area. Overall, the Code Compliant Alternative is expected to cast more shadows than the Project Variant and the impact would be expected to be notable.

Reduced Development Alternative

The Reduced Development Alternative would reduce the height of buildings throughout the development with approximately 10-20 feet, most notably the two tower locations. The reduction in building height is expected to lead to fewer shadows cast by the Reduced Development Alternative compared to the Project Variant. An exception to this is during the Summer Solstice when the Project Variant casts fewer shadows in the park areas. However, during the Summer Solstice fewer shadows are cast in general when compared to the Winter Solstice and Vernal / Autumnal Equinox and therefore would not reduce the annual shadow time by a notable amount. Overall the Reduced Development Alternative would cast fewer shadows than the Project Variant, but would be unnoticeable by park users.

Summary

In summary, the No Project Alternative would result in fewer shadows being cast into India Basin Shoreline Park, Big Green Park, and India Basin Open Space and therefore would not change sun exposure on the site in accordance with the sunlight ordinance. The Code Compliant Alternative would have several buildings located within the Big Green Park resulting additional shadows being cast into Big Green Park and India Basin Open Space. Note that the Big Green will be a publically accessible open space but will not be under the jurisdiction of the San Francisco Recreation and Park Department. The Reduced Development Alternative would reduce the building heights throughout the development, therefore reducing the shadowed area compared to the Project Variant. The Code Compliant Alternative is expected to cast noticeable more shadows, while for the Reduced Development Alternative the shadow change is expected to be unnoticeable by park users.